

Human Capital Quality and Bank Size: Unpacking Workforce Productivity in Indonesian KBMI 4 Banks

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Abstract

This study aims to analyse the influence of Human Capital Quality and Bank Size on Workforce Productivity in KBMI 4 banks in Indonesia during the 2021–2025 period. Changes in the banking business environment, driven by digital transformation, technological advancements, and increasing operational complexity, have made the quality of human resources and organisational capacity strategic factors in enhancing workforce productivity. Unlike previous studies, this research measures Human Capital Quality using an Education Index and Workforce Productivity using Profit per Employee to provide a more comprehensive assessment of workforce productivity. This study employed a quantitative approach using the panel data regression method. The sample was selected using a purposive sampling technique based on specific criteria, resulting in four KBMI 4 banks as the research sample with a five-year observation period. Data analysis was conducted using EViews through panel data regression model selection tests, classical assumption tests, the F-test, the t-test, and the coefficient of determination. The results indicate that Human Capital Quality has a positive and significant effect on Workforce Productivity. Furthermore, Bank Size also has a positive and significant effect on Workforce Productivity. Simultaneously, Human Capital Quality and Bank Size have a significant effect on Workforce Productivity. These findings indicate that improving the quality of human resources and strengthening organisational capacity are important factors in enhancing workforce productivity in the large-scale banking industry.

Keywords: *Human Capital Quality; Bank Size; Workforce Productivity; KBMI 4 Banks.*

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INTRODUCTION

Human capital has evolved into one of the most important sources of competitive advantage in modern organisations. Changes in the business environment driven by digital transformation, the automation of work processes, the development of financial technology, and increasing customer expectations regarding service quality have encouraged the banking industry to no longer rely solely on capital strength and assets as the primary factors in value creation. Organisational advantage is increasingly determined by a company's ability to develop human resources that possess high levels of competence, knowledge, skills, and adaptive capacity. These conditions position human capital as a strategic asset that contributes to improving workforce productivity while promoting the achievement of sustainable

organisational performance. The KBMI 4 Bank group, as the banks with the largest core capital in Indonesia, has a greater responsibility to maintain the effectiveness of human resource management because this group of banks controls the majority of the national banking industry's assets while also serving as a pioneer of digital transformation in the financial services sector.

The development of organisational capacity in KBMI 4 Banks has shown an increasingly strong trend throughout the 2021–2025 period. This increase in capacity is reflected not only through sustained asset growth but also through the continuity of human resource management, which serves as the main driver of banking operational activities. The relatively stable number of employees across all banks indicates that investment in human capital remains a primary concern despite the industry's changing business model due to digitalisation. These conditions demonstrate that the expansion of organisational size has occurred alongside efforts to maintain workforce capacity as the company's strategic capital. This phenomenon can be observed in Figure 1.

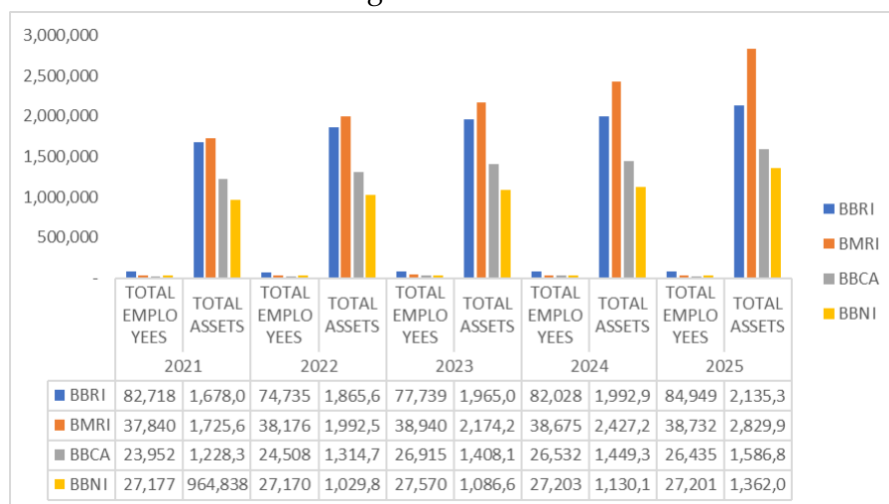


Figure 1. Development of the Number of Employees and Total Assets of KBMI 4 Banks, 2021–2025

Source: Compiled from the Annual Reports of KBMI 4 Banks, 2021–2025.

Figure 1 shows that the total assets of all KBMI 4 Banks increased consistently throughout the observation period. BBRI increased its total assets from IDR 1,678,098 billion in 2021 to IDR 2,135,371 billion in 2025. BMRI recorded higher asset growth, from IDR 1,725,611 billion to IDR 2,829,948 billion. BBKA and BBNI also showed a sustained trend of asset growth until the end of the research period. These developments indicate that company size continued to expand, resulting in greater organisational capacity. The number of employees at each bank also remained relatively stable, with an increasing trend in several banks, particularly BBRI and BBKA. This phenomenon indicates that organisational growth is supported not only by increased financial capacity but also by the presence of human resources that continue to be maintained as the company's primary capital. Theoretically, an increase in company size accompanied by effective human resource management should be able to generate higher workforce productivity.

The development of the financial performance of KBMI 4 Banks during the same period exhibited a different pattern. The increase in organisational size was not always accompanied by a consistent increase in net profit across all banks. These performance variations indicate that the growth in organisational capacity has not entirely produced uniform outputs,

resulting in differences in the effectiveness of resource utilisation among the banks. These conditions are presented in Figure 2.

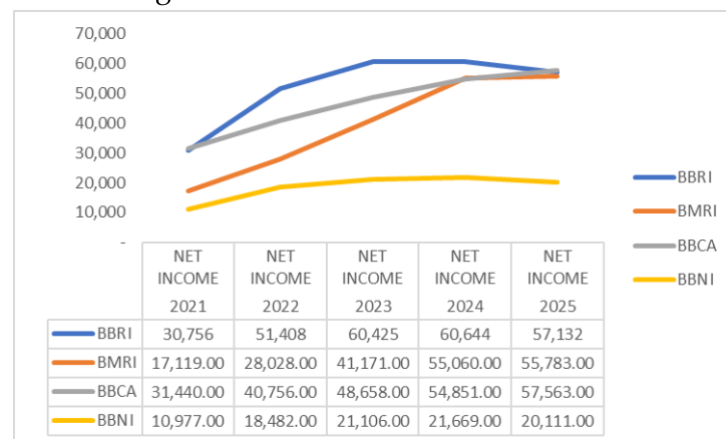


Figure 2. Development of the Net Profit of KBMI 4 Banks, 2021–2025

Source: Compiled from the Annual Reports of KBMI 4 Banks, 2021–2025.

Figure 2 shows that the development of the net profit of KBMI 4 Banks was fluctuating. BBRI experienced a significant increase in profit, reaching IDR 60,644 billion in 2024, but declined to IDR 57,132 billion in 2025. BBNi also recorded a similar pattern, with net profit declining from IDR 21,669 billion to IDR 20,111 billion in 2025. A different condition occurred at BMRI and BBKA, which were still able to maintain an increasing profit trend until the end of the observation period. These differences indicate that growth in the number of employees and increases in company size have not always resulted in consistent performance achievements across all KBMI 4 Banks. These variations demonstrate differences in the effectiveness of managing human resources to generate optimal productivity; therefore, the relationship between human capital quality, company size, and workforce productivity still requires empirical verification.

Human Capital Quality describes the level of quality of an organisation's human resources in terms of knowledge, education, competence, skills, experience, and individuals' ability to create value for the company. Investment in education and the development of individual capabilities is an important aspect of building the quality of human capital because it can improve workforce productivity, strengthen organisational capacity, and support economic growth. Yuldashevna (2024) explains that education plays an important role in the development of human capital because investment in education enhances workforce capability, individual productivity, and organisational competitiveness in responding to changes in the business environment. Annabi (2017) explains that investment in education leads to increased productivity because the development of human capital contributes to improving workforce capability and economic growth through enhancing the quality of human resources. In addition, Nanaeva and Minkailova (2025) explain that human resources in modern organisations have undergone a transformation in their role, from merely being an operational factor to becoming strategic capital capable of creating added value, enhancing innovation, and strengthening a company's competitiveness. From the Resource-Based View perspective, human capital is regarded as a strategic resource that possesses value for organisations because individuals' capabilities, knowledge, and competencies can become the foundation for achieving sustainable competitive advantage.

Bank Size describes the magnitude of organisational capacity, which is generally measured using total assets. Larger banks possess more adequate resources to support investment in technology, human resource development, and improvements in operational efficiency. Rizka & Ulfida (2024) explain that asset growth has a positive effect on company performance because increased investment in assets can improve operational efficiency and financial performance. Ertan et al. (2020) found that firm growth does not automatically lead to declining cost ratios or expanding profit margins, even during the early years of high growth, suggesting that the benefits of scale are not guaranteed and depend on how cost structures are managed, Nhu (2025) found that bank size is a strategic resource that contributes to improving bank performance because larger banks generally possess stronger capacity to support the development of human capital and operational activities.

Workforce Productivity reflects the ability of the workforce to generate output based on the resources possessed by the organisation. Workforce productivity is influenced not only by the number of employees but also by the quality of human resources, the effectiveness of work systems, and the utilisation of technology. Nuriddin (2025) explains that increased workforce productivity is reflected in the more effective utilisation of human resources, particularly through the development of intellectual capacity and the application of modern technology. Natsir et al. (2024) argue that effective human resource management practices, such as recruitment, training, employee development, and performance evaluation, are capable of improving operational efficiency and organisational effectiveness. Zeynullagil (2022) adds that effective organisational management has a positive effect on workforce productivity through the support of organisational structures, incentive systems, and a work culture that encourages greater employee efficiency.

Numerous studies have examined the relationship between human capital, company size, and productivity. Backman (2012) found that human capital is an important determinant of firm productivity because employees' education, experience, and cognitive skills positively affect firm productivity. The study also revealed that firms with greater access to human capital tend to achieve higher levels of productivity, and that firm attributes explain a substantial proportion of productivity variation. Yertas (2024) demonstrated that continuous training and development improve employee productivity by enhancing competence, adaptability, and work efficiency. Akbar et al. (2020) showed that the quality of human resources has a positive effect on the performance of Islamic banking employees, making optimisation through recruitment, training, and competency development an important factor in improving organisational performance. Karim et al. (2020) found that the utilisation of information technology improves banking efficiency, and this effect becomes stronger in larger banks due to the support of economies of scale in banking operations. Bi et al. (2021) showed that improvements in human capital are positively associated with increases in company size because a more highly qualified workforce tends to support organisational growth. Different findings were reported by Fonseca et al. (2019), who found that the effect of human capital on organisational performance depends on task structure and job management within the company; therefore, improvements in the quality of human resources do not always result in optimal performance enhancement.

The empirical gap in this study is reflected in the difference between the development of organisational capacity and the performance achievements of KBMI 4 Banks. The number

of employees has remained relatively stable, and total assets have shown consistent growth, reflecting the strengthening of organisational capacity and investment in human resources. Theoretically, these conditions should have been accompanied by improvements in workforce productivity and more optimal organisational performance. However, net profit performance exhibited a pattern that was not entirely consistent across all banks, with some banks experiencing a decline in the final period while others continued to record growth. This inconsistency indicates that increases in the number of employees and bank size do not necessarily result in optimal performance; therefore, the relationship between Human Capital Quality, Bank Size, and Workforce Productivity still requires empirical verification.

The theoretical gap in this study arises because there is still no strong consensus regarding the direction of the relationship between Human Capital Quality, Bank Size, and Workforce Productivity. One perspective explains that the quality of human capital and organisational size play important roles in improving productivity by strengthening a company's ability to manage resources and enhance work efficiency. Another perspective suggests that increases in organisational size are not always accompanied by improvements in productivity when human resource management is ineffective, particularly in organisations with high levels of complexity. These conditions indicate the existence of conceptual inconsistency, suggesting that the relationship among these three variables remains open for further investigation, particularly within the context of large banks in Indonesia, which possess complex and dynamic organisational characteristics.

The novelty of this study lies in the use of an Education Index to measure Human Capital Quality, Profit per Employee to measure Workforce Productivity, and panel data from KBMI 4 banks during the 2021–2025 digital transformation period. In addition, this study integrates Human Capital Theory and the Resource-Based View to provide a more comprehensive explanation of workforce productivity in large-scale banking institutions.

The urgency of this study lies in the need to explain the gap between improvements in the quality of human resources and the expansion of bank size and workforce productivity performance, which has not been entirely consistent among KBMI 4 Banks. A deeper understanding is required to determine whether Human Capital Quality and Bank Size are truly capable of serving as the main drivers of improvements in Workforce Productivity within the banking industry. The findings of this study are expected to provide theoretical contributions to the development of human resource management as well as practical contributions to strategic decision-making related to workforce management in the large-scale banking sector.

LITERATURE REVIEW

Resource-Based View Theory

Resource-Based View (RBV) Theory was proposed by Jay B. Barney (1991), who explained that sustainable competitive advantage and organisational performance originate from a company's ability to manage internal resources that are valuable, rare, inimitable, and non-substitutable. In the banking industry, these resources consist not only of financial assets and technology but also include the quality of human resources reflected in the level of education, competence, experience, and employees' ability to create value for the organisation. Human capital is regarded as a strategic resource capable of improving organisational

productivity and efficiency when managed optimally. In addition, bank size may be considered an organisational resource that enables a company to achieve economies of scale, gain access to better technology, and possess greater investment capacity for workforce development. Therefore, based on the RBV perspective, human capital quality and bank size are strategic resources that play important roles in improving workforce productivity because both can create added value and promote the achievement of superior and sustainable organisational performance.

Human Capital Quality

Human Capital Quality describes the quality of human resources as reflected in the level of education, knowledge, skills, experience, and individuals' ability to contribute to the achievement of organisational objectives. From a strategic management perspective, human capital is viewed not only as an operational workforce but also as an asset that supports organisational development and sustainability. Bai (2024) explains that investment in human capital through the development of employees' knowledge, skills, capabilities, and attitudes plays an important role in enhancing an organisation's core competitiveness and supporting improvements in organisational performance. Furthermore, Douglas (2021) states that a human capital management strategy focusing on capability development, training, and employee competency enhancement is able to strengthen organisational resilience and capacity in responding to environmental changes. In line with this, Pudiasuti & Nugroho (2021) explain that the quality of human resources is an important factor influencing organisational productivity because improvements in employee performance contribute to the achievement of company targets and objectives. In the banking industry, human capital quality is an important aspect because banking activities require a workforce possessing professional competence, technological capability, and an understanding of customer needs. Therefore, the higher the quality of human capital, the greater the potential for improving workforce productivity. In this study, Human Capital Quality is measured using the Education Index because educational attainment provides a more comprehensive representation of workforce quality than employee quantity alone.

The measurement of Human Capital Quality in this study uses the Education Index adapted from the approach of Hosseinioun et al. (2025), by assigning ordinal weights to each level of employee education: Primary School/Junior High School/Senior High School = 1, Diploma = 2, Bachelor's Degree = 3, Master's Degree = 4, Doctoral Degree = 5, and then normalising the weighted total score by dividing it by the total number of employees multiplied by the maximum weight (5), so that the index ranges from 0 to 1, using the following formula:

$$EI = \frac{(1 \times n_{\text{Primary/Junior High/Senior High}}) + (2 \times n_D) + (3 \times n_{S1}) + (4 \times n_{S2}) + (5 \times n_{S3})}{\text{Total Number of Employees} \times 5}$$

where a value approaching 1 reflects a higher average quality of human capital within the company.

Bank Size

Bank Size indicates the size or scale of a company that reflects its economic capacity, total assets, and operational capability. Bank size is an important indicator because companies with a larger scale generally have broader access to resources, greater investment capability, and stronger organisational infrastructure. Elidawati et al. (2024) explain that company size affects competitiveness because larger companies possess advantages in operational scale and resource utilisation compared with smaller companies. In addition, Kozak (2020) found that increases in bank size and market share have a positive effect on bank efficiency, meaning that larger banks tend to have greater capability in optimising their resources. Nevertheless, Curti & Mihov (2018) show that very large banks also face higher operational risks due to increasing organisational complexity. In the context of KBMI 4, larger bank size provides greater capability to invest in technology, work systems, and the development of workforce quality, thereby potentially improving workforce productivity.

Bank Size is an indicator that reflects the scale of a bank's operational activities. Wijayanti & Paramita (2025) explain that firm size can be measured using several indicators, such as total assets, the logarithm of company size, total equity, and market value of shares, where one of the proxies used is the Natural Logarithm of Total Assets, which includes all bank assets, including current assets, fixed assets, and other assets, using the following formula:

$$\text{Bank Size} = \ln(\text{Total Aset})$$

The use of the natural logarithm aims to reduce the disparity in total asset values among banks, which is very large, so that the data distribution becomes more proportional for statistical analysis. Larger banks generally have greater capacity to allocate resources, develop infrastructure, and finance investments in employee competency development, which in turn has the potential to improve workforce productivity.

Workforce Productivity

Workforce Productivity is the ability of the workforce to generate output effectively and efficiently through the utilisation of organisational resources. Workforce productivity reflects the extent to which employees are able to complete their work and support the achievement of organisational objectives. Pudiasuti & Nugroho (2021) explain that the quality of human resources and appropriate human resource management strategies influence improvements in employee productivity in achieving company targets. Furthermore, Mulia & Sholikhah (2024) state that organisational productivity can be improved through effective human resource management, including good communication, continuous training, employee motivation, and inclusive leadership. Jacobs (2017) adds that modern workforce productivity increasingly depends on employees' ability to perform knowledge-based work and develop competencies that align with organisational needs. In the banking industry, workforce productivity is a strategic indicator because service quality, operational efficiency, and digital transformation are highly dependent on the workforce's ability to perform business activities effectively. In this study, Workforce Productivity is measured using Profit per Employee because this indicator directly reflects employees' contribution to organisational performance.

Workforce Productivity is the ability of the workforce to generate economic output through the effective and efficient utilisation of human resources. The measurement of Workforce Productivity in this study uses Profit per Employee, which is the ratio of net profit

to the total number of employees. This ratio indicates the amount of profit generated by each employee and therefore reflects the level of workforce productivity in supporting the achievement of organisational performance. The higher the Profit per Employee value, the higher the level of workforce productivity possessed by the company. This measurement refers to Boateng (2019), who used the Profit per Employee Ratio as one of the productivity indicators in the banking industry:

$$\text{Workforce Productivity} = \frac{\text{Net Profit}}{\text{Total Number of Employees}}$$

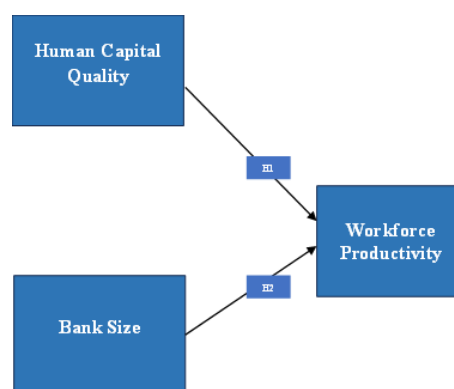


Figure 3. Conceptual Framework

METHODOLOGY

This study employs a quantitative approach with an associative method aimed at analysing the effect of Human Capital Quality and Bank Size on Workforce Productivity in KBMI 4 group banks in Indonesia during the 2021–2025 period. A quantitative approach is used because this study focuses on testing the relationships among variables through the processing of numerical data using statistical methods to obtain empirical evidence objectively and measurably. The associative method is employed to determine the relationship and influence between the independent variables, namely Human Capital Quality and Bank Size, and the dependent variable, namely Workforce Productivity, through testing the formulated hypotheses (Creswell, 2009).

The analytical method used in this study is panel data regression to determine the direction and magnitude of the influence of Human Capital Quality and Bank Size on Workforce Productivity. Panel data regression was selected because this study uses a combination of cross-sectional data in the form of several KBMI 4 banks and time-series data during the 2021–2025 period. The panel data regression approach enables the study to accommodate differences in characteristics among banks as well as changes in conditions over time, thereby producing estimates that are more efficient and informative than the use of separate data (Gujarati & Porter, 2009).

Data analysis was conducted using the EViews application through several stages of testing. The first stage was descriptive statistical analysis to describe the characteristics of each research variable. Subsequently, the panel data regression model was selected through the Chow test, Hausman test, and Lagrange Multiplier test to determine the most appropriate estimation model. After the model had been selected, the study proceeded with classical assumption testing to ensure that the regression model met the analytical feasibility criteria. Hypothesis testing was conducted through the partial test (t-test) to determine the effect of each independent variable on the dependent variable, the simultaneous test (F-test) to determine the collective influence of the independent variables, and the coefficient of determination (R^2) to measure the model's ability to explain variations in Workforce Productivity.

The type of data used in this study is panel data, namely a combination of cross-sectional and time-series data during the 2021–2025 period. The study uses secondary data obtained from the annual reports and annual financial statements of KBMI 4 group banks during the observation period. These data were collected through official publications available on the website of each bank. The information used in this study includes data concerning the quality of human resources, the number of employees, company assets, and other financial and operational information required to measure the variables of Human Capital Quality, Bank Size, and Workforce Productivity.

The data collection technique was conducted using the documentation method, namely a data collection technique by collecting, reviewing, and analysing secondary documents relevant to the study. The documents used include annual reports, annual financial statements, sustainability reports where available, and various other supporting documents published by each bank during the research period (Sekaran & Bougie, 2016).

The population in this study comprises all banks included in the KBMI 4 group (Bank Group Based on Core Capital 4) in Indonesia during the 2021–2025 period. The sample selection technique uses the purposive sampling method, namely a method of determining samples based on specific criteria adjusted to the objectives of the study. This method is used to ensure that the selected sample possesses complete and relevant information to support the testing of relationships among the research variables.

The sample selection criteria in this study include: (1) banks included in the KBMI 4 group during the 2021–2025 research period; (2) banks that consistently published annual reports and annual financial statements throughout the observation period; and (3) banks that provided the data required for measuring the variables of Human Capital Quality, Bank Size, and Workforce Productivity. Based on these criteria, a total of four KBMI 4 banks met the requirements and were used as the research sample. With an observation period of five years, namely from 2021 to 2025, the total number of observations used in this study was 20 panel data observations (4 banks $\times$ 5 years). These data were subsequently analysed to examine the effect of Human Capital Quality and Bank Size on Workforce Productivity in KBMI 4 banks in Indonesia.

RESULTS AND DISCUSSION

Results

Descriptive Statistical Analysis

Descriptive statistical analysis was conducted to provide a general overview of the characteristics of the research data based on the minimum, maximum, mean, median, and standard deviation values of each variable used. This analysis aims to observe the pattern of data distribution and determine the general condition of each research variable before further testing is conducted. The variables analysed in this study consist of Human Capital Quality (X1), Bank Size (X2), and Workforce Productivity (Y) in KBMI 4 group banks in Indonesia during the 2021–2025 period. The results of the descriptive statistical analysis can be seen in the following table.

Table 1. Descriptive Statistical Data

Date: 06/24/26 Time: 12:07
Sample: 2021 2025

	X1	X2	Y
Mean	0.585326	14.28382	1.038525
Median	0.584391	14.30521	0.771411
Maximum	0.606294	14.85577	2.177530
Minimum	0.560421	13.77972	0.371818
Std. Dev.	0.013363	0.301523	0.551161
Skewness	-0.051169	0.010562	0.768391
Kurtosis	1.858340	2.052887	2.356427
Jarque-Bera	1.094883	0.747892	2.313236
Probability	0.578428	0.688014	0.314548
Sum	11.70651	285.6763	20.77050
Sum Sq. Dev.	0.003393	1.727403	5.771792
Observations	20	20	20

Source: data processed using EViews, 2026

Based on the results of descriptive statistical data processing of 20 research observations, an overview of each variable is obtained as follows:

The Human Capital Quality (X1) variable has a mean value of 0.585326, with a minimum value of 0.560421 and a maximum value of 0.606294. The standard deviation value of 0.013363 indicates that the level of data dispersion of Human Capital Quality is relatively low, meaning that the characteristics of human resource quality in KBMI 4 banks during the research period tend to be stable. The median value of 0.584391, which is close to the mean value, indicates that the distribution of Human Capital Quality data is relatively balanced.

The Bank Size (X2) variable shows a mean value of 14.28382, with a minimum value of 13.77972 and a maximum value of 14.85577. The standard deviation of 0.301523 indicates variations in bank size across observation periods; however, the level of difference remains

within a relatively controlled range. The median value of 14.30521, which does not differ greatly from the mean value, indicates that the distribution of Bank Size data in the research sample is relatively normal and does not show extreme differences among observations.

Furthermore, the Workforce Productivity (Y) variable has a mean value of 1.038525, with a minimum value of 0.371818 and a maximum value of 2.177530. The standard deviation value of 0.551161 indicates that the Workforce Productivity variable has a higher level of variation than the independent variables. This shows differences in workforce productivity levels among KBMI 4 banks during the research period. The median value of 0.771411, which is below the mean value, indicates that there are several observations with relatively higher workforce productivity levels, thereby increasing the overall mean value.

Overall, the descriptive statistical results indicate that all research variables have a total of 20 panel data observations, derived from four KBMI 4 banks during the 2021–2025 period. The variation in the values of each variable provides an initial overview that there are differences in characteristics among banks in terms of human capital quality, bank size, and workforce productivity, which will subsequently be analysed through panel data regression testing.

Panel Data Regression Model

The determination of the panel data regression model in this study was carried out through several stages of testing, namely the Chow test, Hausman test, and Lagrange Multiplier (LM test). These tests aim to determine the most appropriate panel data regression model to be used in this study, namely between the Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM). Model selection was conducted based on the probability value of each test.

The results of the Chow test indicate that the probability value is smaller than the significance level of 0.05; therefore, the more appropriate model compared with the Common Effect Model (CEM) is the Fixed Effect Model (FEM). Furthermore, the results of the Hausman test indicate a probability value greater than 0.05; therefore, the more appropriate model is the Random Effect Model (REM) compared with the Fixed Effect Model (FEM). The final test through the Lagrange Multiplier (LM test) indicates a probability value smaller than 0.05; therefore, the Random Effect Model (REM) is more appropriate than the Common Effect Model (CEM).

Table 2. Summary of Panel Data Regression Model Selection

No	Test	Test Results	Model Decision
1	Chow Test	Cross-section F Probability = 0.0000 < 0.05 and Cross-section Chi-square = 0.0000 < 0.05	Fixed Effect Model (FEM)
2	Hausman Test	Chi-square Probability = 0.2286 > 0.05	Random Effect Model (REM)
3	Lagrange Multiplier (LM) Test	Breusch-Pagan Cross-section Probability = 0.0004 < 0.05	Random Effect Model (REM)

Source: data processed using EViews, 2026

Based on the entire series of panel data regression model selection tests, it can be concluded that the Random Effect Model (REM) is the best model used in this study. The REM was selected because it is capable of providing more efficient estimates by considering the differences in characteristics among banks that are random during the research period.

Therefore, further analysis to examine the effect of Human Capital Quality and Bank Size on Workforce Productivity was conducted using the Random Effect Model (REM) approach.

Classical Assumption Tests

Classical assumption testing in this study was conducted after obtaining the best panel data regression model, namely the Random Effect Model (REM). This testing aims to ensure that the regression model used has fulfilled the analytical feasibility criteria before hypothesis testing is carried out. In this study, the classical assumption tests conducted include the normality test and the multicollinearity test.

Normality Test

The normality test was conducted to determine whether the residual data in the regression model are normally distributed. The normality test in this study used the Jarque-Bera method by observing the probability value. Data are considered normally distributed if the probability value is greater than the significance level of 0.05.

Based on the results of the normality test, the Jarque-Bera value obtained was 4.113268 with a Probability value of 0.127884. This probability value is greater than 0.05 ($0.127884 > 0.05$); therefore, it can be concluded that the residuals in the regression model are normally distributed. Thus, the regression model used in this study has fulfilled the normality assumption.

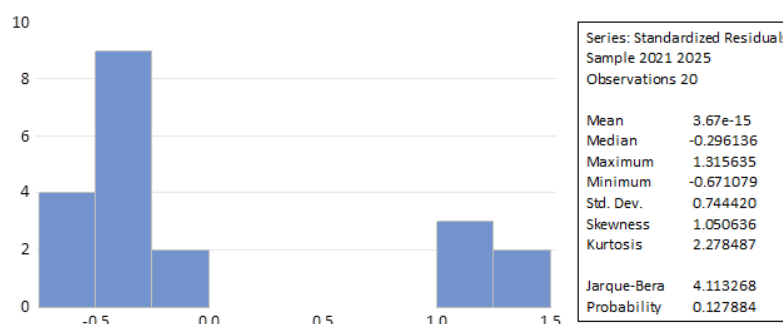


Figure 4. Residual Normality Test Results

Source: data processed using EViews, 2026

Multicollinearity Test

The multicollinearity test was conducted to determine whether there is a high relationship or correlation among the independent variables in the regression model. A regression model is considered free from multicollinearity problems if the correlation value among the independent variables is below 0.80.

Table 3. Multicollinearity Test Results

Variable	X1	X2
X1	1.000000	-0.136128
X2	-0.136128	1.000000

Source: data processed using EViews, 2026

Based on the results of the multicollinearity test in the table above, it is known that the correlation value between the Human Capital Quality (X1) and Bank Size (X2) variables is -0.136128. This correlation value is less than 0.80; therefore, it can be concluded that there is no multicollinearity problem among the independent variables in the research model. Thus, the Human Capital Quality and Bank Size variables can be used simultaneously in the regression model to explain their influence on Workforce Productivity.

Coefficient of Determination Test (R^2)**Table 4.** Coefficient of Determination Test (R^2)

Weighted Statistics			
R-squared	0.761800	Mean dependent var	0.088329
Adjusted R-squared	0.733776	S.D. dependent var	0.276310
S.E. of regression	0.142567	Sum squared resid	0.345532
F-statistic	27.18422	Durbin-Watson stat	1.232226
Prob(F-statistic)	0.000005		

Source: data processed using EViews, 2026

Based on the results of the coefficient of determination test in the table above, the Adjusted R-squared value obtained is 0.733776. This value indicates that the independent variables in this study, namely Human Capital Quality and Bank Size, are capable of explaining variations in the dependent variable Workforce Productivity by 73.38%. Meanwhile, the remaining 26.62% is explained by other factors outside the research model that are not included in this analysis.

The use of the Adjusted R-squared value in this study was chosen because it provides a more accurate measurement of the explanatory power of the model by considering the number of independent variables and the number of observations used. The Adjusted R-squared value of 73.38% indicates that the research model has a fairly strong explanatory ability in describing the relationship between Human Capital Quality and Bank Size and Workforce Productivity in KBMI 4 group banks in Indonesia.

The coefficient of determination value indicates that workforce productivity in KBMI 4 banks is not only influenced by the quality of human resources and bank size but may also be influenced by other factors outside the research model, such as banking digitalisation, human resource management strategies, organisational culture, incentive systems, operational efficiency levels, and other internal and external factors that are not analysed in this study.

F-Test Results**Table 5.** F-Statistic Test

Weighted Statistics			
R-squared	0.761800	Mean dependent var	0.088329
Adjusted R-squared	0.733776	S.D. dependent var	0.276310
S.E. of regression	0.142567	Sum squared resid	0.345532
F-statistic	27.18422	Durbin-Watson stat	1.232226
Prob(F-statistic)	0.000005		

Source: data processed using EViews, 2026

Based on the results of data processing, the Prob(F-statistic) value obtained is 0.000005. This value is smaller than the significance level of 0.05, indicating that the regression model in this study has fulfilled the goodness-of-fit criteria. Statistically, these results indicate that the Human Capital Quality (X1) and Bank Size (X2) variables simultaneously have a significant effect on Workforce Productivity (Y) in KBMI 4 banking companies in Indonesia during the 2021–2025 period.

The F-statistic value of 27.18422 indicates that the research model has a good ability to explain the relationship between the independent variables and the dependent variable. Thus, the regression model used can serve as the basis for analysing the influence of each

independent variable partially through t-test analysis. In addition, these results indicate that improvements in human capital quality and company size jointly contribute to increasing workforce productivity in KBMI 4 banks in Indonesia.

t-Test Results

Table 6. t-Statistic Test

Dependent Variable: Y				
Method: Panel EGLS (Cross-section random effects)				
Date: 06/24/26 Time: 09:32				
Sample: 2021 2025				
Periods included: 5				
Cross-sections included: 4				
Total panel (balanced) observations: 20				
Swamy and Arora estimator of component variances				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-28.33466	3.894117	-7.276273	0.0000
X1	24.42901	9.756967	2.503751	0.0228
X2	1.055338	0.405988	2.599435	0.0187

Source: data processed using EViews, 2026

Based on the table above, the results of the partial test (t-test) in this study can be explained as follows:

1. The Human Capital Quality (X1) variable has a positive coefficient value of 24.42901 with a probability value of 0.0228. Since the probability value is smaller than the significance level of 0.05, it can be concluded that Human Capital Quality has a positive and significant effect on Workforce Productivity. These results indicate that the higher the quality of human capital possessed by the bank, the greater the workforce productivity.
2. The Bank Size (X2) variable has a positive coefficient value of 1.055338 with a probability value of 0.0187. Since the probability value is smaller than 0.05, it can be concluded that Bank Size has a positive and significant effect on Workforce Productivity. These findings indicate that the larger the bank size, the higher the level of workforce productivity that can be achieved through resource support, operational capacity, and broader organisational management.

Based on the results of the t-test, all independent variables in this study, namely Human Capital Quality and Bank Size, are proven to have a positive and significant effect on Workforce Productivity in KBMI 4 banks in Indonesia during the 2021–2025 period.

Discussion

This study aims to analyse the effect of Human Capital Quality and Bank Size on Workforce Productivity in KBMI 4 group banks in Indonesia during the 2021–2025 period. Based on the results of the simultaneous test (F-test), the F-statistic probability value obtained is 0.000005 (< 0.05), indicating that the independent variables jointly have a significant effect on Workforce Productivity. In addition, the Adjusted R^2 value of 0.733776 indicates that the Human Capital Quality and Bank Size variables are capable of explaining variations in Workforce Productivity by 73.38%, while the remaining 26.62% is influenced by other factors outside the research model. These results indicate that the research model has a strong explanatory ability in describing the factors influencing workforce productivity in KBMI 4 banks in Indonesia.

The results of the partial test indicate that Human Capital Quality has a positive and significant effect on Workforce Productivity. This is evidenced by the coefficient value of 24.42901 with a probability value of 0.0228 (< 0.05). These findings indicate that improvements in the quality of human capital possessed by banks are capable of encouraging increased workforce productivity. Better human resource quality, in terms of competence, professional capability, and knowledge mastery, enables employees to perform operational activities more effectively and produce more optimal performance. In the banking industry, which has a high level of complexity, the quality of human capital becomes an important factor because the ability of the workforce to manage services, technology, and business processes determines the level of efficiency and organisational productivity.

The results of this study indicate that banks with higher-quality human capital possess a greater ability to optimise internal resources in achieving better workforce productivity. This condition is in line with the Resource-Based View (RBV), which explains that valuable, rare, and difficult-to-imitate internal resources can become sources of competitive advantage for organisations. In the context of KBMI 4 banking, human capital is not merely viewed as the number of employees but as a strategic asset capable of creating added value through enhanced capabilities, innovation, and work effectiveness.

Furthermore, the Bank Size variable shows a positive and significant effect on Workforce Productivity with a coefficient value of 1.055338 and a probability value of 0.0187 (< 0.05). These results indicate that the larger the bank size, the higher the level of workforce productivity generated. Banks with larger sizes generally possess broader resources, more complex operational networks, and greater investment capabilities in technological development and management systems. These conditions can support employees in carrying out their work more effectively, thereby increasing workforce productivity.

The positive effect of Bank Size on Workforce Productivity indicates that organisational scale provides advantages in creating operational efficiency. Large banks tend to possess more adequate infrastructure, access to more advanced technology, and more structured human resource management systems. Thus, increases in bank size can support the optimisation of employee performance through the provision of facilities, training, and a more supportive working environment.

Overall, the results of this study indicate that Human Capital Quality and Bank Size are important factors that play a role in improving Workforce Productivity in KBMI 4 banks in Indonesia. The quality of human resources contributes through enhanced competence and work effectiveness, while bank size provides support through organisational capacity and greater resource management capabilities. These findings confirm that improvements in workforce productivity in the banking industry depend not only on technological aspects and company assets but also on the organisation's ability to develop human quality and manage business scale optimally.

CONCLUSION

Based on the results of the research and discussion conducted regarding the effect of Human Capital Quality and Bank Size on Workforce Productivity in KBMI 4 group banks in Indonesia during the 2021–2025 period, the following conclusions can be drawn:

1. Human Capital Quality has a positive and significant effect on Workforce Productivity. The results of the study indicate that the better the quality of human capital possessed by the bank, the higher the level of workforce productivity generated. This shows that competence, capability, and the quality of human resources are important factors in supporting work effectiveness and improving organisational performance in the banking industry.
2. Bank Size has a positive and significant effect on Workforce Productivity. The research findings indicate that bank size plays a role in improving workforce productivity. Banks with greater organisational capacity tend to have better resource support, technology, infrastructure, and management systems, thereby creating working conditions that support improvements in employee productivity.
3. Human Capital Quality and Bank Size simultaneously have a significant effect on Workforce Productivity. These results indicate that improvements in workforce productivity in KBMI 4 banks are influenced not only by the quality of human resources but also by the organisation's ability to manage business scale and provide adequate operational support.
4. Workforce Productivity in KBMI 4 banks may also be influenced by factors outside the research variables. Although Human Capital Quality and Bank Size have been proven to play an important role in improving workforce productivity, other factors may influence productivity, such as human resource development strategies, digital transformation, organisational culture, reward systems, and the effectiveness of internal management.

This study contributes to the literature by using the Education Index and Profit per Employee as alternative measures and by providing updated evidence from KBMI 4 banks during the digital transformation period.

References:

- Akbar, E. E., Noviarita, H., & Anggraeni, E. (2020). Optimization of Human Resources Quality in Improving the Performance of Islamic Banking Employees. *JURNAL PERSPEKTIF EKONOMI DARUSSALAM*, 6(2), 136-144. <https://doi.org/10.24815/jped.v6i2.14491>
- Annabi, N. (2017). Investments in education: What are the productivity gains? *Journal of Policy Modeling*, 39(3), 499-518. <https://doi.org/10.1016/j.jpolmod.2017.03.003>
- Backman, M. (2012). Human capital in firms and regions: Impact on firm productivity. *Papers in Regional Science*, 93(3), 557-576. <https://doi.org/10.1111/pirs.12005>
- Bai, Y. (2024). A Study of the Impact of Human Capital Investment on Organizational Performance. *Highlights in Business, Economics and Management*, 32, 210-216. <https://doi.org/10.54097/qd8pxd61>
- Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, 17(1), 99-120. <https://doi.org/10.1177/014920639101700108>
- Bi, Q., Hang, J., & Zhou, M. (2021). Human capital and average firm size. *Economics Letters*, 204, 109920. <https://doi.org/10.1016/j.econlet.2021.109920>
- Boateng, K. (2019). The Relationship between Efficiency , Productivity , and Profitability of Ghanaian Banks. *IOSR Journal of Business and Management (IOSR-JBM)*, 21(6), 52-60. <https://doi.org/10.9790/487X-2106045260>
- Creswell, J. W. (2009). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. Sage Publications.
- Curti, F., & Mihov, A. (2018). Diseconomies of Scale in Banking: Evidence from Operational Risk. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.3210206>

- Douglas, S. (2021). Building organizational resilience through human capital management strategy. *Development and Learning in Organizations: An International Journal*, 35(5), 19–21. <https://doi.org/10.1108/DLO-08-2020-0180>
- Elidawati, E., Maksum, A., Yahya, I., & Nurlinda, N. (2024). The Influence of Company Size on the Competitiveness of Medium and Large Scale Manufacturing Companies in the City of Serdang Bedagai. *Proceedings of the 1st International Conference on Social Science (ICSS)*, 3(1), 35–41. <https://doi.org/10.59188/icss.v3i1.144>
- Ertan, A., Lewellen, S., & Thomas, J. K. (2020). Do Profit Margins Expand for High Growth Firms? *Journal of Management Accounting Research*, 32(3), 117–135. <https://doi.org/10.2308/jmar-18-079>
- Fonseca, T., de Faria, P., & Lima, F. (2019). Human capital and innovation: the importance of the optimal organizational task structure. *Research Policy*, 48(3), 616–627. <https://doi.org/10.1016/j.respol.2018.10.010>
- Gujarati, D. N., & Porter, D. C. (2009). *Basic Econometrics* (5 ed.). McGraw-Hill/Irwin.
- Hosseinioun, M., Neffke, F., Zhang, L., & Youn, H. (2025). Skill dependencies uncover nested human capital. *Nature Human Behaviour*, 9(4), 673–687. <https://doi.org/10.1038/s41562-024-02093-2>
- Jacobs, R. L. (2017). Knowledge Work and Human Resource Development. *Human Resource Development Review*, 16(2), 176–202. <https://doi.org/10.1177/1534484317704293>
- Karim, M. Z. A., Anuar, A. R., & Mohd. Khan, S. J. (2020). Information Technology and Cost Efficiency in Malaysian Banking Industry. *Malaysian Management Journal*, 7. <https://doi.org/10.32890/mmj.7.2.2003.8612>
- Kozak, S. (2020). Are Larger Banks More Efficient in the Central Eastern European Countries? *Annales Universitatis Mariae Curie-Skłodowska, sectio H – Oeconomia*, 54(2), 31. <https://doi.org/10.17951/h.2020.54.2.31-40>
- Mulia, V. C., & Sholikhah, A. (2024). Increasing Organizational Productivity Through Effective Human Resource Management. *Proceeding of International Students Conference of Economics and Business Excellence*, 1(1), 92–94. <https://doi.org/10.33830/iscebe.v1i1.3686>
- Nanaeva, I. S., & Minkailova, M. M. (2025). Human Resources as the Strategic Capital of a Modern Organization. *EKONOMIKA I UPRAVLENIE: PROBLEMY, RESHENIYA*, 9/12(162), 38–44. <https://doi.org/10.36871/ek.up.p.r.2025.09.12.005>
- Natsir, I., Ode, H., Irfana, T. B., Pulungan, D. R., & Sihite, M. (2024). An Analysis of the Role of Human Resource Management in Enhancing Organizational Efficiency and Effectiveness. *International Journal of Economics (IJE)*, 3(2), 1089–1097. <https://doi.org/10.55299/ijec.v3i2.1097>
- Nhu, Q. N. T. (2025). Human Capital and Bank Performance: Does Size Matter? *Journal of Risk and Financial Management*, 18(8), 429. <https://doi.org/10.3390/jrfm18080429>
- Nuriddin, A. (2025). Labor Productivity as A Developing Indicator. *Journal of Social Sciences and Humanities Research Fundamentals*, 5(5), 121–125. <https://doi.org/10.55640/jsshrf-05-05-31>
- Pudiastuti, E. T., & Nugroho, S. H. (2021). Strategies for Improving the Performance of Human Resources Through an Organizational Work Productivity. *JOURNAL ASRO*, 12(01), 98. <https://doi.org/10.37875/asro.v12i01.386>
- Rizka, N. R., & Ulfida, D. (2024). Asset Growth and Firm Performance: The Moderating Role of Asset Utilization. *Behavioral Accounting Journal*, 7(2), 118–135. <https://doi.org/10.33005/baj.v7i2.352>
- Sekaran, U., & Bougie, R. (2016). *Research Methods for Business: A Skill-Building Approach* (7 ed.). John Wiley & Sons.
- Wijayanti, S., & Paramita, R. S. (2025). The effect of liquidity, credit risk, firm size, and capital structure on the profitability of Islamic commercial banks registered with the OJK for the period 2020-2023. *Jurnal Ilmu Manajemen*, 11(1), 1059–1074.

<https://doi.org/10.26740/jim.v13n4.p1059-1074>

Yertas, M. (2024). The Role of Training and Continuous Development in Improving Employee Productivity and its Impact on Company Financial Performance. *Atestasi : Jurnal Ilmiah Akuntansi*, 7(2), 1362–1379. <https://doi.org/10.57178/atestasi.v7i2.1047>

Yuldashevna, K. G. (2024). The Economics of Education: Investing in Human Capital. *International Journal of Innovations in Engineering Research and Technology*, 11(1), 49–51. <https://doi.org/10.26662/ijiirt.v11i1.pp49-51>

Zeynullagil, U. (2022). The Effect of Organizational Management on Employee Work Efficiency. *International Journal Papier Public Review*, 3(4), 35–40. <https://doi.org/10.47667/ijppr.v3i4.183>