Architecture
Image Studies

The Role of Intellectual Capital in Moderation of The Effect of Diversification on The Profitability and Technical Efficiency of Conventional Commercial Banks in Indonesia

Amiruddin Muhidu[1], Dedy Takdir Saifuddin S[2], La Ode Anto[3], Sudirman Zaid[4]

Abstract

This study aims to examine the effect of income diversification and asset diversification on the profitability and technical efficiency of conventional commercial banks in Indonesia, as well as to investigate the moderating role of intellectual capital in these relationships. The research covers 68 conventional commercial banks in Indonesia during the 2013–2023 period. The analysis is conducted using the System Generalized Method of Moments (Sys-GMM) to address potential endogeneity and unobserved heterogeneity in dynamic panel data, while Data Envelopment Analysis (DEA) is applied to measure banks' technical efficiency. The findings reveal that income diversification (IDI) has an insignificant effect on profitability but a negative and significant effect on technical efficiency, indicating that higher income diversification tends to reduce operational efficiency. Conversely, asset diversification (ADI) shows no significant influence on either profitability or efficiency. Regarding the components of intellectual capital, Structural Capital Efficiency (SCE) has a positive and significant impact on ROA and ROE, while Capital Employed Efficiency (CEE) exerts a positive and significant effect on technical efficiency. Meanwhile, Human Capital Efficiency (HCE) does not significantly affect any performance indicator. Moreover, Value Added Intellectual Capital (VAIC) has a positive and significant effect on both ROA and ROE, underscoring the role of intellectual capital in enhancing banks' profitability. In terms of moderation effects, SCE strengthens the relationship between income diversification and profitability (ROA), while HCE and CEE weaken the effect of asset diversification on profitability (ROE). These results suggest that the moderating role of intellectual capital varies depending on the type of diversification and the performance dimension examined. Overall, this study contributes to the banking literature by highlighting how intellectual capital can either reinforce or diminish the impact of diversification strategies on bank performance, providing both theoretical insights and practical implications for regulators and bank management in formulating strategies to enhance competitiveness and efficiency in the Indonesian banking sector.

Keywords: *Income Diversification, Asset Diversification, Intellectual Capital, Profitability, Technical Efficiency, System GMM, DEA.*

Introduction

The banking sector plays a strategic role as a key pillar of the financial system and a catalyst for national economic growth through its intermediary function, namely collecting and channeling public funds to support production and consumption activities. For this function to function optimally, the banking industry is required to be healthy, strong, competitive, and contributing (Financial Services Authority, 2021). Furthermore, banks also play a crucial role in the transmission of monetary policy implemented by Bank Indonesia through instruments such as open market operations, policy interest rates, and minimum reserve requirements, which impact interest rates, credit, exchange rates, asset prices, and economic expectations (Bank Indonesia, 2020). Therefore, banking stability and performance are crucial prerequisites for the sustainability of the national economy.

Banking performance is generally measured using accounting ratios such as BOPO, NPL, CAR, ROA, ROE, and NIM. In aggregate, the performance of conventional commercial banks in Indonesia

---

[1]Halu Oleo University, Kendari, Indonesia (corresponding author).
[2] Halu Oleo University, Kendari, Indonesia.
[3] Halu Oleo University, Kendari, Indonesia
[4] Halu Oleo University, Kendari, Indonesia

from 2015 to May 2024 showed an improving trend, despite experiencing significant pressure during the COVID-19 pandemic in 2020–2021, reflected in increased operating expenses (BOPO), rising non-performing loans (NPL), and declining return on assets (ROA). However, capital resilience remained strong thanks to the OJK's countercyclical policies (OJK, 2020; OJK, 2024). These fluctuations indicate that bank performance stability remains vulnerable to external shocks, necessitating the strengthening of sustainable performance management strategies.

In addition to financial ratios, technical efficiency (ET) is also an important indicator in assessing bank performance. Technical efficiency reflects a bank's ability to manage inputs to optimally produce outputs and is an indicator of vulnerability to financial distress (Adusei, 2016). High efficiency demonstrates a bank's ability to survive in a competitive and dynamic environment and supports financial system stability (Putri et al., 2016; Lema, 2017). Conceptually, technical efficiency refers to the thinking of Farrell (1957), who emphasized optimizing resource use, rather than simply reducing costs. Therefore, it is relevant in measuring the effectiveness of banking operations amidst reform, deregulation, and technological innovation (Alrafadi et al., 2014; Jelassi & Delhoumi, 2021).

Technological developments, financial technology, open banking, and regional banking integration encourage banks to diversify their revenues and assets. In Indonesia, this trend is reflected in a significant increase in the share of non-interest income from 20.72% in 2014 to 44.72% in 2024, with growth exceeding that of interest income (OJK, 2024). Revenue diversification, particularly the shift toward fee-based income, aims to reduce reliance on volatile interest income and improve risk management (Syaifuddin, 2009). However, theoretically, the effect of diversification on performance remains debated, with portfolio theory (Markowitz, 1952) supporting diversification to improve performance, while agency theory (Jensen & Meckling, 1976) highlights the potential for decreased efficiency and increased complexity, as well as agency problems (Sang, 2017). Differences in empirical results are also evident in previous studies (Ahamed, 2017; Doan et al., 2018; Abuzayed et al., 2018; Adesina, 2021).

In addition to diversification, intellectual capital is a crucial strategy for improving banking performance in the era of digital transformation. Intellectual capital encompasses human capital, structural capital, and relational capital, all of which contribute to value creation and competitive advantage (Stewart & Ruckdeschel, 1997; IIRC, 2013). From the Resources-Based View (Penrose, 1960), intellectual capital is viewed as a strategic resource that is rare, valuable, and difficult to imitate. Although several studies have found a positive effect of intellectual capital on bank performance (Adesina, 2019; Duho, 2020; Vidyarthi, 2019a), the results remain inconsistent (Ting et al., 2022). The limitations of previous research, particularly in the use of performance indicators, prompted this study to examine the influence of revenue and asset diversification and intellectual capital on the performance of commercial banks in Indonesia using profitability (ROA and ROE) and technical efficiency based on a profit approach through Data Envelopment Analysis, while also examining the moderating role of intellectual capital in this relationship.

Literature Review

Profitability Concept

Profitability is one of the main indicators used to assess the success of banking performance. Conceptually, profitability describes a bank's ability to generate profits from the resources it manages, including assets, capital, and intermediation activities. Within the framework of economic theory and financial management, profitability is viewed not only as a measure of the outcome of business activities but also as an indicator of the efficiency, competitiveness, and sustainability (going concern) of financial institutions (Mishkin, 2021). In the literature, several key theories form the conceptual foundation of profitability. First, the risk-return tradeoff theory, rooted in portfolio theory by Markowitz (1952), asserts a positive relationship between the risk taken and the level of return earned. In the banking context, the greater the exposure to credit or market risk, the greater the potential profit. However, this risk must be managed effectively to prevent systemic losses (Merton, 1974). Second, the Structure, Conduct, and Performance (SCP) paradigm, introduced by Mason (1939) and further developed by Bain (1936), emphasizes that market structure, such as industry concentration, barriers to entry, and product differentiation, influences firm behavior (conduct) in pricing, production strategies, innovation, and competition policies. This behavior, in turn, determines industry performance, such as efficiency, profitability, stability, and customer satisfaction. In concentrated markets, competition is relatively low, allowing banks to set higher interest margins to increase profitability. Several studies also confirm the relevance of the SCP paradigm in the banking sector, particularly in developing countries where market

concentration remains high (Kasman & Kasman, 2015). Third, the efficient structure hypothesis (ESH), pioneered by Demsetz (1973) and further developed by Berger & Mester (1997), holds that high profitability is not solely due to a concentrated market structure, but rather because more efficient banks can reduce operating costs and thus achieve larger profit margins. This perspective emphasizes the importance of internal efficiency, including technical and operational efficiency, as a determinant of long-term profitability.

The Concept of Efficiency

Every organization strives to achieve optimal results reflected in measures of economic performance, effectiveness, and efficiency; conceptually, efficiency is rooted in microeconomic theory through producer theory which emphasizes efforts to maximize profits and minimize costs (Shone, 1975) and consumer theory which emphasizes maximizing satisfaction (Suryandari & Rahayuningsih, 2020), so that efficiency is understood as the ability to achieve optimal results with available resources in the production process, which is visualized through the production frontier as the maximum output limit at each input level (Coelly, Rao, O'Donnell, & Battese, 1998, p. 4); in economic theory, efficiency is divided into technical efficiency (micro perspective, focusing on the technical-operational relationship of converting inputs into outputs) and economic efficiency (macro perspective, prices are not always given because they are influenced by macro policies) (Ascarya & Yumanita, 2006), while Farrell (1957) divides efficiency into technical efficiency and allocative efficiency which then form economic efficiency. In the banking context, efficiency is an important performance parameter because profitability is not always in line with regulatory-based "healthy" criteria, such as CAR, reserve requirements, legal lending limits, and manager credibility (Hadad, Santoso, Mardanugraha, et al., 2003), so that efficiency measurements do not only rely on accounting ratios (e.g., BOPO), but also use parametric and nonparametric approaches (Hafidz et al., 2013); parametric approaches include SFA, TFA, and DFA, and in Indonesian banking studies it was shown that SFA and DFA can produce similar efficiency benchmark conclusions (Hadad, Santoso, Mardanugraha, et al., 2003), while nonparametric approaches such as DEA form an efficient frontier through linear programming and are considered superior for multi-input–multi-output cases, although more sensitive to errors and outliers than SFA in certain contexts (Fiorentino et al., 2006). DEA itself is a linear programming-based optimization method for evaluating the relative efficiency of organizational units (Subramanyam T, 2017), rooted in the ideas of Farrell (1957) and popularized by Charnes et al. (1978) through the CCR model, then developed by Banker et al. (1984) into a BCC model with VRS assumptions; the DEA model can be input or output oriented and use CRS or VRS assumptions, with the finding that in CRS the choice of input/output orientation does not differentiate technical efficiency scores (Maniati & Sambracos, 2017), and has been widely applied in bank efficiency studies (Ascarya & Yumanita, 2006; Havidz & Setiawan, 2015; Lema, 2017; Septianto & Widiharih, 2010; Suliyanto & Jati, 2014; Adusei, 2016; T. Le et al., 2022; Onumah & Duho, 2020); Furthermore, the determination of DEA input-output variables can follow the production, intermediation, or asset approaches (Hafidz et al., 2013; Hadad, Santoso, Ilyas, et al., 2003), and the literature also confirms the relevance of the profit approach to capture variations in bank strategic responses in a dynamic environment (Drake et al., 2006; Berger & Mester, 2003; Aggelopoulos & Georgopoulos, 2017), so this study chooses the profit approach because it best suits the focus of income diversification and is in line with profitability measures based on the return on asset ratio.
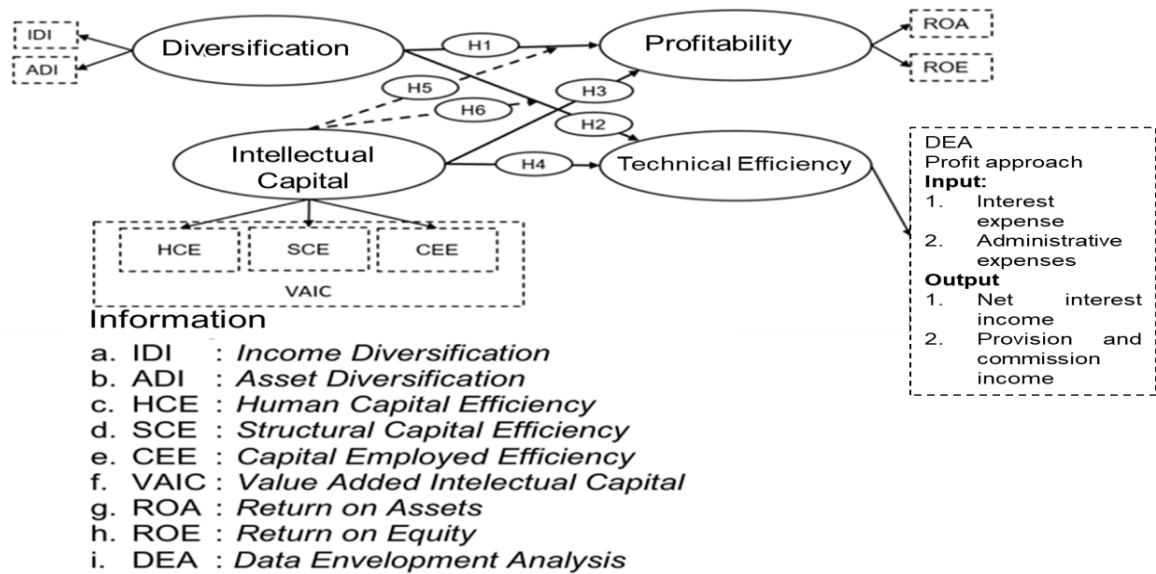
Diversification Concept

One important concept in strategic management that focuses on the development and management of a diverse business portfolio is diversification, which is generally understood as an effort to spread activities, investments, or revenue sources to reduce risk, maintain stability, increase efficiency, and optimize profits. In a macroeconomic context, diversification refers to expanding the range of economic activities of a country/region so as not to rely on a particular sector (Grillitsch & Asheim, 2018; Sarin et al., 2020), while in a financial context, diversification is understood as spreading investments across various instruments or assets to reduce portfolio risk (Sharma & Vipul, 2018; Nwosa et al., 2019; Adegbie et al., 2022). At the corporate level, diversification is defined as corporate expansion into new markets or product lines to pursue risk-adjusted total returns, either through acquisitions or internal development (Lecraw, 1984; Choi et al., 2019; Liu et al., 2018; Xiao et al., 2018). As a multidisciplinary strategy, diversification is generally divided into related and unrelated diversification: related diversification occurs when expansion is carried out in sectors that are still related to the core business, thus enabling the utilization of intangible assets (e.g., innovation, brands, networks), increasing economies of scale, and spreading risks, while unrelated diversification encourages the formation of conglomerates through the development of business lines that are different

from the main business (Mehmood et al., 2019). In the literature, diversification is also often mapped into asset diversification and income diversification: asset diversification emphasizes the spread of allocations across various types of productive assets (e.g., credit, securities, and other productive assets), while income diversification emphasizes the expansion of income sources through various activities or products to reduce dependence on a single source, increase stability, and strengthen resilience to external shocks (Le et al., 2022; Bonfiglio et al., 2022; Adhikari & Khanal, 2022). In the banking context, these two forms of diversification are relevant because banks traditionally rely on their intermediary function to generate net interest margin (NIM). Therefore, when interest rate changes or economic shocks occur, reliance on interest income can increase risk; therefore, banks can expand their asset portfolio and increase the portion of non-interest income, for example through fee-based income from credit cards, fund transfers, account management, wealth management, bancassurance, capital market activities, and digital banking services (Nepali, 2018).

The Concept of Intellectual Capital

Intellectual capital (IC) is a concept that explains the role of intangible assets in creating competitive advantage and improving company performance, while contributing to national economic development through optimal utilization of intellectual resources. At the macro level, the concept of national intellectual capital emphasizes the importance of investment in education, research and development, and innovation ecosystems to drive competitiveness and sustainable economic growth. Policymakers are increasingly recognizing the need for an environment that supports the development and retention of intellectual capital at both the organizational and national levels (Käpylä et al., 2012; Vo & Tran, 2023, 2024). Various studies have shown that strong and systematic intellectual capital management increases innovation capacity, adaptability, and sustainable competitive advantage, especially in technology- and knowledge-based sectors facing rapid change and high disruption (Hormiga et al., 2011; Poh et al., 2018; Sharabati et al., 2010; Hama & Cavusoglu, 2023), and has a positive impact on company performance (Cohen & Kaimenakis, 2007). Edvinsson & Malone (1997) emphasized that intellectual capital contributes significantly to a company's market value, alongside financial capital, through the support of organizational structure, business processes, continuous innovation, customer relations, and human resource quality. In general, intellectual capital consists of three main components: human capital, which reflects the knowledge, skills, and experience of human resources; structural capital, which encompasses organizational systems, processes, and culture; and capital employed, which demonstrates a company's ability to utilize physical and financial capital to create added value and profit (Nazari & Herremans, 2007; Attar et al., 2019; Bontis et al., 2018; Khalique et al., 2015; Wang & Chang, 2005; Mawutor et al., 2023).

Figure 1 Conceptual Framework

Information

a. IDI : *Income Diversification*
b. ADI : *Asset Diversification*
c. HCE : *Human Capital Efficiency*
d. SCE : *Structural Capital Efficiency*
e. CEE : *Capital Employed Efficiency*
f. VAIC : *Value Added Intelectual Capital*
g. ROA : *Return on Assets*
h. ROE : *Return on Equity*
i. DEA : *Data Envelopment Analysis*

Research Hypothesis

H1. Diversification has a positive and significant effect on profitability.

H2. Diversification has a positive and significant effect on technical efficiency.

H3. The effect of intellectual capital on profitability.

H4. The effect of intellectual capital on technical efficiency is positive and significant.

H5. Intellectual capital moderates the effect of diversification on profitability.

H6. Intellectual capital moderates the effect of diversification on technical efficiency.

Research Methods

This study aims to empirically test the model developed from the proposed grand theoretical model by placing intellectual capital—consisting of Human Capital Efficiency (HCE), Structural Capital Efficiency (SCE), and Capital Employed Efficiency (CEE)—and diversification including Income Diversification (IDI) and Asset Diversification (ADI) as determinants of bank profitability (ROA and ROE) and technical efficiency (TEF) in conventional banking in Indonesia. The focus of the study is limited to conventional commercial banks with an observation period of 2013–2024, so that all analyses reflect the dynamics of national banking performance in the last decade. The study population includes all conventional commercial banks in Indonesia during the period 2013–2024. Sampling was conducted using a purposive sampling technique with the criteria of banks remaining operational throughout the study period, not experiencing changes in business status, having complete research variable data, and financial reports that are accessible through Bank Indonesia, the Financial Services Authority, or other relevant sources. Based on these criteria, from 105 existing conventional commercial banks, 84 banks were obtained as research samples. The approach used is descriptive-correlation, where descriptive analysis aims to describe the technical efficiency conditions of banks using a nonparametric approach based on input-output, while correlational analysis is used to test the relationship between the variables of intellectual capital, diversification, profitability, and technical efficiency.

This study places financial performance as the dependent variable, measured through profitability and technical efficiency. Profitability is represented by Return on Assets (ROA) and Return on Equity (ROE), which reflect a bank's ability to generate profits based on assets and equity, respectively. Technical efficiency (TEF) is measured using a profit-based Data Envelopment Analysis (DEA) approach, with input variables being interest expense and administrative expenses, and output variables being interest income and fee/commission income, referring to Aggelopoulos & Georgopoulos (2017) and Gardijan Kedžo & Tuškan Sjauš (2021). The independent variables consist of income diversification (IDI) and asset diversification (ADI), measured using the Herfindahl Index. Intellectual capital is used as a moderating variable and measured using the Value Added Intellectual Capital (VAIC) method, which encompasses Human Capital Efficiency (HCE), Structural Capital Efficiency (SCE), and Capital Employed Efficiency (CEE), as introduced by Pulic.

To minimize potential bias and enhance the internal validity of the model, this study uses control variables that include banking-specific and macroeconomic indicators. These banking-specific indicators include bank size (SIZE), proxied by the natural logarithm of total assets; liquidity (LIQ), which reflects the bank's ability to meet short-term obligations; and capital adequacy (CAR), which is an indicator of capital resilience. Meanwhile, macroeconomic indicators include economic growth, measured by annual GDP growth, inflation rate, and per capita income. The use of these control variables aims to absorb the influence of external factors that can affect the relationship between diversification, intellectual capital, profitability, and technical efficiency, so that the resulting estimates better reflect the causal influence of the main variables studied.

Research Result

Sys-GMM Model Diagnostic Test Results

Table 2Sys-GMM Model Diagnostic Test Results

Model Testing with VAIC as IC Proxy			
Test Type		**z**	**Pr>z**
Arellano-Bond test AR (1)		-1,97	0,048
Arellano-Bond test AR (2)		0,83	0,409
Model Testing with HCE, SCE, CEE as IC proxies			
Test Type		**z**	**Pr>z**
Arellano-Bond test AR (1)		-2,08	0,037
Arellano-Bond test AR (2)		0,67	0,504
Model Testing with VAIC as IC Proxy			
Test Type		**chi2(15)**	**Prob>chi2**
Sargan test		4,59	0,995
Hansen test		10,06	0,816
Difference in Hansen test:			
GMM Instrumen for levels			
Excluding group	**chi2(9)**	3,08	0,961
Difference	**chi2(6)**	6,98	0,322
iv			
Excluding group	**chi2(6)**	1,59	0,953
Difference	**chi2(9)**	8,47	0,488
Model Testing with HCE, SCE, CEE as IC Proxies			
Test Type		**chi2(15)**	**Prob>chi2**
Sargan test		8,21	1,000
Hansen test		24,2	0,867
	Difference in Hansen test		
	GMM Instrumen for levels		
Excluding group	**chi2(9)**	9,21	0,987
Difference	**chi2(6)**	14,98	0,242
	iv		
Excluding group	**chi2(6)**	13,09	0,786
Difference	**chi2(9)**	11,11	0,745
Model Testing with VAIC as IC Proxy			
Test Type		**z**	**Pr>z**
Arellano-Bond test AR (1)		-1,58	0,113
Arellano-Bond test AR (2)		1,48	0,139
Testing the HCE, SCE, CEE Models as IC Proxies			
Test Type		**z**	**Pr>z**
Arellano-Bond test AR (1)		-1,58	0,113
Arellano-Bond test AR (2)		1,42	0,157
Model Testing with VAIC as IC Proxy			
Test Type		**chi2(15)**	**Prob>chi2**
Sargan test		4,48	0,996
Hansen test		17,45	0,293

Difference in Hansen test			
GMM Instrumen for levels			
Excluding group	**chi2(9)**	6,41	0,698
Difference	**chi2(6)**	11,04	0,087
iv			
Excluding group	**chi2(6)**	2,92	0,819
Difference	**chi2(9)**	14,53	0,105
Model Testing with HCE, SCE, CEE as IC Proxies			
Test Type		**chi2(33)**	**Prob>chi2**
Sargan test		13,84	0,999
Hansen test		37,99	0,253
Difference in Hansen test			
GMM Instrumen for levels			
Excluding group	**chi2(21)**	13,38	0,895
Difference	**chi2(12)**	24,61	0,017
iv			
Excluding group	**chi2(18)**	20,25	0,319
Difference	**chi2(15)**	17,74	0,277
Model Testing with VAIC as IC Proxy			
Test Type		**z**	**Pr>z**
Arellano-Bond test AR (1)		-1,83	0,068
Arellano-Bond test AR (2)		-1,89	0,059
Model Testing with HCE, SCE, CEE as IC Proxies			
Test Type		**z**	**Pr>z**
Arellano-Bond test AR (1)		-1,97	0,049
Arellano-Bond test AR (2)		-1,12	0,262
Model Testing with VAIC as IC Proxy			
Test Type		**z**	**Pr>z**
Arellano-Bond test AR (1)		-1,83	0,068
Arellano-Bond test AR (2)		-1,89	0,059
Model Testing with HCE, SCE, CEE as IC Proxies			
Test Type		**chi2(6)**	**Prob>chi2**
Sargan test		16,3	0,012
Hansen test		10,29	0,113
Difference in Hansen test			
GMM Instrumen for levels			
Excluding group	**chi2(3)**	4,58	0,205
Difference	**chi2(3)**	5,71	0,127

Source: Results of secondary data processing using STATA 17

Hypothesis Testing

Table 2 Hypothesis Testing Results

Variables	ROA	ROE
The Effect of Diversification on Profitability		
IDI	Not Significant	Not Significant
ADI	Not Significant	Not Significant
The Effect of Diversification on Technical Efficiency		
Variables	TEF	
IDI	Significant negative	
ADI	Not Significant	
The Influence of Intellectual Capital on Profitability		
Variables	ROA	ROE
HCE	Not Significant	Not Significant
SCE	Significant positive	Significant positive
CEE	Not Significant	Not Significant
VAIC	Significant positive	Significant positive

The Influence of Intellectual Capital on Technical Efficiency		
Variables	**TEF**	
HCE	Not Significant	
SCE	Not Significant	
CEE	Significant positive	
VAIC	Not Significant	
Intellectual Capital Can Moderate the Effect of Diversification on Profitability		
Variables	**ROA**	**ROE**
IDI_HCE	Not Significant	Not Significant
IDI_SCE	Significant positive	Not Significant
IDI_CEE	Not Significant	Not Significant
IDI_VAIC	Significant positive	Not Significant
ADI_HCE	Not Significant	Significant negative
ADI_SCE	Not Significant	Not Significant
ADI_CEE	Not Significant	Significant negative
ADI_VAIC	Not Significant	Not Significant
Intellectual Capital Can Moderate the Effect of Diversification on Technical Efficiency		
Variables	**TEF**	
HCE	Not Significant	
SCE	Not Significant	
CEE	Significant positive	
VAIC	Not Significant	
IDI_HCE	Not Significant	
IDI_SCE	Not Significant	
IDI_CEE	Not Significant	
ADI_HCE	Not Significant	

Source: Results of secondary data processing using STATA 17

Discussion

The Effect of Revenue Diversification on ROA

The estimation results show that income diversification (IDI) has no significant effect on ROA of conventional commercial banks in Indonesia, indicating that the shift in income composition from interest-based to non-interest-based (fees, commissions, investment returns, and others) has not been sufficient to increase profits because the contribution of non-interest to profits is still relatively limited, while the costs and associated operational risks tend to offset the potential increase in profitability. This finding is inconsistent with modern portfolio theory (Markowitz, 1952) which normatively predicts that diversification improves the risk-return trade-off through imperfect correlation of income sources, so that ROA should increase, but the insignificant result suggests that the risk reduction mechanism and economies of scope have not been fully realized, among other things because non-interest income is still closely related to credit activities (e.g., credit fees, credit provisions, guarantee fees) so that the benefits of diversification on profit per asset are limited. In contrast, agency theory is more capable of explaining this condition because diversification can reflect the empire-building behavior of managers that increases complexity without always creating value, so that agency costs, monitoring costs, and operational risks can erode non-interest benefits (Jensen & Meckling, 1976), and in aggregate the positive impact on some banks can be "wiped out" by the negative impact on other banks depending on the quality of governance and managerial capabilities. The literature also shows that the insignificance of IDI on ROA can be read as a result of a trade-off between the conglomeration hypothesis that emphasizes the benefits of economies of scope (Teece, 1980 in Berger et al., 2000) and the strategic focus hypothesis that emphasizes focus on core businesses because excessive diversification increases complexity, costs, and risks (Berger et al., 2000), while also indicating the possibility of a non-linear relationship as shown by Boadi (2018) and Duho & Onumah (2019). Across countries, these findings fall in the middle, as some studies find a positive effect of revenue diversification on profitability (Uddin et al., 2022; Ahamed, 2017; Vidyarthi, 2020; Brahmana et al., 2018; Githaiga, 2021, 2022b), while others find a negative effect, favoring strategic focus and highlighting agency costs and earnings volatility (Mawutor et al., 2023; Adesina, 2021). Therefore, these insignificant results do not necessarily imply diversification failure, but rather indicate that during the observation period and in the Indonesian context, the economic benefits of non-interest income are still

"offset" by the costs and risks involved. Therefore, the predictions of modern portfolio theory and the conglomeration hypothesis have not yet been fully realized, while the concerns of agency theory and the strategic focus hypothesis remain relevant.

The Effect of Revenue Diversification on ROE

The results of the study indicate that revenue diversification has no significant effect on the ROE of conventional commercial banks in Indonesia, indicating that the change in income composition from interest to non-interest has not been able to generate a consistent increase in the rate of return on shareholder equity, so from an investor perspective, this diversification strategy has not been proven to create value. This finding is inconsistent with the predictions of modern portfolio theory (Markowitz, 1952) which states that diversification should improve the risk-return trade-off, because in the Indonesian banking context, additional non-interest income appears to be neutralized by capital requirements, increased operating costs, and additional risks, so that the net effect on ROE is insignificant. From a conglomeration versus strategic focus perspective, these results indicate that, in aggregate, Indonesian banks have not been able to convert revenue diversification into effective economies of scope to improve the efficiency of equity utilization, as argued by Teece (1980) and Berger et al. (2000). Empirically, this finding differs from the results of Uddin et al. (2022), Ahamed (2017), and Addai et al. (2022) found a positive effect of diversification on ROE, but this is in line with Mercieca et al. (2007), Stiroh & Rumble (2006), and Mawutor et al. (2023), who showed that the benefits of diversification for shareholders are often limited or even negative when the costs and volatility of non-interest activities are more dominant. Therefore, in the Indonesian context, revenue diversification plays a more significant role as a support for service stability and differentiation rather than as a primary engine for equity value creation. Therefore, strengthening product design, cross-selling strategies, digital capabilities, and intellectual capital is necessary so that diversification investments can contribute more significantly to ROE.

The Effect of Asset Diversification on ROA

The results of the study indicate that asset diversification (ADI) has no significant effect on the ROA of conventional commercial banks in Indonesia, indicating that variations in asset composition—including credit, securities, interbank placements, and other assets—have not been able to produce significant changes in the rate of return on assets. This finding is inconsistent with the predictions of portfolio theory (Markowitz, 1952), which states that the distribution of assets in instruments with low correlation should improve the risk-return profile, because in practice, the selected portfolio of non-credit assets tends to have relatively similar returns and low risk, thus not increasing profit per unit of asset. From the perspective of conglomeration and strategic focus, this insignificance indicates that economies of scope in managing various types of assets have not been realized (Teece, 1980), and that portfolio distribution without special advantages in non-credit instruments can reduce focus on core lending without increasing profitability (Berger et al., 2000). Empirically, these results differ from those of AlKhouri & Arouri (2019), Syed Moudud-Ul-Huq et al. (2021), and Uddin et al. (2022) found a positive effect of asset diversification on profitability, but this is in line with Duho et al. (2020) who showed an insignificant effect. In the Indonesian context, these findings reflect the dominance of credit as the primary productive asset, prudential regulations that encourage placement in low-risk instruments such as government bonds (SBN), and the depth of the still-developing financial market, making asset diversification more important for maintaining stability and liquidity than for increasing ROA.

The Effect of Asset Diversification on ROE

The estimation results show that asset diversification has no significant effect on the ROE of conventional commercial banks in Indonesia, indicating that changes in asset allocation structure have not been able to produce a consistent increase in the rate of return on shareholder equity, so that from an investor perspective, the asset deployment strategy has not provided real added value. This finding is inconsistent with the predictions of portfolio theory (Markowitz, 1952), which states that a more differentiated asset portfolio should improve the risk-return profile and encourage an increase in ROE, because in practice, the additional return from non-credit assets tends to be commensurate with the increase in risk, capital requirements, and costs that accompany it. The conglomeration versus strategic focus perspective is more capable of explaining this result, where not all forms of asset portfolio diversification increase efficiency and firm value, and banks that remain focused on the main line can actually be more efficient (Berger et al., 2000). Empirically, this finding differs from Uddin et al. (2022) found a positive effect of asset diversification on ROE, but this is in line with the view that diversification can have a neutral or even negative impact when burdened with risk management costs, system

development, and capital requirements (Boadi, 2018). In the Indonesian context, the insignificance of ADI on ROE reflects that asset diversification still functions more as a risk management and regulatory compliance instrument—amidst the dominance of asset quality, operational costs, and capital requirements—rather than as a primary driver of increased shareholder equity returns.

The Effect of Income Diversification on Technical Efficiency

The key findings of this study indicate that revenue diversification has a significant negative effect on the technical efficiency of conventional commercial banks in Indonesia, indicating that the larger the portion of non-interest income, the lower the bank's ability to efficiently convert inputs in the form of interest expenses and administrative expenses into revenue output. These results indicate that expanding activities outside the core intermediation business does not automatically lead to improvements in banking production processes, but instead increases operational complexity, information technology requirements, compliance costs, and cross-unit coordination, thus giving rise to input slack and inefficiencies. This finding does not directly contradict portfolio theory (Markowitz, 1952) because the theory focuses on the risk-return trade-off at the portfolio level, rather than on the technical efficiency of the production process. However, it is more in line with the strategic focus hypothesis, which emphasizes that focusing on core businesses can produce higher efficiency than excessive diversification (Berger et al., 2000). From an agency theory perspective, these negative results can also be interpreted as a manifestation of agency costs, where revenue diversification is driven by managerial preferences that increase complexity and costs without corresponding increases in input-output productivity (Jensen & Meckling, 1976). Unlike several studies that found a positive effect of diversification on efficiency (Sang, 2017; Nisar et al., 2018; Najam & Riaz Malik, 2021), these findings provide a novel empirical contribution by measuring relative technical efficiency based on Data Envelopment Analysis (DAA) with a profit approach, which more sensitively captures the impact of transition costs and substantial investments on fee-based income development. In the Indonesian context, these results imply that revenue diversification strategies need to be accompanied by strengthened process management, service standardization, and more effective use of technology so that revenue source expansion does not compromise banking technical efficiency.

The Effect of Asset Diversification on Technical Efficiency

In contrast to revenue diversification, the results of the study indicate that asset diversification does not significantly affect the technical efficiency of conventional commercial banks in Indonesia, indicating that variations in the composition of asset portfolios—whether credit, securities, interbank placements, or other productive assets—do not systematically increase or decrease a bank's ability to convert operational inputs into outputs efficiently. This finding suggests that optimizing risk–return through asset diversification, as predicted by portfolio theory (Markowitz, 1952), does not necessarily impact technical efficiency, which is more determined by the effectiveness of input use in the intermediation process. From the perspective of conglomeration and strategic focus, these results can be interpreted as indicating that both more diversified and more focused banks are still able to operate at relatively equal levels of technical efficiency, while from the perspective of agency theory, asset diversification decisions during the observation period appear to be within the limits of adequate governance and supervision so as not to give rise to systematic technical inefficiencies. Empirically, these findings place Indonesia in a middle position among the various previous research results (Sang, 2017; Syed Moudud-Ul-Huq et al., 2021), and can be interpreted as meaning that strict prudential regulations, a relatively homogeneous asset portfolio structure, and similarities in technology and intermediation processes between banks cause the positive and negative effects of asset diversification on technical efficiency to offset each other, so that their effects are not significantly detected.

The Influence of Intellectual Capital on ROA

The estimation results show that partially Human Capital Efficiency (HCE) and Capital Employed Efficiency (CEE) do not have a significant effect on ROA, while Structural Capital Efficiency (SCE) and the aggregate value of intellectual capital measured through VAIC have a positive and significant effect on ROA, which indicates that the asset-based profitability of conventional commercial banks in Indonesia is more determined by the ability to manage organizational structures, processes, systems, and embedded knowledge bases than by the efficiency of human capital and financial capital alone. This finding is in line with the Resource-Based View (Penrose, 1960) and Dynamic Capabilities (Teece, 2007), which emphasize that intangible assets that are structured, difficult to imitate, and integrated into organizational routines—such as risk management systems, core banking systems, credit procedures, and compliance mechanisms—are the main sources of long-term performance advantages.

Empirically, these results are consistent with various studies that found a positive effect of SCE and VAIC on ROA, while the contribution of HCE and CEE was unstable or insignificant (Mondal & Ghosh, 2020; Poh et al., 2018; Haris et al., 2019; Ozkan et al., 2017; Ur Rehman et al., 2022). In the Indonesian context, the insignificance of HCE and CEE can be attributed to the dominance of the traditional intermediation model and the strong influence of banking regulations, so that improvements in human resource quality and financial capital efficiency are not fully reflected in asset returns. While strengthening structural capital through systems, procedures, and organizational infrastructure directly impacts asset quality and operational efficiency, thus being more quickly reflected in increased ROA.

The Influence of Intellectual Capital on ROE

For the equity-based profitability (ROE) indicator, the estimation results show a similar pattern to ROA, namely Human Capital Efficiency (HCE) and Capital Employed Efficiency (CEE) do not have a significant effect on ROE, while Structural Capital Efficiency (SCE) and the aggregate value of intellectual capital as measured by VAIC have a positive and significant effect, indicating that the increase in returns for shareholders of conventional commercial banks in Indonesia is more determined by the organization's ability to manage systems, processes, governance, and embedded knowledge bases than by the efficiency of human capital and financial capital alone. This finding is in line with the Resource-Based View (Penrose, 1960) and Dynamic Capabilities (Teece, 2007) which emphasize that competitive advantage and the creation of economic rent for shareholders originate from intangible assets that are structured, difficult to imitate, and integrated into organizational routines, such as risk management systems, information technology infrastructure, and strong governance, which enable banks to manage equity more productively. Empirically, these results are consistent with various international studies that found that VAIC and, in particular, SCE are positively related to ROE, while the contributions of HCE and CEE are heterogeneous or insignificant (Haris et al., 2019; Mondal & Ghosh, 2020; Ozkan et al., 2017; Poh et al., 2018; Ur Rehman et al., 2022). In the Indonesian context, the insignificance of HCE and CEE can be explained by the homogeneity of capital levels due to regulations, as well as human resource investments that are still in the development phase and therefore have not fully increased profit productivity. Meanwhile, banks that have strengthened their aggregate structural and intellectual capital are able to convert equity into higher profits. These findings imply that the strategy to strengthen intellectual capital in Indonesian banking should prioritize strengthening structural capital as an enabler so that investments in human resources and financial capital can be more effectively converted into shareholder value, in line with the logic of VAIC as a measure of the efficiency of value creation from tangible and intangible assets (Pulic, 2004).

The Influence of Human Capital Efficiency (HCE) on Technical Efficiency

The coefficient of Human Capital Efficiency (HCE) on technical efficiency (TEF) in this study was insignificant, indicating that changes in human capital efficiency have not systematically impacted differences in technical efficiency levels among conventional commercial banks in Indonesia. This finding suggests that increased HR spending—such as on salaries, training, and competency development—has not consistently translated into higher capabilities in optimizing the use of inputs to produce outputs. From the perspective of the Resource-Based View (Penrose, 1960) and Dynamic Capabilities (Teece, 2007), these results suggest that although HR is a strategic resource, its contribution to technical efficiency depends heavily on the extent to which these capabilities are integrated into organizational processes and routines. When business processes are still rigid or not well standardized, improving HR quality has more implications for service quality and regulatory compliance than for intermediation production efficiency. Empirically, this finding differs from the results of studies in several developing countries that found a positive influence of HCE on bank efficiency (Vidyarthi, 2019a; Maji & Hussain, 2021; Onumah & Duho, 2020), thus strengthening the indication that the role of human capital on technical efficiency is highly contextual and influenced by the level of maturity of systems, governance, and operational processes in each banking industry.

The Influence of Structural Capital Efficiency (SCE) on Technical Efficiency

Similar to Human Capital Efficiency (HCE), Structural Capital Efficiency (SCE) also has no significant effect on the technical efficiency of conventional commercial banks in Indonesia, indicating that the efficiency of organizational structures, systems, procedures, and technological infrastructure has not significantly improved banks' ability to minimize input usage at a given output level. Within the Resource-Based View and dynamic capabilities framework (Penrose, 1960; Teece, 2007), structural capital should be the primary driver of efficiency through process standardization and system integration. However, this insignificant finding indicates that investment in technology and systems has

not been fully optimized, partly due to duplication of processes, system fragmentation between units, and uneven levels of integration. Empirically, this result aligns with the findings of Duho (2020), Onumah & Duho (2020), and Vidyarthi (2019a), who also found that SCE has no significant effect on banking technical efficiency. In the Indonesian context, the heterogeneity of digitalization levels—where large banks are relatively more advanced while medium and small banks are still in the transition stage—causes the contribution of structural capital to aggregate technical efficiency to be insufficiently strong to be statistically detected.

The Influence of Capital Employed Efficiency (CEE) on Technical Efficiency

Unlike Human Capital Efficiency (HCE) and Structural Capital Efficiency (SCE), the results of this study indicate that Capital Employed Efficiency (CEE) has a positive and significant effect on technical efficiency (TEF), indicating that conventional commercial banks in Indonesia that are more efficient in utilizing invested assets and capital tend to be closer to the efficiency frontier. Within the Data Envelopment Analysis framework, high CEE is reflected in the bank's ability to increase credit distribution and income with relatively lower input costs. This finding is in line with the Resource-Based View (Penrose, 1960) which emphasizes that productive management of the asset and capital base allows for the distribution of fixed costs over a larger volume of output, and is consistent with the dynamic capabilities perspective which views capital utilization efficiency as the result of successful seizing and transforming functions in optimizing performance improvement opportunities (Teece, 2007). Empirically, although different from the findings of Adesina (2019) who showed a negative influence of CEE on technical efficiency in most African regions, the results of this study are in line with evidence in Indonesia which shows that capital utilization efficiency contributes positively to increasing banking efficiency (Hidayati & Nandiroh, 2023).

The Effect of VAIC on Technical Efficiency

Finally, the results of the study show that the aggregate VAIC variable has no significant effect on the technical efficiency of conventional commercial banks in Indonesia, indicating that when Human Capital Efficiency (HCE), Structural Capital Efficiency (SCE), and Capital Employed Efficiency (CEE) are combined into a single composite index, their variation is not strong enough to explain differences in technical efficiency between banks. This finding suggests that the positive effect of CEE on technical efficiency is masked by the insignificant contribution of HCE and SCE when all intellectual capital components are treated in aggregate. In the perspective of the Resource-Based View and dynamic capabilities (Penrose, 1960; Teece, 2007), each component of intellectual capital has different mechanisms and pathways of influence on performance, so combining them into a single index has the potential to obscure important information relevant to technical efficiency. Empirically, these results differ from several studies that found a positive effect of VAIC on efficiency (Adesina, 2019; Hidayati & Nandiroh, 2023; Vidyarthi, 2019a), but are in line with the view that the explanatory power of VAIC is often driven by only one or two of its components. In the Indonesian context, these findings confirm that the composition and quality of each component of intellectual capital are more important determinants of technical efficiency than the overall VAIC index. Therefore, banking policy and strategy implications need to be directed more specifically at strengthening components that truly impact performance, particularly optimizing capital employed, accompanied by gradual improvements in the quality of human and structural capital to significantly contribute to medium- and long-term technical efficiency.

The Role of Intellectual Capital in Moderating the Effect of Revenue Diversification on ROA

Empirically, the estimation results show that the effect of revenue diversification on ROA is only significantly strengthened by Structural Capital Efficiency (SCE) and aggregate intellectual capital as measured by VAIC, while the interaction of Human Capital Efficiency (HCE) and Capital Employed Efficiency (CEE) with revenue diversification is insignificant. This finding indicates that new revenue diversification has economic value for asset-based profitability when supported by certain intellectual capital capacities, particularly structural capital and the overall accumulation of intellectual capital, which enables banks to efficiently manage the complexity of non-interest business lines. The insignificant role of HCE reflects that human capital efficiency in Indonesian banking is still more concentrated in credit intermediation activities and has not evenly supported fee-based income innovation, while the insignificant role of CEE indicates that the efficient utilization of physical and financial capital has not been a key factor in converting revenue diversification into asset profits. Conversely, the significant positive moderating role of SCE confirms the importance of strong systems, processes, information technology, and organizational governance in exploiting economies of scope and dynamic capabilities, so that revenue diversification can increase ROA. In aggregate, the significant

interaction of VAIC and revenue diversification brings together Modern Portfolio Theory with Resource-Based View and dynamic capabilities (Markowitz, 1952; Penrose, 1960; Teece, 2007), by showing that the benefits of revenue diversification on asset profitability can only be optimally realized by banks that have high quality intellectual capital, especially in the context of digital transformation and increasingly intense competition in Indonesian banking.

The Role of Intellectual Capital in Moderating the Effect of Asset Diversification on ROA

In contrast to revenue diversification, the results of the study indicate that all interactions between intellectual capital components—Human Capital Efficiency (HCE), Structural Capital Efficiency (SCE), Capital Employed Efficiency (CEE), and the aggregate VAIC index—with asset diversification (ADI) on ROA are insignificant, indicating that intellectual capital has not been able to strengthen or weaken the influence of asset diversification on asset-based profitability of conventional commercial banks in Indonesia. Conceptually, this finding is not entirely in line with portfolio theory (Markowitz, 1952) and the economies of scope view which predicts that a more diverse asset portfolio, when supported by strong organizational capacity, should produce a more optimal risk-return combination (Teece, 1980, 2007). However, from an agency theory perspective (Jensen & Meckling, 1976), this insignificance can be explained by the strong prudential regulatory constraints—such as the LLL, asset quality assessments, and bank health requirements—that limit managerial space in utilizing intellectual capital to optimize returns from asset diversification, as well as by the nature of asset diversification benefits that tend to be long-term and therefore not captured directly in the annual ROA indicator. Empirically, considering that the international literature still rarely examines the moderating role of intellectual capital in the relationship between asset diversification and profitability, this finding enriches the study by showing that in the Indonesian banking context, asset portfolio structure and profitability are more influenced by regulatory factors and asset characteristics themselves than by variations in intellectual capital quality.

The Role of Intellectual Capital in Moderating the Effect of Revenue Diversification on ROE

On the equity-based profitability (ROE) side, all interaction variables between revenue diversification and intellectual capital—including Human Capital Efficiency (HCE), Structural Capital Efficiency (SCE), Capital Employed Efficiency (CEE), and the aggregate Value Added Intellectual Capital (VAIC) index—did not have a significant effect, indicating that the moderating role of intellectual capital previously seen on ROA does not persist when performance is measured from a shareholder perspective. Theoretically, ROE is strongly influenced by capital structure and leverage policy, so that increases in non-interest income supported by intellectual capital tend to be allocated to strengthening core capital and capital buffers, rather than being directly reflected as an increase in equity returns, as explained in Agency Theory regarding conflicts of interest and managerial risk preferences (Jensen & Meckling, 1976). From a conglomeration versus strategic focus perspective, these results indicate that the benefits of revenue diversification for shareholders are highly dependent on the ability of new activities to create added value after accounting for the costs of complexity, operational risk, and capital requirements (Berger et al., 2000), which in the Indonesian banking context during the study period were not significantly altered by additional intellectual capital. Empirically, although different from many studies that find a direct positive effect of intellectual capital on ROE (T. D. Q. Le & Nguyen, 2020; Tiwari & Vidyarthi, 2018; Haris et al., 2019), these findings confirm that intellectual capital does not automatically increase shareholder value through revenue diversification mechanisms, but rather plays a role through increased efficiency, risk management, and strengthening core banking services.

The Role of Intellectual Capital in Moderating the Effect of Asset Diversification on ROE

There is a relationship between asset diversification and equity-based profitability (ROE), the results of the study show a more complex pattern, where the interaction of Human Capital Efficiency (HCE) and Capital Employed Efficiency (CEE) with asset diversification has a significant negative effect on ROE, while the interaction of Structural Capital Efficiency (SCE) and Value Added Intellectual Capital (VAIC) is not significant. This finding indicates that in banks with higher human capital efficiency and physical-financial capital utilization, asset diversification strategies actually tend to reduce returns on equity, which can be explained through Agency Theory and Strategic Focus Hypothesis that competent HR and highly capital-efficient banks tend to choose a more conservative portfolio strategy and focus on core segments to maintain stability, regulatory compliance, and asset quality, even though this sacrifices potential short-term ROE (Jensen & Meckling, 1976; Berger et al., 2000). The insignificant role of SCE and VAIC indicates that strengthening systems, processes, and aggregate intellectual capital is more directed at maintaining operational stability and efficiency than at changing the risk–

return profile of equity through asset diversification (Teece, 1980, 2007). Empirically, this finding extends the literature by showing that although intellectual capital and capital efficiency are often viewed as drivers of performance, in the Indonesian banking context both can weaken the benefits of asset diversification on ROE when used as moderating factors, thus confirming that shareholder value is more optimally achieved through a strategic focus on truly mastered core assets rather than an overly broad asset portfolio expansion.

The Role of Intellectual Capital in Moderating the Effect of Income Diversification on Technical Efficiency (TEF)

In general, the results of the study indicate that all interactions between revenue diversification (IDI) and intellectual capital—both Human Capital Efficiency (HCE), Structural Capital Efficiency (SCE), Capital Employed Efficiency (CEE), and Value Added Intellectual Capital (VAIC)—do not significantly influence technical efficiency (TEF), which indicates that intellectual capital has not been proven to strengthen or weaken the relationship between revenue diversification and the bank's ability to convert inputs into outputs efficiently. This finding indicates that although theoretically intellectual capital is seen as a strategic resource that can increase productivity and dynamic capabilities (Penrose, 1960; Teece, 2007), in the context of conventional Indonesian banking, its contribution plays a greater role in increasing basic efficiency and the performance of core business lines based on intermediation, rather than in changing the sensitivity of technical efficiency to variations in non-interest income sources. The difference between these results and several previous studies that found a direct positive effect of intellectual capital on efficiency (Adesina, 2019; Duho, 2020; Vidyarthi, 2019a; Hidayati & Nandiroh, 2023) confirms that the role of intellectual capital is highly dependent on the variable's position in the model; when placed as a moderator, intellectual capital accumulation does not automatically increase the effectiveness of revenue diversification. Therefore, these results imply that intellectual capital development in Indonesian banking is still primarily directed at strengthening traditional operations and regulatory compliance, so its benefits have not yet been significantly transmitted to the technical efficiency resulting from revenue diversification strategies.

The Role of Intellectual Capital in Moderating the Effect of Asset Diversification on Technical Efficiency (TEF)

The results of the study indicate that all interactions between intellectual capital and asset diversification (ADI_HCE, ADI_SCE, ADI_CEE, and ADI_VAIC) do not significantly affect technical efficiency (TEF). In other words, although intellectual capital has the potential to improve a bank's ability to efficiently convert inputs into outputs, these intellectual capital components do not significantly alter the effect of changes in asset composition on technical efficiency. Within the framework of Modern Portfolio Theory, asset diversification should reduce total portfolio risk and approach the efficient frontier (Markowitz, 1952). However, for the fully regulated banking sector, the effect of changes in asset composition on technical efficiency is largely limited by regulations, exposure limits, and asset quality standards, so the room for intellectual capital to influence the relationship between income diversification and technical efficiency is relatively limited.

The interaction of Human Capital Efficiency (HCE) and asset diversification on technical efficiency (TEF)

The estimation results show that the interaction between HCE and diversification is insignificant. This suggests that increasing human capital efficiency is not sufficient to strengthen or weaken the relationship between asset diversification and technical efficiency. Theoretically, strong human capital should help banks select asset combinations that provide maximum output for a given input, particularly from a resource-based and dynamic capabilities perspective (Penrose, 1960; Teece, 2007). However, the absence of a moderating effect, as estimated in this study, may indicate that human capital expertise does not alter efficiency sensitivity to changes in asset composition (asset diversification). No previous research has examined this, so this study provides new theoretical insights into the role of human capital efficiency in encouraging asset diversification to improve the technical efficiency of conventional commercial banks in Indonesia.

The interaction of Structural Capital Efficiency (SCE) and asset diversification on technical efficiency (TEF)

The interaction between structural capital efficiency and income diversification also showed insignificant results. This indicates that the quality of structural capital, which includes information systems, operational procedures, and governance, is unable to strengthen or weaken the impact of asset diversification on technical efficiency. From an economies of scope perspective (Teece, 1980), strong structures and systems should be utilized across portfolios to enhance asset diversification efficiency. However, for Indonesian banks operating within a strict prudential regulatory framework, robust credit and risk management systems are more focused on meeting prudential standards and controlling overall portfolio risk. Thus, while the quality of SCE is important for preventing inefficiency, it does not significantly alter the marginal relationship between asset diversification expansion and TEF. Empirically, this finding provides a different perspective from the theoretical perspectives of risk-based and dynamic capability (Penrose, 1960; Teece, 2007), and provides a new perspective in the literature, as no previous research has examined the moderating role of structural capital efficiency on the influence of asset diversification and technical efficiency.

The interaction of Capital Employed Efficiency (CEE) and asset diversification on technical efficiency (TEF)

Similar to the previous results of the interaction between intellectual capital components, the interaction between capital employed efficiency (CEE) and asset diversification also showed insignificant results. This result indicates that the efficiency of physical and financial capital utilization does not alter the effect of asset diversification on technical efficiency. Theoretically, a high CEE indicates that a bank is relatively efficient in using tangible assets to generate output (Teece, 1980). When a bank diversifies its asset portfolio, changes in asset structure do not significantly increase or decrease technical efficiency. This may occur because physical and financial capacity has been optimized for various types of assets within existing regulatory constraints. Empirically, no research has examined the moderating role of CEE on the influence of asset diversification and technical efficiency. This finding enriches the literature because it illustrates that capital utilization does not necessarily drive the effect of asset diversification on technical efficiency. Previous research has only examined the direct influence of CEE on technical efficiency, such as that conducted by Vidyarthi (2019a) who studied banks in India, Onumah & Duho (2020) who studied banks in Ghana, and Hidayati & Nandiroh (2023) who studied the influence of intellectual capital and technical efficiency of Islamic banks in Indonesia.

The interaction of Value Added Intellectual Capital (VAIC) and asset diversification on technical efficiency (TEF)

All components of intellectual capital each showed insignificant interaction results, and intellectual capital, as proxied by VAIC, also showed insignificant estimates of the effect of asset diversification on technical efficiency. This indicates that the overall accumulation of intellectual capital does not moderate the relationship between asset diversification and technical efficiency. This contrasts with previous research that found intellectual capital directly increases efficiency (Adesina, 2019; Duho, 2020; Hidayati & Nandiroh, 2023). However, it should be noted that these previous studies examined the direct impact of intellectual capital on technical efficiency. This study, however, positions intellectual capital as a moderator in the relationship between asset diversification and technical efficiency, indicating that the moderating role of intellectual capital is insufficient to significantly influence the impact of asset diversification on technical efficiency. From the perspective of RBV and dynamic capabilities (Penrose, 1960; Teece, 2007), these results can be interpreted to mean that the configuration of intellectual capital in conventional banks in Indonesia is currently channeled more towards improving traditional business processes, rather than towards changing the efficiency trade-offs arising from a more diversified asset portfolio structure.

Conclusion and Suggestions

Based on the results of empirical analysis, this study concludes that diversification strategies in Indonesian banking do not automatically improve performance, because revenue diversification has no significant effect on ROA and ROE and actually reduces technical efficiency due to increased operational complexity, while asset diversification is neutral to profitability and efficiency due to strong prudential regulations and the dominance of the intermediation function. Intellectual capital plays an important but selective role, where structural capital and VAIC consistently drive profitability, technical efficiency is more determined by the ability to utilize physical and financial capital productively, and human capital has not shown a strong role; in a moderating relationship, structural capital and VAIC are only able to strengthen the effect of revenue diversification on ROA, but not on ROE or technical efficiency, even certain human capital and capital employed actually weaken the effect of asset

diversification on ROE. These findings imply that banks need to prioritize strengthening intellectual capital—particularly systems, processes, technology, and risk management—and direct diversification to business lines that are synergistic with the core business so as not to sacrifice efficiency, while further research is recommended to expand the observation period, include Islamic banks, use alternative efficiency approaches such as SFA, and integrate contextual factors such as digital transformation, macroprudential policies, ESG, and non-aggregate intellectual capital measures, considering the limitations of data, DEA methods, and VAIC measurements that do not fully capture the qualitative aspects and long-term dynamics of banking performance.

References

Abuzayed, B., Al-Fayoumi, N., & Molyneux, P. (2018). Diversification and bank stability in the GCC. Journal of International Financial Markets, Institutions and Money, 57, 17–43. https://doi.org/10.1016/j.intfin.2018.04.005

Addai, B., Tang, W., & Agyeman, A. S. (2022). Examining the impact of income diversification on bank performance: Are foreign banks heterogeneous? Journal of Applied Economics, 25(1), 1–21. https://doi.org/10.1080/15140326.2021.2022828

Adegbie, F. F., Ajayi, A., Aguguom, T. A., & Otitolaiye, E. D. (2022). Diversification of the Economy, Tax Revenue and Sustainable Growth in Nigeria. International Journal of Innovative Research and Scientific Studies, 6(1), 115–127. https://doi.org/10.53894/ijirss.v6i1.1114

Adesina, K. S. (2019). Bank technical, allocative and cost efficiencies in Africa: The influence of intellectual capital. North American Journal of Economics and Finance, 48, 419–433. https://doi.org/10.1016/j.najef.2019.03.009

Adesina, K. S. (2021). How diversification affects bank performance: The role of human capital. Economic Modelling, 94, 303–319. https://doi.org/10.1016/j.econmod.2020.10.016

Adhikari, S., & Khanal, A. R. (2022). Business Risk, Financial Risk and Savings: Does Perceived Higher Business Risk Induce Savings Among Small Agricultural Operations in the USA? Dalam Agricultural Finance Review. https://doi.org/10.1108/afr-01-2022-0006

Adusei, M. (2016). Determinants of bank technical efficiency: Evidence from rural and community banks in Ghana. Cogent Business and Management, 3(1). https://doi.org/10.1080/23311975.2016.1199519

Aggelopoulos, E., & Georgopoulos, A. (2017). Bank branch efficiency under environmental change: A bootstrap DEA on monthly profit and loss accounting statements of Greek retail branches. European Journal of Operational Research, 261(3), 1170–1188. https://doi.org/10.1016/j.ejor.2017.03.009

Ahamed, M. M. (2017). Asset quality, non-interest income, and bank profitability: Evidence from Indian banks. Economic Modelling, 63, 1–14. https://doi.org/10.1016/j.econmod.2017.01.016

AlKhouri, R., & Arouri, H. (2019). The effect of diversification on risk and return in banking sector: Evidence from the Gulf Cooperation Council countries. International Journal of Managerial Finance, 15(1), 100–128. https://doi.org/10.1108/IJMF-01-2018-0024

Alrafadi, K. M. S., Alam, S., Badrul, M., Kamaruddin, H., Md, M., Arshad, Y., Graduate, A., & School, B. (2014). Efficiency and Determinants in Libyan Banking. Dalam International Journal of Business and Social Science (Vol. 5, Nomor 5). www.ijbssnet.com

Ascarya, & Yumanita, D. (2006). Analisis Efisiensi Perbankan Syariah di Indonesia dengan Data Envelopment Analysis. Indonesia DiterbTAZKIA Islamic Finance and Business Review, 18(2).

Attar, M., Kang, K., & Sohaib, O. (2019, Januari 8). Knowledge Sharing Practices, Intellectual Capital and Organizational Performance. https://hdl.handle.net/10125/59994

Bain, J. S. (1936). Relation of Profit Rate to Industry Concentration: American Manufacturing, 1936-1940. Dalam Harvard Law Review. Corwin Edwards, Maintaining Competition.

Bank Indonesia. (2020). Transmisi Kebijakan Moneter di Indonesia Menuju Era Ekonomi Digital.

Banker, R. D., Charnes, A., & Cooper, W. W. (1984). Some Models For Estimating Technical And Scale In-Eficiencies in DEA. Management Science, 30, 1078–1092.

Berger, A. N., & Deyoung, R. (1997). Problem loans and cost efficiency in commercial banks. Dalam Journalof BANKING & ELSEVIER FINANCE Journal of Banking & Finance (Vol. 21).

Berger, A. N., Cummins, J. D., Weiss, M. A., & Zi, H. (2000). Conglomeration versus Strategic Focus: Evidence from the Insurance Industry. Journal of Financial Intermediation, 9(4), 323–362. https://doi.org/10.1006/jfin.2000.0295

Boadi, I. (2018). Income Diversification and Banks' Profitability from an African Market Perspective: A Relief for SMEs? Dalam African Entrepreneurship (hlm. 153–188). Springer International Publishing. https://doi.org/10.1007/978-3-319-73700-3_8

Bonfiglio, A., Abitabile, C., & Henke, R. (2022). A Choice Model-Based Analysis of Diversification in Organic and Conventional Farms. Bio-Based and Applied Economics, 11(2), 131–146. https://doi.org/10.36253/bae-12206

Bontis, N., Ciambotti, M., Palazzi, F., & Sgro, F. (2018). Intellectual capital and financial performance in social cooperative enterprises. Journal of Intellectual Capital, 19(4), 712–731. https://doi.org/10.1108/JIC-03-2017-0049

Brahmana, R., Kontesa, M., & Gilbert, R. E. (2018). Income Diversification and Bank Performance: Evidence from Malaysian Banks. 38(2). https://www.researchgate.net/publication/324826997

Charnes, A., Cooper, W., & Rhodes, E. (1978). Measuring the efficiency of decision making units. Dalam Company European Journal of Operational Research (Vol. 2).

Choi, F., Hon, C. T., Mao, Y. H., & Lai, I. K. W. (2019). Sustainable Development for Small Economy and Diversification From a Dominant Industry: Evidence From Macao. Sustainability, 11(6), 1626. https://doi.org/10.3390/su11061626

Cohen, S., & Kaimenakis, N. (2007). Intellectual capital and corporate performance in knowledge-intensive SMEs. Learning Organization, 14(3), 241–262. https://doi.org/10.1108/09696470710739417

Doan, A. T., Lin, K. L., & Doong, S. C. (2018). What drives bank efficiency? The interaction of bank income diversification and ownership. International Review of Economics and Finance, 55, 203–219. https://doi.org/10.1016/j.iref.2017.07.019

Drake, L., Hall, M. J. B., & Simper, R. (2006). The impact of macroeconomic and regulatory factors on bank efficiency: A non-parametric analysis of Hong Kong's banking system. Journal of Banking and Finance, 30(5), 1443–1466. https://doi.org/10.1016/j.jbankfin.2005.03.022

Duho, K. C. T. (2020). Intellectual capital and technical efficiency of banks in an emerging market: a slack-based measure. Journal of Economic Studies, 47(7), 1711–1732. https://doi.org/10.1108/JES-06-2019-0295

Edvinsson, L., & Malone, M. S. (1997). Intellectual Capital: Realizing Your Company's True Value by Finding Its Hidden Brainpower. https://api.semanticscholar.org/CorpusID:166850645

El-Bannany, M. (2008). A study of determinants of intellectual capital performance in banks: The UK case. Journal of Intellectual Capital, 9(3), 487–498. https://doi.org/10.1108/14691930810892045

Farrell, M. J. (1957). The Measurement of Productive Efficiency. Journal of the Royal Statistical Society. Series A (General), 120(3), 253. https://doi.org/10.2307/2343100

Fiorentino, E., Karmann, A., & Koetter, M. (2006). The Cost Efficiency of German Banks: a Comparison of SFA and DEA.

Githaiga, P. N. (2021). Human capital, income diversification and bank performance–an empirical study of East African banks. Asian Journal of Accounting Research, 6(1), 95–108. https://doi.org/10.1108/AJAR-06-2020-0041

Githaiga, P. N. (2022b). Intellectual Capital and Bank Performance: The Moderating Role of Income Diversification. Asia-Pacific Journal of Business Administration, 15(4), 509–526. https://doi.org/10.1108/apjba-06-2021-0259

Grillitsch, M., & Asheim, B. (2018). Place-Based Innovation Policy for Industrial Diversification in Regions. European Planning Studies, 26(8), 1638–1662. https://doi.org/10.1080/09654313.2018.1484892

Hadad, M. D., Santoso, W., Mardanugraha, E., & Illyas, D. (2003). Pendekatan Parametrik Untuk Efisiensi Perbankan Indonesia.

Hafidz, J., Rachmanira, S., & Octia, T. (2013). Tingkat Persaingan dan Efisiensi Bank Umum dan BPR di Pasar Kredit Mikro di Indonesia.

Hama, N. O., & Cavusoglu, B. (2023). The Sustainability of Intellectual Capital in Enhancing Organizational Innovation: A Case Study of Sulaimani Polytechnic University. Sustainability (Switzerland), 15(15). https://doi.org/10.3390/su151512068

Haris, M., Yao, H. X., Tariq, G., Malik, A., & Javaid, H. M. (2019). Intellectual Capital Performance and Profitability of Banks: Evidence from Pakistan. Journal of Risk and Financial Management, 12(2). https://doi.org/10.3390/jrfm12020056

Havidz, S. A. H., & Setiawan, C. (2015). Bank Efficiency and Non-Performing Financing (NPF) in the Indonesian Islamic Banks. Asian Journal of Economic Modelling, 3(3), 61–79. https://doi.org/10.18488/journal.8/2015.3.3/8.3.61.79

Hidayati, I., & Nandiroh, U. (2023). Technical Efficiency and Intellectual Capital Islamic Banks in Indonesia. Jurnal Ilmiah Akuntansi dan Bisnis, 18(2), 357. https://doi.org/10.24843/JIAB.2023.v18.i02.p11

Hormiga, E., Batista-Canino, R. M., & Sánchez-Medina, A. (2011). The role of intellectual capital in the success of new ventures. International Entrepreneurship and Management Journal, 7(1), 71–92. https://doi.org/10.1007/s11365-010-0139-y

International Integrated Reporting Council (IIRC). (2013). The International <IR> Framework, International Integrated Reporting Council. https://www.theiirc.org/ international-ir-framework/

Jelassi, M. M., & Delhoumi, E. (2021). What explains the technical efficiency of banks in Tunisia? Evidence from a two-stage data envelopment analysis. Financial Innovation, 7(1). https://doi.org/10.1186/s40854-021-00282-w

Jensen, M. C., & Meckling, W. H. (1976). Theory of the Firm: Managerial Behavior, Agency Costs and Ownership and Structure. Dalam Journal of Financial Economics (Vol. 3). Q North-Holland Publishing Company.

Käpylä, J., Kujansivu, P., & Lönnqvist, A. (2012). National intellectual capital performance: A strategic approach. Journal of Intellectual Capital, 13(3), 343–362. https://doi.org/10.1108/14691931211248909

Kasman, S., & Kasman, A. (2015). Bank competition, concentration and financial stability in the Turkish banking industry. Economic Systems, 39(3), 502–517. https://doi.org/10.1016/j.ecosys.2014.12.003

Khalique, M., Bontis, N., Shaari, J. A. N., & Isa, A. H. bin M. (2015). Intellectual Capital in Small and Medium Enterprises in Pakistan. Journal of Intellectual Capital, 16(1), 224–238. https://doi.org/10.1108/jic-01-2014-0014

Le, T. D. Q., & Nguyen, D. T. (2020). Intellectual capital and bank profitability: New evidence from Vietnam. Cogent Business and Management, 7(1). https://doi.org/10.1080/23311975.2020.1859666

Le, T. D. Q., Ho, T. N. T., Nguyen, D. T., & Ngo, T. (2022). Intellectual capital–bank efficiency nexus: evidence from an emerging market. Cogent Economics and Finance, 10(1). https://doi.org/10.1080/23322039.2022.2127485

Lecraw, D. J. (1984). Diversification Strategy THE JOURNAL OF INDUSTRIAL ECONOMICS Volume XXXIII December I984 No. 2 DIVERSIFICATION STRATEGY AND PERFORMANCE DONALDJ. LECRAW. Dalam Source: The Journal of Industrial Economics (Vol. 33, Nomor 2).

Lema, T. Z. (2017). Determinants of Bank Technical Efficiency: Evidence from Commercial Banks in Ethiopia. Cogent Business and Management, 4(1). https://doi.org/10.1080/23311975.2016.1268356

Liu, Y., Mauer, D. C., & Zhang, Y. (2018). The Hedging Benefits of Industrial and Global Diversification: Evidence From Economic Downturns. Journal of Business Finance & Accounting, 45(9–10), 1322–1351. https://doi.org/10.1111/jbfa.12354

Maji, S. G., & Hussain, F. (2021). Technical efficiency, intellectual capital efficiency and bank performance in emerging markets: the case of India. Journal of Advances in Management Research, 18(5), 708–737. https://doi.org/10.1108/JAMR-09-2020-0218

Maniati, M., & Sambracos, E. (2017). Measuring the Technical Efficiency for the Shipping Banks—An Approach Using Data Envelopment Analysis. Theoretical Economics Letters, 07(03), 502–516. https://doi.org/10.4236/tel.2017.73038

Markowitz, H. (1952). PORTFOLIO SELECTION*. The Journal of Finance, 7(1), 77–91. https://doi.org/10.1111/j.1540-6261.1952.tb01525.x

Mawutor, J. K. M., Boadi, I., Antwi, S., & Tetteh, A. B. (2023). Improving banks' profitability through income diversification and intellectual capital: The sub-Saharan Africa perspective. Cogent Economics & Finance, 11(2). https://doi.org/10.1080/23322039.2023.2271658

Mehmood, R., Hunjra, A. I., & Chani, M. I. (2019). The Impact of Corporate Diversification and Financial Structure on Firm Performance: Evidence from South Asian Countries. Journal of Risk and Financial Management, 12(1). https://doi.org/10.3390/jrfm12010049

Mercieca, S., Schaeck, K., & Wolfe, S. (2007). Small European banks: Benefits from diversification? Journal of Banking and Finance, 31(7), 1975–1998. https://doi.org/10.1016/j.jbankfin.2007.01.004

Merton, R. C. (1974). On The Pricing of Corporate Debt: The Risk Structure of Interest Rates. The Journal of Finance, 29(2), 449–470. https://doi.org/10.1111/j.1540-6261.1974.tb03058.x

Mishkin, F. S. (2021). The Economics of Money, Banking, and Financial Market (13 ed.). Pearson.

Mondal, A., & Ghosh, C. (2020). Effect of intellectual capital disclosure on cost of equity capital: a study on Indian companies. Asian Journal of Accounting Research, 6(2), 165–179. https://doi.org/10.1108/AJAR-08-2020-0069

Moudud-Ul-Huq, Syed, Mateev, Miroslav, Abbas, Faisal, Hossain, Mahmud, & Sohail, Hafiz M. (2021). How Does Bank Diversification Affect Efficiency? Insights of the Central Europe. Global Business Review, 25(6), 1603–1618. https://doi.org/10.1177/09721509211026823

Najam, H., & Riaz Malik, I. (2021). Nexus between Diversification and Banking Efficiency in Developing Economies. JOURNAL OF BUSINESS & ECONOMICS, 13(2), 34–49. https://doi.org/10.5311/JBE.2021.26.6

Nazari, J. A., & Herremans, I. M. (2007). Extended VAIC model: Measuring intellectual capital components. Journal of Intellectual Capital, 8(4), 595–609. https://doi.org/10.1108/14691930710830774

Nisar, S., Peng, K., Wang, S., & Ashraf, B. N. (2018). The Technical Efficiency of South Asian Commercial Banks and the Effects of Income Diversification. International Journal of Information and Management Sciences, 29, 279–302. https://doi.org/10.6186/IJIMS.201809

Nwosa, P. I., Fasina, O. T., & Ikechukwu, O. M. (2019). Export Diversification and Economic Growth in Nigeria. Signifikan Jurnal Ilmu Ekonomi, 8(2). https://doi.org/10.15408/sjie.v8i2.9861

OJK (Otoritas Jasa Keuangan). (2024). Statistik Perbankan Indonesia - Mei 2024. https://www.ojk.go.id/id/kanal/perbankan/data-dan-statistik/statistik-perbankan-indonesia/Default.aspx

OJK, (Otoritas Jasa Keuangan Republik Indonesia). (2020, Mei 28). Siaran Pers: OJK Keluarkan Paket Kebijakan Lanjutan Stimulus Covid-19. https://www.ojk.go.id/id/berita-dan-kegiatan/siaran-pers/Documents/Pages/Siaran-Pers-OJK-Keluarkan-Paket-Kebijakan-Lanjutan-Stimulus-Covid-19-/SP%20-%20OJK%20Keluarkan%20Paket%20Kebijakan%20Lanjutan%20Stimulus%20Covid-19.pdf

Onumah, J. M., & Duho, K. C. T. (2020). Impact of intellectual capital on bank efficiency in emerging markets: evidence from Ghana. International Journal of Banking, Accounting and Finance, 11(4), 435. https://doi.org/10.1504/IJBAAF.2020.10028856

Ozkan, N., Cakan, S., & Kayacan, M. (2017). Intellectual capital and financial performance: A study of the Turkish Banking Sector. Borsa Istanbul Review, 17(3), 190–198. https://doi.org/10.1016/j.bir.2016.03.001

Penrose, E. T. (1960). The Growth of the Firm—A Case Study: The Hercules Powder Company. Business History Review, 34(1), 1–23. https://doi.org/10.2307/3111776

Poh, L. T., Kilicman, A., & Ibrahim, S. N. I. (2018). On intellectual capital and financial performances of banks in Malaysia. Cogent Economics and Finance, 6(1). https://doi.org/10.1080/23322039.2018.1453574

Pulic, A. (2004). Intellectual capital – does it create or destroy value? Measuring Business Excellence, 8(1), 62–68. https://doi.org/10.1108/13683040410524757

Putri, A. M., Mawardi, W., & Manajemen, J. (2016). Analisis Efisiensi Bank Persero dan Bank Asing dengan Metode Stochastic Frontier Analysis (SFA) dan Analysis Of Variance (ANOVA) (Studi Kasus pada Bank Persero dan Bank Asing di Indonesia periode tahun 2010-2014). Dalam DIPONEGORO JOURNAL OF MANAGEMENT (Vol. 5, Nomor 2). http://ejournal-s1.undip.ac.id/index.php/management

Sang, N. M. (2017). Income Diversification and Bank Efficiency in Vietnam. Journal of Economics and Development, 52–67. https://doi.org/10.33301/jed.2017.19.03.04

Sarin, V., Mahapatra, S. K., & Sood, N. (2020). Export Diversification and Economic Growth: A Review and Future Research Agenda. Journal of Public Affairs, 22(3). https://doi.org/10.1002/pa.2524

Septianto, H., & Widiharih, T. (2010). Analisis Efisiensi Bank Perkreditan Rakyat di Kota Semarang dengan Pendekatan Data Envelopment Analysis. Media Mestika, 41–48.

Sharabati, A. A. A., Jawad, S. N., & Bontis, N. (2010). Intellectual capital and business performance in the pharmaceutical sector of Jordan. Management Decision, 48(1), 105–131. https://doi.org/10.1108/00251741011014481

Sharma, P., & Vipul. (2018). Improving Portfolio Diversification: Identifying the Right Baskets for Putting Your Eggs. Managerial and Decision Economics, 39(6), 698–711. https://doi.org/10.1002/mde.2939

Shone, R. (1975). The Theory of Production. 123–152. https://doi.org/10.1016/b978-0-12-641350-2.50013-5

Stewart, T., & Ruckdeschel, C. (1997). Intellectual Capital, The New Wealth of Organizations. Doubleday/Currency. https://doi.org/10.1002/pfi.4140370713

Stiroh, K. J., & Rumble, A. (2006). The dark side of diversification: The case of US financial holding companies. Journal of Banking and Finance, 30(8), 2131–2161. https://doi.org/10.1016/j.jbankfin.2005.04.030

Subramanyam T. (2017). Selection of Input-Output Variables in Data Envelopment Analysis-Indian Commercial Banks. https://www.researchgate.net/publication/318359768

Suliyanto, & Jati, D. P. (2014). Perbandingan Efisiensi BPR dan Bank Umum dengan Pendekatan Data Envelopment Analisis. Jurnal Keuangan dan Perbankan, 18, 297–306.

Suryandari, A., & Rahayuningsih, E. S. (2020). Strategi Bertahan Hidup Ekonomi Rumah Tangga Petani Padi Aspek Pendapatan, Konsumsi, Dan Tabungan Studi Kasus Di DesaTonjung Kecamatan Burneh Kabupaten Bangkalan Arita Suryandari, Eni Sri Rahayuningsih. Jurnal Pamator Jurnal Ilmiah Universitas Trunojoyo, 13(2), 176–182. https://doi.org/10.21107/pamator.v13i2.8525

Syaifuddin, D. T. (2009). Efisiensi dan Kinerja Bank (Aplikasi Teori Hubungan Struktural) (B. Sarita, Ed.). Universitas Haluoleo Press. https://www.researchgate.net/publication/338159330

Teece, D. J. (1980). Economies of scope and the scope of the enterprise. Journal of Economic Behavior and Organization, 1, 223–247.

Teece, D. J. (2007). Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. Strategic Management Journal, 28(13), 1319–1350. https://doi.org/10.1002/smj.640

Ting, I. W. K., Chen, F.-C., Kweh, Q. L., Sui, H. J., & Le, H. T. M. (2022). Intellectual capital and bank branches' efficiency: an integrated study. Journal of Intellectual Capital, 23(4), 840–863. https://doi.org/10.1108/JIC-07-2020-0245

Tiwari, R., & Vidyarthi, H. (2018). Intellectual capital and corporate performance: a case of Indian banks. Journal of Accounting in Emerging Economies, 8(1), 84–105. https://doi.org/10.1108/JAEE-07-2016-0067

Uddin, M. J., Majumder, Md. T. H., Akter, A., & Zaman, R. (2022). Do the diversification of income and assets spur bank profitability in Bangladesh? A dynamic panel data analysis. Vilakshan - XIMB Journal of Management, 19(2), 177–194. https://doi.org/10.1108/xjm-01-2021-0023

Ur Rehman, A., Aslam, E., & Iqbal, A. (2022). Intellectual capital efficiency and bank performance: Evidence from islamic banks. Borsa Istanbul Review, 22(1), 113–121. https://doi.org/10.1016/J.BIR.2021.02.004

Vidyarthi, H. (2019a). Dynamics of intellectual capitals and bank efficiency in India. Service Industries Journal, 39(1), 1–24. https://doi.org/10.1080/02642069.2018.1435641

Vidyarthi, H. (2020). Dynamics of income diversification and bank performance in India. Journal of Financial Economic Policy, 12(3), 383–407. https://doi.org/10.1108/JFEP-05-2019-0084

Vo, D. H., & Tran, N. P. (2023). Measuring national intellectual capital and its effect on country's competitiveness. Competitiveness Review, 33(4), 820–839. https://doi.org/10.1108/CR-08-2021-0110

Vo, D. H., & Tran, N. P. (2024). Does national intellectual capital matter for economic growth in the Asia–Pacific economies? Journal of Intellectual Capital, 25(2–3), 253–274. https://doi.org/10.1108/JIC-09-2022-0184

Wang, W. Y., & Chang, C. (2005). Intellectual Capital and Performance in Causal Models. Journal of Intellectual Capital, 6(2), 222–236. https://doi.org/10.1108/14691930510592816

Xiao, J., Boschma, R., & Andersson, M. (2018). Industrial Diversification in Europe: The Differentiated Role of Relatedness. Economic Geography, 94(5), 514–549. https://doi.org/10.1080/00130095.2018.1444989