IJFS International Journal of Financial Systems

International Journal of Financial Systems
Volume 1, Number 2 (2023)
July-December 2023
Page : 217-244
P-ISSN : 3025-8480
E-ISSN : 3025-8537
DOI : https://doi.org/10.61459/ijfs.v1i2.33

Article History
Received : 10/20/2023
Revised : 12/29/2023
Accepted : 03/15/2024
Available Online : 04/22/2024

Evaluation of the Productivity of Rural Banks for Economic Resilience in East Java: A View from Efficiency and Technological Change

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ABSTRACT

The Rural Bank (BPR) plays a crucial role in the Indonesian banking industry, particularly at the regional level, serving as an alternative financing source for the unbankable population. This research aims to analyse the productivity levels of BPRs in East Java using the Malmquist Productivity Index (MPI) during the period from 2016 to 2022. The study sample comprises 30 BPRs in East Java. The analysis results indicate that the productivity of BPRs in East Java fluctuates from year to year. Moreover, during the COVID-19 pandemic, BPR productivity experienced a significant decline. The study provides recommendations for BPR management and regulators to pay more attention to BPR productivity and decision-making foundations.

Keywords :
Rural Bank; East Java; Productivity; Economic Resilience; Technology; MPI.
JEL Code: G21, O18, R15

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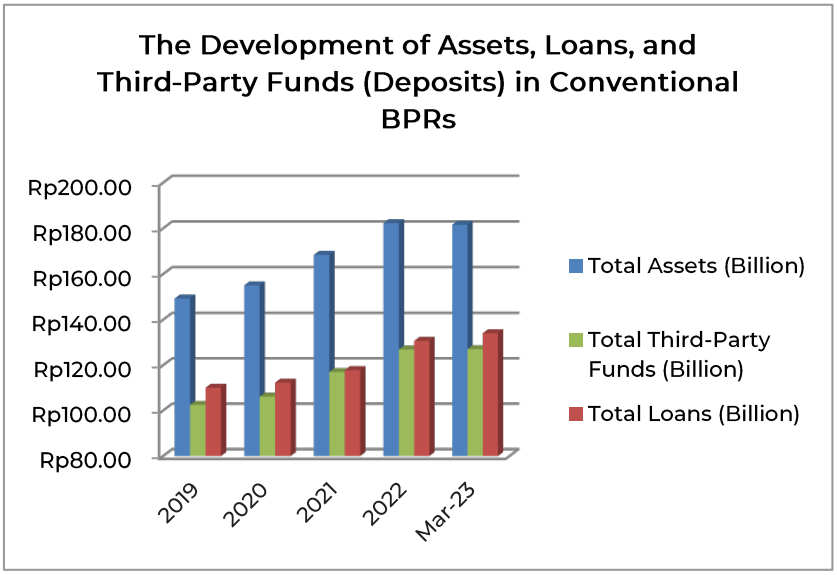
1. Introduction

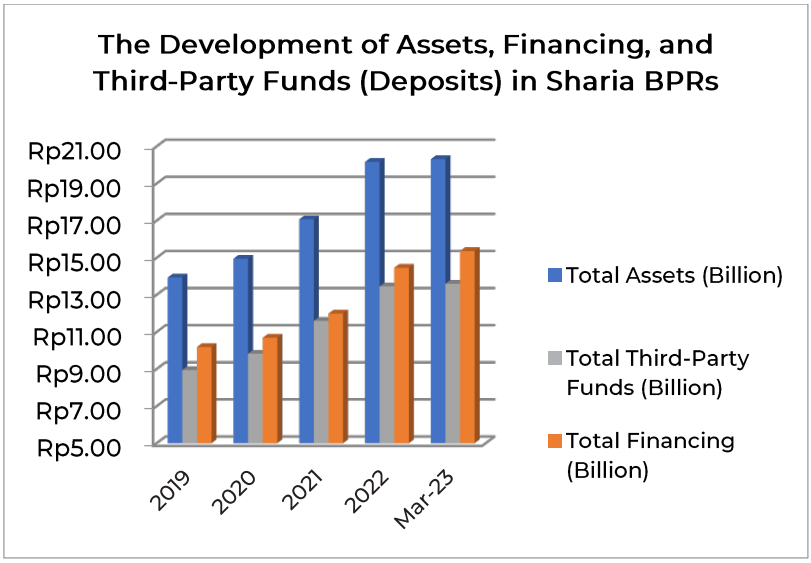
The role of the financial sector in real economic growth has been a primary focus of the global economic policy (Furqani & Mulyany, 2009; Masrizal et al., 2022). The financial sector aids in the allocation of funds to industries with promising growth prospects. The ability to allocate financial resources more effectively to productive projects and drive economic growth increases with the development of the financial sector (Zarrouk et al., 2017). The better a financial system performs its functions, the greater its contribution to national and regional economic growth in a particular area (Adriani & Wiksuana, 2018; Supartoyo et al., 2018). The financial sector serves as the primary mediation institution and source of financing for developing countries, including Indonesia (Agustina et al., 2019). Therefore, a nation's finances must be managed carefully to support economic progress. Consequently, the sound performance of the banking sector is always a major concern for researchers and policymakers responsible for ensuring an inclusive and economically sustainable nation (Sharma et al., 2013).

Bank Perkreditan Rakyat (BPR) is an element of the banking sector that significantly contributes to the economy (Hosen & Muhari, 2013). This is because BPR serves as an alternative financial provider for individuals who are considered unbankable (Wasiaturrahma et al., 2020). With the issuance of Law No. 7 of 1992, as amended by Law No. 10 of 1998 concerning banking, banking institutions, including BPR, are officially in operation. The law stipulates that BPRs engaged in conventional or Sharia-based business activities do not provide payment traffic services.



Source: ibpr-s.ojk.go.id (2023)

Figure 1: The Development of Assets, Loans, and Third-Party Funds (Deposits) in Conventional BPRs in Indonesia



Source: ibpr-s.ojk.go.id (2023)

Figure 2: The Development of Assets, Loans, and Third-Party Funds (Deposits) in Sharia BPRs in Indonesia

Based on the above figure, it can be observed that the disbursement of loans by both Conventional and Sharia BPRs shows a continuous upward trend. The total disbursement of loans by Conventional BPRs reached IDR 134.11 trillion in March 2023, while Sharia BPRs reached IDR 15.35 trillion in March 2023. This proves that BPRs play a significant role in maintaining economic resilience, considering that the disbursement of funds to the public has been increasing year by year, especially during the COVID-19 pandemic. Additionally, the development of assets and Third-Party Funds (Deposits) held by BPRs has also been continuously increasing. In Conventional BPRs, the total assets as of March 2023 reached IDR 181.60 trillion, and Third-Party Funds (Deposits) reached IDR 127.09 trillion. In Sharia BPRs, total assets as of March 2023 were recorded at IDR 20.31 trillion, and Third-Party Funds (Deposits) at IDR 13.59 trillion. This also illustrates that BPRs are capable of operating sustainably and can serve as intermediaries that collect and channel public funds to support national economic resilience.

The past few years have been a dynamic period marked by numerous challenges and crucial moments for achieving economic performance in Indonesia, particularly in East Java. The COVID-19 pandemic led to a 2.39% decrease in East Java's Gross Regional Domestic Product (GRDP) in 2020 (BPS, 2020). In the midst of this significant crisis, various stabilisation policies aimed at economic recovery were implemented by the government (Juhro,

2016). East Java's economic performance has been quite impressive, with data from BPS indicating a 5.34% increase in East Java's economy in 2022. Spatially, East Java contributed 25.51% to the economic structure of Java Island in the third quarter of 2022, following DKI Jakarta (Bappeda Jatim, 2022). Data from the East Java Cooperatives and SMEs Service states (2021) that Small and medium-sized enterprises (UMKM) also played a significant role, contributing 57.81% to East Java's GRDP, dominated by UMKMs in the accommodation and food service sector. In line with this, a study by Ramadhanty & Auwalin (2021) explained that financing products or loans from banks have a significant and positive impact on regional economic growth. Therefore, with its intermediation function and specific purpose of providing credit to the public, BPRs can play a crucial role in driving the economic resilience of East Java. Despite the relatively small scale of BPRs, their role should not be underestimated as they provide broad financial services to the UMKM sector (Hartono et al., 2008).

Amid the rapid digital transformation in the banking industry, BPRs face challenges in adapting to the digitalisation wave. Digital transformation is expected to bring positive impacts not only to the banks but also to the banking service users. Additionally, there has been a significant increase in the use of the internet by UMKMs in East Java, indicating a good level of enthusiasm for digital transformation (Dinas Koperasi & UKM Jatim, 2021). Mulauddin (2022) further explained the automation in the industrial world, making companies more efficient in their operations.

Examining such potential, the growth of Rural Banks (BPR) in East Java needs to be complemented by optimal financial performance. This is crucial due to the small market share of BPR, primarily based on the micro sector (Firmansyah, 2015). Sanjaya & Marlius (2018) state that BPR, as part of the banking industry ecosystem, often competes with other financial institutions. Therefore, BPR needs to devise strategies to create a competitive advantage and operate efficiently in the industry competition. As known, measuring banking productivity, especially for BPR, is crucial so that stakeholders such as banking practitioners and regulators can evaluate and formulate future strategies to maintain stability and advance the banking industry in Indonesia (As-Salafiyah, 2023).

Given these circumstances, it is important to conduct further research to assess the extent to which BPRs can operate productively. Measuring productivity in BPR allows the assessment of the efficiency and

effectiveness of various operational processes within the institution. This assessment, in turn, facilitates the identification of areas that may require improvement or optimisation. By measuring output against input, stakeholders can evaluate the bank's contribution to economic development and financial inclusion.

Research related to banking productivity in Indonesia is still limited. There has been no research specifically focused on the productivity of BPRs in East Java during the period from 2016 to 2022, taking into account technological changes, efficiency changes, the impact of the COVID-19 pandemic on productivity, the use of technology in the banking sector, especially in BPRs, and its relevance in driving inclusive and sustainable economic resilience in East Java amid global uncertainty. This research aims to answer questions related to the level of productivity, the impact of the COVID-19 pandemic on BPR productivity in East Java, and the use of technology in the banking sector, particularly in BPRs, and its relevance in promoting inclusive and sustainable economic resilience in East Java amidst global uncertainty. Furthermore, this research provides benefits to stakeholders in making decisions and policies, improving the performance of BPRs, local government authorities in East Java in creating regulations to support the sustainability of BPRs, and academics for future research.

2. Literature Review

A. Rural Bank or Bank Perkreditan Rakyat (BPR)

According to the Financial Services Authority (OJK), Bank Perkreditan Rakyat is a type of bank that operates with a micro and regional scale. Based on their management, Bank Perkreditan Rakyat is categorised into two types: Bank Perkreditan Rakyat (BPR) with a conventional system and Bank Pembiayaan Rakyat Syariah (BPRS) following Islamic principles and free from interest (Wasiaturrahma et al., 2020).

BPRs have several differences from Commercial Banks. First, BPRs have significantly lower capital requirements than Commercial Banks. Second, their target is to serve the credit needs of farmers, fishermen, small traders, employees, retirees, and other segments of society who have not been reached by formal banking to prevent them from falling into the clutches of loan sharks (Iswandari & Anan, 2017).

The existence of BPRs in supporting national economic resilience can be seen through the distribution of credit or financing to the public, enabling people to access funds to cover expenses and achieve savings goals. In addition, micro-scale banks can enhance economic resilience during crises by increasing loans to small businesses and households (Berger et al., 2022).

Despite differences in operational systems, these banks play a crucial role as intermediaries between the microeconomic and household sectors (Nashihin & Harahap, 2014). BPRs serve the same function, providing financial products and services to micro, small, and medium-sized enterprises (UMKM) and low-income communities in rural areas (Masrizal et al., 2022; Budiyanti, 2020). Naufal & Firdaus (2017) have noted that BPR customers often face capital constraints, and the presence of BPRs helps improve the local economy. The economic scale of BPRs is significant and should not be underestimated (Hartono et al., 2008).

B. Productivity

Productivity levels are commonly used to measure the achievements of financial institutions, and productivity is often associated with the success of these institutions in reaching their goals (Mawarati, 2016). Productivity measurement can be based on both input and output variables. According to Mongid & Tahir (2010), productivity demonstrates the relationship between output and input variables for an institution.

Productivity is defined as the proportion of one or more output variables to the input variables used in the production process (Kopelman, 1986). Total production (output) is influenced by the magnitude of input variables. Productivity can also be affected by changes in efficiency due to technological advancements (Fare et al., 1994). Therefore, the productivity growth index also captures technological changes (Herindar et al., 2021). This, in turn, has an impact on the performance of institutions, as Firmansyah (2019) mentions that bank profitability can increase as productivity improves.

C. Previous Study

Research measuring the productivity of the banking sector is relatively scarce, particularly in the context of Bank Perkreditan/ Pembiayaan Rakyat or BPR. Generally, earlier research has focused on

efficiency and profitability within the banking sector, which in turn impacts the financial sector's performance. However, based on the available literature review, there are relevant studies. For example, Reddy (2006) conducted research comparing the productivity of BPR and Commercial Banks in India, examining changes in technical factors and scale efficiency during the period from 1996 to 2002. The study found that BPR exhibited higher technical efficiency compared to Commercial Banks. Furthermore, BPR demonstrated higher productivity growth than profit growth during the study period. Productivity growth in banking within regions with low banking density showed significantly higher results. This study shares similarities with the current research in that both utilise the Malmquist Productivity Index (MPI) method, although they use different variables.

Another study conducted by Bassem (2014) measured the productivity of microfinance institutions in the Middle East and North Africa region during the period from 2006 to 2011. Using the Malmquist Productivity Index (MPI) method, this study revealed a decline in productivity in the microfinance industry. Furthermore, the study identified the cause of declining productivity as a result of reduced technological change. Hence, improving the productivity of microfinance institutions requires enhancing institutional performance, including technological changes.

In Indonesia, Herindar et al. (2021) conducted research to measure the productivity of Sharia People's Credit Banks (BPRS) during the Covid-19 pandemic. Using the MPI method during the study period from 2016 to 2021, the research finds an overall increase in BPRS productivity. The increase in productivity was influenced by changes in efficiency and technology within BPRS. However, BPRS experienced a decrease in productivity during the Covid-19 pandemic, although it was not significant. This study differs from the current research in terms of the selected study period and regional coverage.

As-salafiyah & Rusydiana (2022) also addressed the scarcity of literature regarding productivity in the banking sector. Their study analysed BPRS productivity from 2013 to 2020 using the MPI method. The research’s results indicated a general decline in BPRS productivity from 2019 to 2020, although some BPRS entities experienced increased productivity. The study suggested that BPRS should enhance digitalisation

to respond to technological innovation changes and thus increase BPRS productivity in Indonesia.

Other relevant studies include Rakhmadi (2010), which conducted an analysis of efficiency and productivity in Islamic banking during the period from 2007 to 2009; Mawarti (2016), which compared productivity and efficiency between Western and Eastern region BPRS in Indonesia from 2013 to 2015; Wijaya (2018), which measured the efficiency and productivity levels of Islamic Commercial Banks in Indonesia from 2012 to 2016; Nurfikasari et al. (2019), which investigated the productivity of Islamic banking in Indonesia using the Malmquist Productivity Index (MPI) during the period from 2014 to 2018; Octarina et al. (2020), which conducted research on banking productivity in Indonesia across 84 banks from 2005 to 2016; Salleh & Rani (2020), which compared productivity performance in 7 Islamic Commercial Banks and 7 Conventional Banks in Indonesia from 2011 to 2018; and Defung (2020), which analysed the sources of productivity and their determinants in the Indonesian banking sector during the restructuring period using the MPI method.

Based on the aforementioned research, there is a lack of focus on BPR productivity in East Java during the period from 2016 to 2022, while considering technological changes, efficiency changes, the impact of the Covid-19 pandemic on productivity levels, technology usage in the banking sector, specifically BPR, and its relevance in promoting inclusive and sustainable economic resilience in East Java amid global uncertainty. This research aims to answer questions regarding the level of productivity, the impact of the Covid-19 pandemic on BPR productivity in East Java, and technology usage in banking, especially BPR. Furthermore, the research is designed to provide benefits to stakeholders in decision-making, policy improvement, and BPR performance enhancement. It also intends to assist regional government authorities in East Java in formulating regulations to support BPR sustainability and provide valuable insights for academics for future research.

3. Research Methods

The Malmquist Productivity Index (MPI) method is used in this research to measure the level of productivity in business units, including financial institutions. This method was discovered by Sten Malmquist in 1953 and further developed in 1982 by Caves to compare production technology by defining output, input, and productivity indices. The

Malmquist index measures two things: the catch-up effect, which measures the relative efficiency change from the first period to the second period, and the frontier shift effect (innovation effect), which measures the change in technology, the combination of inputs and outputs from the first period to the second period (Caves et al., 1982; Rani et al., 2017; Rusydiana, 2018).

In measuring the Malmquist productivity index in this research, DEAP 2.1 software is used as the analytical tool. The calculation of BPR productivity in East Java in this research is based on the assumption of Variable Returns to Scale (VRS) with an output-oriented perspective, which can be observed from the growth of Total Factor Production (TFP). The estimation of TFP growth and its components refers to the Malmquist index using the Cobb-Douglas production function, which can be formulated as follows:

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

There are two factors that cause changes in the level of productivity (Total Factor Productivity Change (TFPCH)) measured in the productivity measurement application, namely the change in technology (TECHCH) and the change in efficiency (EFFCH). Then, the productivity analysis results using DEAP 2.1 software also capture the change in efficiency into two components: pure efficiency change (PECH) and scale change (SECH). Bjurek (1996) introduced a new definition of the Malmquist productivity index for production units between time t and t + 1 based on the level of technology at time k, where k = t and k = t + 1, following the tradition of most productivity indices. The constructed index is the ratio between the output index and the input index, according to the Tornqvist productivity index, where:

$$MTFP_k = \frac{MO_k(y_t, y_{t+1}, x_k)}{MI_k(y_k, x_t, x_{t+1})} = \frac{E_k^O\,(y_{t+1}, x_k)/E_k^O\,(y_t, x_k)}{E_k^I\,(y_k, x_t)/E_k^I\,(y_k, x_{t+1})}, \qquad k = t, \qquad t+1 \quad (2)$$

The equation above represents the relationship between the Malmquist output and input indices. Productivity will increase if the productivity value is greater than one, and if the productivity value is less than one, the productivity level is considered to decrease. If it equals 1, the productivity level is considered constant.

Therefore, it can be concluded that factors affecting productivity changes can be observed through the values of the Efficiency Change

Index (EFFCH) and the Technology Change Index (TECHCH). Additionally, the Pure Efficiency Change Index (PECH) and the Scale Change Index (SECH) are used to determine the causes of the efficiency change index (EFFCH) changes. The Total Factor Productivity (TFP) value indicates changes in the index. A value of M > 1 indicates an increase in productivity, M = 1 indicates no increase in productivity or constancy, and M < 1 indicates a decrease in productivity.

The advantages of using the Malmquist Productivity Index (MPI) are it being a non-parametric method, so it does not require a specific production function. Additionally, this method does not rely on economic behavior assumptions of production units, such as profit maximisation or cost minimisation, making it useful when producer objectives are different or unknown. Furthermore, the Malmquist Productivity Index (MPI) does not require price information data, which is often unavailable. The MPI can also be separated into components of efficiency change and technology change (Djaghballou et al., 2018).

4. Results and Analysis

A. Descriptive Statistics

Table 1: Descriptive Statistics

Variable	Mean	Min	Max	St.Dev
Output				
Total Financing (Y1)	Rp33,289,525	Rp12,448	Rp248,670,017	Rp44,524,253
Operating Income (Y2)	Rp9,391,145	Rp3,042	Rp53,186,525	Rp10,115,322
Input				
Fixed Assets (X1)	Rp1,723,501	Rp10,687	Rp12,444,205	Rp1,959,051
Operational Costs (X2)	Rp7,771,639	Rp93,561	Rp80,667,702	Rp9,050,268
Third-Party Funds (X3)	Rp38,952,755	Rp8,990	Rp324,146,687	Rp49,422,141

Source: ibpr-s.ojk.go.id (2023)

These descriptive statistics provide a summary of the central tendency, variability, and distribution of the data for the variables in this research. Based on the descriptive statistics of the research variables, it can be concluded that, on average, the data tend to center around the third-party funds variable and total financing variable.

B. Productivity of Rural Banks (BPR) in East Java During the Research Period

The table below elucidates the analysis results utilising the Malmquist Productivity Index (MPI) for Rural Banks (BPR) in East Java, which serves as the observed subjects in this study.

Table 2: Average Malmquist Index Scores of People's Credit Banks (BPR) in East Java per Year

Year	EFFCH	TECHCH	PECH	SECH	TFPCH
2016-2017	1.059	1.103	1.042	1.016	1.168
2017-2018	0.937	1.001	0.915	1.025	0.938
2018-2019	0.765	0.793	0.813	0.941	0.607
2019-2020	1.197	1.585	1.165	1.028	1.897
2020-2021	1.073	0.762	1.113	0.964	0.818
2021-2022	0.653	1.065	0.724	0.901	0.695
Mean	**0.928**	**1.020**	**0.949**	**0.978**	**0.946**

The table above elucidates the changes in the total productivity (TFPCH) of Rural Banks (BPR) in East Java, along with the influencing factors, namely technological change (TECHCH) and efficiency change (EFFCH), during the observation period. In the 2016-2017 period, there was an increase in Rural Bank productivity in East Java, with a value of 1.168. This increase was attributed to both EFFCH and TECHCH, which showed simultaneous improvements with values of 1.059 and 1.103, respectively. This implies that efficiency and technology contributed equally to enhancing Rural Bank productivity during this period. Subsequently, from 2017 to 2019, the productivity level experienced a sustained and significant decline. Examining the productivity values during the 2017-2018 period, it was 0.938, with EFFCH at 0.937 and TECHCH at 1.001. This indicates that the decrease in productivity during this period was primarily due to changes in efficiency. Furthermore, in the 2018-2019 period, the productivity level dropped to 0.607, marking the lowest productivity level during the observation years. EFFCH and TECHCH values for the 2018-2019 period both exhibited a considerable decrease compared to the previous period, registering at 0.765 and 0.793, respectively. This elucidates that the decrease in productivity during the 2018-2019 period was attributed to both changes in efficiency and changes in technology.

During the subsequent period of 2019-2020, the productivity level showed a significant increase compared to the preceding period, reaching the highest productivity level throughout the observation period with a value of 1.897. The elevated productivity during this period was accompanied by an increase in EFFCH (1.197) and TECHCH (1.585). This demonstrates that changes in efficiency and changes in technology both contributed significantly to the enhanced productivity. However, in the subsequent period of 2020-2022, the productivity level consistently decreased. In the 2020-2021 period, the productivity level only reached 0.818, with TECHCH decreasing to 0.762, the lowest technological change throughout the observation period, even though EFFCH (1.073) could be considered stable as it continued to show improvement. Furthermore, in the 2021-2022 period, productivity further declined to 0.695, with EFFCH experiencing a significant decrease and reaching its lowest value throughout the period at 0.653, although technological change still exhibited an increase with a value of 1.065.

In summary, the MPI results for 30 Rural Banks (BPR) in East Java indicate a fluctuating trend in productivity from year to year. The average score results show a decline in the productivity value of Rural Banks in East Java (0.946), attributed to a decrease in efficiency change (0.928) and an increase in technological change (1.020). This explains that changes in efficiency more significantly contributed to the decline in Rural Bank productivity in East Java, even though technological change exhibited an increase.

Farida (2019) explains that the use of technology in banking in East Java is a growing trend. One such technology adopted by banks in East Java is mobile banking, providing convenient financial transactions through mobile phones, allowing users to perform online banking transactions anytime, anywhere. Another adopted technology is digitalisation, with fintech companies like Komunal, based in Surabaya, East Java, digitalising Rural Banks through the DepositoBPR platform. This platform enables users to make digital deposits and apply for loans without physically visiting their bank locations (East Ventures, 2021; Shu, 2023).

Therefore, based on the analysis results, it can be concluded that technology utilisation can enhance bank productivity in various ways. For example, technology can automate routine tasks, reduce errors, and improve the speed and accuracy of transactions. It also allows banks to offer new products and services, such as mobile banking and online payments, enhancing customer satisfaction and loyalty. Furthermore, technology can assist banks in better risk management and compliance, reducing costs and improving efficiency (Lee et al., 2010). The use of data analytics and artificial intelligence in banking systems can help analyse customer data, identify patterns, and make more accurate decisions. Digital platforms and mobile applications can help banks provide better customer service, improve response times, and offer more personalised services. Additionally, the use of blockchain technology can enhance security and reduce fraud (Cho & Chen, 2021; Shah et al., 2022).

Furthermore, concerning the efficiency aspect of Rural Banks in East Java showing a decline, this aligns with research by Wasiaturrahma et al. (2020), concluding that Rural Banks in Indonesia are still not efficient in performing their intermediation role. To improve intermediation and production efficiency, Rural Banks need to increase their capital. This is because the capital adequacy ratio has a significant positive effect on the technical efficiency of Rural Banks. Additionally, the location factor also plays a role, as it can be observed that the more Rural Banks there are in urban areas, the greater their efficiency potential. Urban areas have more comprehensive infrastructure, allowing for faster business development and easy technology adoption. Almas (2018) also states that many Rural Banks in East Java have not achieved optimal efficiency, with the major source of inefficiency stemming from the amount of financing or loans provided. Therefore, as intermediaries and microfinance institutions, Rural Banks need to increase fund or financing distribution to the public while adhering to prudential principles (Kusumawardhani et al., 2008).

Levine et al. (2021) explain that small banks can enhance economic resilience through countercyclical lending to small businesses, limiting loan reductions during economic downturns. Increased financing or credit to the public by banks can improve economic resilience by stimulating economic growth, strengthening the purchasing power of the public, and expanding access to financial resources. Adequate and affordable financing can help individuals and businesses diversify their income strategies, accumulate assets, and mitigate risks, ultimately resulting in higher economic growth. Moreover, by encouraging financial stability and

supporting local employment, development, and community well-being, small banks can help build resilience over time, especially for regional economic resilience.

C. Productivity of Rural Banks (BPR) in East Java

Table 3: Average Productivity of Rural Banks (BPR) in East Java

DMU	EFFCH	TECHCH	PECH	SECH	TFPCH
BPR Amanat Kesejahteraan Indonesia Batu	0.934	0.869	1.016	0.920	0.812
BPR Arta Swasembada Mojokerto	0.973	0.984	1.023	0.951	0.957
BPR Artatama Sejahtera Batu	0.848	1.109	0.848	1.000	0.941
BPR Bank Daerah Kabupaten Madiun	0.849	1.102	0.850	0.999	0.936
BPR Bank Tulungagung (Perseroda)	1.018	1.020	1.017	1.001	1.038
BPR Dana Raya Jawa Timur Sidoarjo	1.012	1.044	1.012	1.000	1.057
BPR Danamitra Surya Sidoarjo	1.053	0.961	1.053	1.000	1.011
BPR Genteng Banyuwangi	1.014	1.099	1.002	1.012	1.114
BPR Guna Yatra Surabaya	0.978	1.049	0.948	1.031	1.026
BPR Harta Swadiri Pasuruan	0.853	1.090	0.934	0.913	0.930
BPR Intan Nasional Gresik	0.852	1.058	0.964	0.883	0.901
BPR Mitra Jaya Mandiri Jember	1.008	1.083	1.006	1.002	1.091
BPR Nusumma Jombang Jatim	0.978	1.107	1.024	0.955	1.083
BPRS Al Mabrur Babadan Ponorogo	1.044	1.004	1.022	1.021	1.047
BPRS Amanahsejahtera Gresik	1.000	1.137	1.000	1.000	1.137
BPRS Artha Pamenang Kediri	1.009	1.006	1.000	1.009	1.015
BPRS Artha Sinar Sejahtera Syariah Kota Batu	0.928	1.143	0.942	0.985	1.060
BPRS Bakti Artha Sejahtera Sampang	0.860	0.986	0.903	0.953	0.849
BPRS Baktimakmur Indah Sidoarjo	0.937	0.965	0.932	1.005	0.904
BPRS Karya Mugi Sentosa Surabaya	0.956	0.932	0.911	1.049	0.890
BPRS Lantabur Tebuireng Jombang	0.914	0.799	0.923	0.991	0.730
BPRS Madinah Lamongan	0.913	0.955	0.923	0.989	0.872
BPRS Magetan (Perseroda)	0.880	1.016	0.931	0.946	0.894
BPRS Mitra Harmoni Kota Malang	0.831	1.016	0.859	0.968	0.845
BPRS Mitra Mentari Sejahtera	0.833	1.045	0.854	0.976	0.871
BPRS Mojo Artho Kota Mojokerto Perseroda	0.795	1.012	0.839	0.948	0.805
BPRS Rahma Syariah Kediri	0.855	1.150	0.895	0.956	0.983
BPRS Sarana Prima Mandiri Pamekasan	0.893	1.102	0.920	0.971	0.985
BPRS Situbondo	0.897	0.923	0.967	0.928	0.828
BPRS Tanmiya Artha Kota Kediri	1.000	0.937	1.000	1.000	0.937
Mean	**0.928**	**1.020**	**0.949**	**0.978**	**0.946**

Based on the table, the average productivity of BPRs throughout the research period shows a decrease in productivity (0.946). This decrease in productivity was influenced by a decrease in the average value of efficiency change (EFFCH) with a value of (0.928). Meanwhile, technological change (TECHCH) contributes with a value of (1.020). The decrease in efficiency was caused by a decrease in the factors forming EFFCH, namely a decrease in Pure Efficiency Change (PECH) with a value of (0.949), and Scale Efficiency Change (SECH) with a value of (0.978).

Furthermore, individual analysis of the productivity levels of Rural Bank (BPR) in East Java reveals the presence of 11 BPRs with the highest productivity levels. One of the highest productivity value is 1.137, influenced by the increased utilisation of technology (TECHCH). Conversely, the lowest productivity level is 0.730. The low productivity of this bank is attributed to the decrease in EFFCH (0.914) and TECHCH (0.799), representing the lowest values among the entire sample used. This underscores the crucial role of technology utilisation in enhancing bank productivity.

Moreover, the analysis results indicate that among the BPR samples used in this study, conventional BPRs achieving high productivity levels outnumber Shariah-compliant BPRs. Further analysis emphasises the significance of technology in the banking sector, especially for BPRs as microfinance institutions. Therefore, it is imperative for BPRs to undergo digital transformation. Technology adoption is a long-term investment for the future and is projected to be a key driver of sustainable growth in the banking industry (Santosa et al, 2020). The objective is to ensure smooth bank operations through the implementation of Digital Financial Services and Digital Financial Inclusion (DFI) (Banna & Alam, 2021; Banna et al., 2021). BPRs can initiate technology adoption by updating services for customers, drawing insights from the experiences of commercial banks that have successfully transitioned to digital, which can enhance workflow efficiency and improve the quality of customer service.

D. Productivity of Rural Banks (BPR) in East Java During the Covid-19 Pandemic

The phenomenon of the Covid-19 pandemic, which began to occur at the end of 2019 and spread massively in Indonesia at the beginning of 2020, has certainly had a global impact not only on the health sector but also on the economic and social sectors of society, especially the financial industry, namely banking as an intermediary institution that brings together and

channeling funds to the community and being an important factor in driving the wheels of the national economy. For this reason, the following analysis explains the productivity of Rural Banks (BPR) during the Covid-19 pandemic.

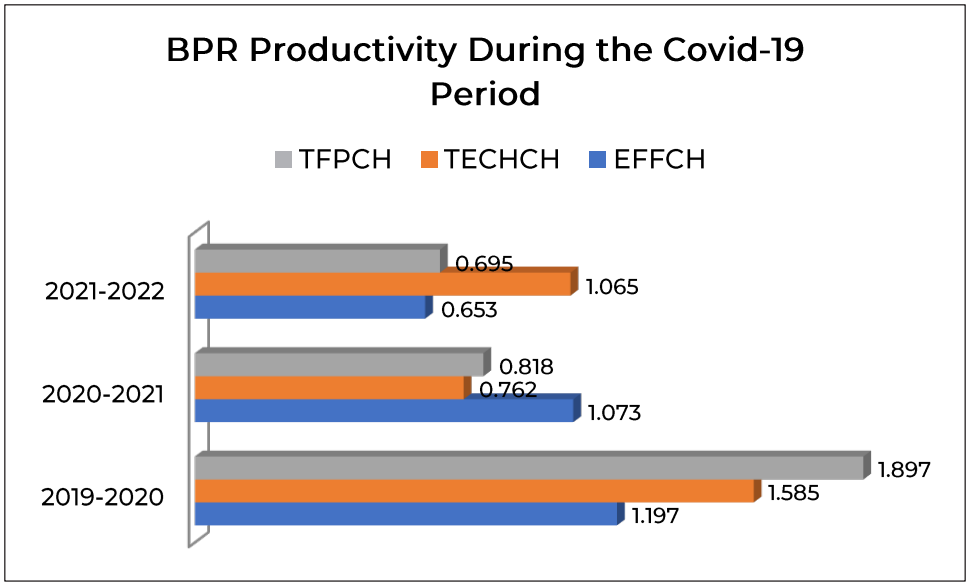


Figure 3: BPR Productivity in East Java During the Covid-19 Period

The image above represents the level of BPR productivity in East Java during the Covid-19 pandemic, namely from the 2019-2022 period. At the beginning of the Covid-19 period, namely in the 2019-2020 period, the average level of BPR productivity still showed an increase, namely (1.897). Changes in efficiency (1.197) and changes in technology (1.585) both contributed to increasing BPR productivity. Then, in the next period, namely 2020-2022, the level of productivity experienced a significant decline in a sustainable manner, namely with productivity values respectively (0.818) and (0.695). In the 2020-2021 period, the decline in productivity was predominantly caused by decreasing technological changes (0.762), while changes in efficiency still showed an increase (1.073). In the 2021-2022 period, the decline in productivity was due to a decrease in the level of efficiency, this was indicated by a decrease in effch (0.653), while technological changes showed an increase (1.065). That means, at the end of the period there was an improvement in the use of technology by BPRs in East Java.

The decline that occurred in bank productivity levels during the pandemic could be caused by banks not being able to carry out their daily operational activities optimally. In addition, the Covid-19 pandemic has

significantly reduced bank performance and stability, and there has been a decline in credit distribution to the real sector, resulting in credit growth becoming negative amidst the economic downturn (Darjana et al., 2022; Shabir et al., 2023). Therefore, it is recommended for banks to switch from conventional systems to digitalisation, as an effort to survive during the pandemic, with the aim of BPRs being able to compete and be closer to their consumers (Rosidi & Zakiyya, 2022). Based on changes in bank efficiency which experienced a decline during the Covid-19 pandemic, the study conducted by Notalin et al (2021) reveals a similar trend, wherein the efficiency of Islamic Commercial Banks experiences a decline due to a reduction in revenue derived from provided financing. This downturn consequently exerts a negative impact on third-party capital investment, impeding capital deployment. In addition, during the pandemic, economic conditions experienced turmoil, which required banks to make more efforts to achieve their targets, which ultimately had an impact on the level of efficiency, especially in musyarakah and mudharabah financing (Setyono et al., 2021). Furthermore, Hasbi and Apriyana (2021) also explained that the Covid-19 pandemic had an impact on the efficiency of BPR and BPRS in West Java.

However, on the other hand, the pandemic has forced the acceleration of digital transformation in the banking sector, and customers are forced to use digital channels, which has led to an increase in digital payments (World Bank, 2022). The increased use of technology during the pandemic has a significant impact on the banking sector. Banks are working towards digitalisation, and customer expectations for banking have increased markedly, accelerated by the pandemic (Moden & Neufeld, 2020). The pandemic is a momentum for BPRs in East Java to be able to improve their services through the adoption of technology. It is evident from the results of the analysis that technological changes in BPR East Java have shown an increase during the pandemic.

E. Malmquist Index Quadrant for Rural Banks (BPR) in East Java

At this stage, Rural Banks (BPR) in East Java will be grouped into four quadrants based on changes in efficiency (EFFCH) and changes in technology (TECHCH), with high and low categories. The EFFCH and TECHCH values are seen from the industry average. If the EFFCH and TECHCH values are 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 Rural Banks (BPR) with changes in efficiency and technological changes in the high category, and it can be considered that these banks have 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 Rural Bank (BPR) group with low technological change and high efficiency change. Quadrant 4, explains the group of Rural Banks (BPR) with changes in technology and changes in efficiency both showing the low category.

Table 4: Malmquist Index Quadrant for Rural Banks (BPR) in East Java

Quadrant 1 (High Technology, High Efficiency)	Quadrant 2 (High Technology, Low Efficiency)
BPR Bank Tulungagung (Perseroda)	BPR Artatama Sejahtera Batu
BPR Dana Raya Jawa Timur Sidoarjo	BPR Bank Daerah Kabupaten Madiun
BPR Genteng	BPR Guna Yatra Surabaya
BPR Mitra Jaya Mandiri Jember	BPR Harta Swadiri Pasuruan
BPRS Al Mabrur Babadan Ponorogo	BPR Intan Nasional Gresik
BPRS Amanahsejahtera Gresik	BPR Nusumma Jombang Jatim
BPRS Artha Pamenang Kediri	BPRS Artha Sinar Sejahtera Syariah Kota Batu
	BPRS Magetan (Perseroda)
	BPRS Mitra Harmoni Kota Malang
	BPRS Mitra Mentari Sejahtera
	BPRS Mojo Artho Kota Mojokerto Perseroda
	BPRS Rahma Syariah Kediri
	BPRS Sarana Prima Mandiri Pamekasan
Quadrant 3 (Low Technology, High Efficiency)	**Quadrant 4 (Low Technology, Low Efficiency)**
BPR Danamitra Surya Sidoarjo	BPR Amanat Kesejahteraan Indonesia Batu
	BPR Arta Swasembada Mojokerto
	BPRS Bakti Artha Sejahtera Sampang
	BPRS Baktimakmur Indah Sidoarjo
	BPRS Karya Mugi Sentosa Surabaya
	BPRS Lantabur Tebuireng Jombang
	BPRS Madinah Lamongan
	BPRS Situbondo
	BPRS Tanmiya Artha Kota Kediri

Based on the table above, it can be concluded that the Rural Banks (BPR) which are the research sample dominate in quadrant 2, namely 13 banks and in quadrant 4 there are 9 banks. Meanwhile, in quadrant 1 there are 7 banks and in quadrant 3 there is only 1 bank. Based on this, it can be

concluded that the average BPR in East Java has a high level of technology, so it can be concluded that technology adoption has been carried out even though it is not yet optimal. However, BPR productivity levels are still relatively low.

In order to increase the use of technology for BPR, several strategies can be done. One approach is to invest in financial technology (fintech) startups that can provide digital solutions to BPRs. Anggreini & Singapurwoko (2019) explained that the emergence of fintech startups can disrupt BPR, but investing in fintech can help BPR remain competitive. Furthermore, providing training and education to BPR employees on how to use technology also needs to be done to help increase the use of technology in BPRs, and the government can provide incentives and support to BPRs to encourage them to adopt technology, such as tax breaks or subsidies for technology investment (Yusi & Idris, 2016). Tax reliefs can incentivise businesses to invest in research and development (R&D) projects, which often involve the use of technology. This, in turn, can lead to increased innovation and competitiveness in the banking sector. For instance, the UK government has introduced tax breaks to encourage business investment in technology and machinery. One such measure is "full expensing," which allows firms to claim up to 100% of the cost of their investment in IT equipment and machinery. This can provide firms with the confidence to invest and grow, potentially boosting technology investment in the banking sector (Isaac & Kollewe, 2023; Jolly, 2023).

In turn, the use of technology in banking has a significant impact in encouraging economic resilience. Modernisation and digital transformation efforts in the banking sector have increased banks' resilience, protecting their ability to provide credit to customers during economic and financial turmoil (Pierri & Timmer, 2022). Other benefits of using technology in banking can increase safe and efficient financial market operations, reduce financing frictions, and fintech innovation in the banking system enabled by technology in financial services, transforming the financial sector and encouraging economic resilience (Cœuré, 2020; Hobbs & Gennarini , 2021; Xia et al., 2022). This is evidenced by the fact that during the COVID-19 recession, digital technology has played a central role in maintaining economic activity safely, helping to keep credit available and costs low (Lane, 2021).

Furthermore, digital resilience can be improved by building in the right automated controls from the start, such as continuous monitoring

capabilities, which can aid processes such as risk and control testing by allowing banks to test more, rather than sampling sporadically, and to improve consistency through reduction manual approach (Hobbs & Gennarini, 2021). Thus, in order to maintain high levels of productivity, the use of technology in BPR must be optimised. BPRs can optimise the use of technology by identifying the right technology that aligns with their business goals and objectives, focusing on digital optimisation, leveraging Fintech, increasing operational efficiency, and optimising data control. By implementing this strategy, BPRs can increase their productivity, improve customer experience, and compete effectively with large banks.

5. Conclusion

This research measures the level of BPR productivity in Indonesia during the 2016-2022 period using the Malmquist Productivity Index (MPI) method. The research results found that 30 BPRs in East Java showed fluctuating productivity trends from year to year. Meanwhile, the average score shows that the productivity value of BPR in East Java has decreased, which is caused by a decrease in efficiency changes (EFFCH), while technological changes (TECHCH) have increased. This explains that changes in efficiency contribute more to the decline in BPR productivity than changes in technology. Furthermore, individual analysis found that there were 11 BPRs with the highest levels of productivity. The majority of the high level of productivity in BPRs in East Java is due to increasing technological changes. Meanwhile, in BPRs that experienced a decline in productivity levels, the majority was due to changes in decreased efficiency, compared to changes in technology. Furthermore, during the Covid-19 pandemic, BPR productivity levels experienced a continuous decline. Based on the MPI quadrants, it is known that in quadrant 2 there are 13 banks in the high technology and low efficiency category and in quadrant 4 the technology and low efficiency category there are 9 banks. Meanwhile, in quadrant 1 in the technology and high efficiency category, there are 7 banks. Meanwhile, in quadrant 3, low technology, high efficiency category, there is only 1 bank. It can be concluded that on average BPRs in East Java have a high level of technology adoption, even though it has not been implemented optimally.

Based on the results of the analysis, several policy recommendations were obtained that can be applied to several related parties. It is hoped that BPRs in East Java will be able to pay attention to and make improvements to the level of productivity. BPRs are also expected to be

more transparent in the publication of financial reports in order to increase customer trust in microfinance institutions. BPR also needs to optimise the use of technology as an effort to revitalise digitalisation of its banking products, so that BPRs' access to the community becomes wider and in turn can increase East Java's economic resilience. Considering that BPRs' current competitors come not only from fellow banking institutions but also from the technology-based microfinancing industry such as fintech. Furthermore, BPR can also collaborate with fintech as a digital solution to help increase the amount of financing to the public.

Furthermore, it is hoped that regulators and local governments or related parties can use the results of this research as a basis for consideration in preparing a strategic road map to strengthen the ecosystem of microfinancing institutions such as BPR. As well as paying more attention to the quality of BPR human resources in East Java to increase transparency, accountability and the publication of financial reports. Considering that competition for microfinance is getting tighter, it is necessary to establish a policy of limiting BPR operational areas in East Java, so as not to compete with other BPRs. This will have implications for strengthening BPR capital so that businesses can develop and increase competitiveness with other banks.

This research is not free from limitations, including the number of samples used for BPRs in East Java was only 30, the approach in selecting variables used an intermediation approach, and did not analyse further the sources of inefficiency in BPRs and the causes of the decline in productivity levels in depth. Future research can use other relevant variables that can influence the level of BPR productivity in East Java. Further research can also use other approaches that are still relevant, for example DEA, DEA Two Stage and so on, to analyse further the causes of the decline in bank efficiency and the causes of low levels of BPR productivity. Apart from that, productivity levels between BPRs and Commercial Banks can be compared to see how much competition there is in the micro segment with larger banks.

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