INTELLECTUAL CAPITAL AND BANK PERFORMANCE: A BOARD OF DIRECTORS' AGENDA

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Abstract

The concept of intellectual capital pertains to intangible assets that are built on knowledge, such as the competencies of employees, procedures, and relationships with customers (Adesina, 2019). By analyzing a sample of 26 commercial banks in Vietnam from 2012–2021, this study aims to investigate the relationship between intellectual capital and the performance of these banks. Using the value-added intellectual coefficient (VAIC) model for measuring intellectual capital efficiency (ICE), we discover a positive influence of overall intellectual capital on the operational efficiency of banks. Regarding the specific components of intellectual capital, our findings validate that capital efficiency has the most significant influence on financial efficiency. The findings suggest that commercial banks need to actively invest in the various aspects of intellectual capital to enhance their market value and cash flow. Furthermore, it is imperative for commercial banks to reconsider their allocation of resources and investment plans, which might potentially result in a fundamental change in their strategy towards achieving sustainable growth. These tactics can enhance financial returns and offer a competitive advantage in a dynamic and demanding market environment.

Keywords: Intellectual Capital, Efficiency, Performance, Bank

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1. INTRODUCTION

In recent years, intellectual capital has garnered increasing attention among business managers. Despite its growing relevance, there remains a lack of consensus in academic circles regarding its precise definition. Intellectual capital is often seen as a catalyst for competitive advantage. Edvinsson and Malone (1997) describe it as encompassing knowledge, applied experience, technological assets, customer relationships, and professional skills that collectively bolster a business's market position. Jardon and Martos (2012), Kamukama (2013), and Sokolovská et al. (2014) further underscore its role as a critical source of competitive advantage, noting that effective management of intellectual resources fosters teamwork and knowledge development. Echoing this sentiment, Chen and Maxwell (2007) posit that investment in green intellectual capital positions companies favorably against stringent global environmental regulations and rising consumer environmental awareness, ultimately

driving competitive advantage. Dong et al. (2022) concur viewing intellectual capital as a tangible resource that enhances daily operations and transforms company resources into competitive edges.

Conversely, some scholars categorize intellectual capital as an intangible asset. Brooking et al. (1998) refer to it as a collection of intangible assets essential for business operations. Stewart (1999) defines it as intellectual material — encompassing knowledge, information, intellectual property, and experience — that can generate wealth. Harrison and Sullivan (2000) highlight its potential for profit generation, while Roos (2005) characterizes it as all non-monetary and immaterial resources under an organization's control that contribute to its value creation process.

Overall, intellectual capital is an integral part of a company's intangible assets. This encompasses not only intellectual properties like patents and trademarks but also knowledge, experience, relationships, work processes, and market and customer insights, all of which are pivotal in enhancing business performance.

Despite its journey towards open integration and knowledge economy transition, Vietnam faces both opportunities and challenges in this global milieu. Effective operation and success in today's competitive landscape require businesses, especially in knowledge-intensive sectors like banking and finance, to leverage not only financial and skilled labor resources but also their knowledge application capabilities. In this context, managing intellectual capital effectively is crucial for banks, enhancing an intangible asset that is increasingly vital for sustainable business advantage. Given this backdrop, studying the impact of intellectual capital on the financial performance of Vietnamese commercial banks is both timely and imperative. However, this area remains under-researched, particularly within the banking sector, and in a developing country like Vietnam. Moreover, most of the previous literature only evaluates the impact of intellectual capital on business performance through one proxy — return on assets (ROA) or return on equity (ROE) — and very few studies consider both indexes to comprehensively assess firm performance. In addition, many prior studies did not perform quantile regression to evaluate the impact of intellectual capital on each level of firm performance. This study will overcome these gaps to provide more comprehensive research results than previous studies.

In this research, we investigate the impact of intellectual capital on the performance of Vietnamese commercial banks. Thus, the following research question was addressed in the study:

RQ: Does intellectual capital positively associate with bank performance?

Through the results, this paper makes important contributions to the literature. First, we provide more empirical evidence on the influence of intellectual capital on firm performance in the banking sector of an emerging market, which diversifies the findings of related literature in financial areas. Second, we apply ROA as the main proxy for bank performance, and ROE as the alternative measure, to provide a thorough assessment of firm performance. Third, various analyzing methods, such as pooled ordinary least square (POLS), fixed effect model (FEM), random effect model (REM), generalized method of moment (GMM), Prais-Winsten, Newey-West, two-way cluster, and quantile regression, are used to affirm the results' robustness on the impact of intellectual capital on bank performance.

Our findings indicate that intellectual capital positively affects bank profitability. Furthermore, when considering different aspects of intellectual capital, our investigation suggests that the effectiveness of capital, especially concerning investments in tangible infrastructure and cutting-edge technology, demonstrates the most significant relationship with financial performance. Consequently, our study also provides implications for bank managers and policymakers in finance and banking areas. To enhance their market worth and revenue stream, commercial banks must actively invest in the constituents of intellectual capital by increasing the quality of both tangible and intangible assets and improving staff training and development. In addition, commercial banks need to reconsider how they allocate resources and devise investment strategies, which can support them in achieving sustainable growth. Overall, this study offers recommendations for enhancing intellectual capital efficiency (ICE) in the banking system, contributing to the improvement of commercial banks' performance as well as the development of the financial market in Vietnam.

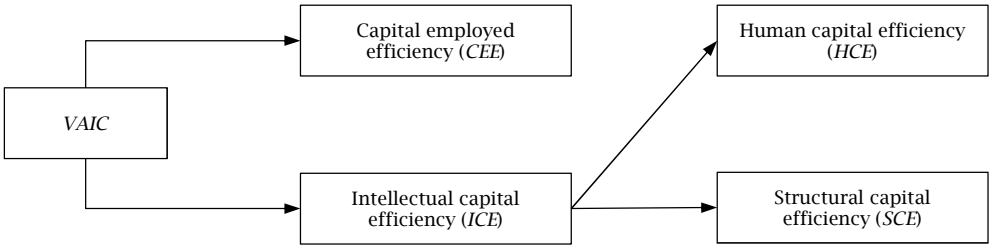
The rest of the paper is structured as follows. Section 2 presents the literature review on intellectual capital and its impact on bank performance. Section 3 details the methodology of this study. Section 4 summarizes the key findings and results, and Section 5 discusses the conclusions, managerial implications, and study limitations.

2. LITERATURE REVIEW

2.1. Intellectual capital measurement model

Since the 1990s, when intangible assets, including intellectual capital, began receiving special attention from business managers, numerous models have been developed for their measurement. There are certain endeavors in the literature to propound various measures of intellectual capital. For instance, various typical measures comprise the intangible asset monitor, intellectual capital index, and the economic value-added, which are propounded by Sveiby (1997), Roos and Roos (1997), and Stewert (1997), respectively. In fact, the value-added intellectual coefficient (VAIC) model propounded by Pulic (2000, 2004) has been a productive tool for measuring the efficiency of intellectual capital in the financial literature (Adesina, 2019). The model captures three main resources of an organization, comprising the efficiency of human capital, capital employed, and structure capital. This method assumes that these resources have been a pivotal part of the significant contribution to the process of value creation in an organization. The VAIC model is unique in that it measures the effectiveness of intellectual capital utilization, linking it directly to the value-creation process of a company. The model is visually summarized in Figure 1.

Figure 1. Value-added intelligence coefficient (VAIC) model



Source: Pulic (2000).

In essence, the VAIC model posits that a higher VAIC index indicates more efficient resource use and greater value creation. Pulic's (2000) approach utilizes publicly available accounting data, making it a practical tool for businesses to assess their intellectual capital. The main components in the model are calculated as follows:

• Value added (VA) is defined as the difference between output revenue and input costs. Notably, salaries are treated as investments rather than expenses. The formula is:

VA = Output Revenue - Input costs + Depreciation.

• Capital employed efficiency (CEE) measures the efficiency of tangible assets in creating value. It is calculated by dividing VA by capital employed.

• Human capital efficiency (HCE) reflects the value generated from employee investment. Pulic (2000) emphasized the pivotal role of employees in a knowledge-based economy. HCE equals VA divided by total employee costs.

• Structural capital efficiency (SCE) focuses on the value generated from non-human intangible assets like corporate culture, work processes, and intellectual property. The formula is:

SCE = (VA - Employee costs) / VA.

Pulic (2000) also noted an inverse relationship between human and structural capital in the value creation process, implying that an increase in SCE may correspond to a decrease in HCE.

It is necessary to acknowledge that, naturally, the VAIC model contains some drawbacks. For instance, it cannot capture all aspects of ICE. In other words, many ingredients of intellectual capital cannot be presented in such a model (Adesina, 2019; Meles et al., 2016). However, there are three main points leading us to employ VAIC in this research. First, it has been employed widely in the financial literature in recent times, especially in the banking industry (Adesina, 2019, 2021; Nguyen & Lu, 2024, 2023). Second, compared to other measures, the VAIC model is quite simple for calculating ICE since researchers can rely on the available financial information of banks to formulate it (Adesina, 2019). Third, some prior studies suggest that it can be seen as a helpful measure to calculate ICE in not only the financial sector but also others (Poh et al., 2018). Therefore, in the study, the VAIC method is employed to measure banks' ICE.

2.2. The impact of intellectual capital on bank performance

The effect of intellectual capital on firm value or firm performance is investigated in different aspects. Soewarno and Tjahjadi (2020) argued that intellectual capital as an intangible asset would efficiently and effectively generate and compete for a firm's good performance. Earlier research in the developing economies found that intellectual capital is an important source of competitive advantage for organizations that increase the firm's performance (Ali et al., 2020; Wang et al., 2021). Regarding intellectual capital disclosure, Orens et al. (2009) analyzed the corporate websites of 267 non-financial listed companies and found a positive effect of intellectual capital information on market value. According to Ulum (2015), voluntary intellectual capital disclosure is a positive signal for the capital market that allows management to provide information about intangible assets. Thus, there is a positive effect between intellectual capital disclosure on the firm's value. Similarly, Rahman et al. (2020) found that intellectual capital disclosure is positively associated with corporate performance. Salvi et al. (2020) studied a sample of 110 companies to evaluate the impact of intellectual capital disclosure quality on firm value in the context of integrated reporting. The findings suggest a significantly positive relationship between all three components of intellectual capital (structural, human, social and relationship) and firm value, generating multiple implications for reporting entities, investors, regulators, and managers.

Literature investigating the influence of intellectual capital on firm performance in the banking sector often views intellectual capital via available indicators such as the VAIC model. These studies have garnered significant attention in the scientific community, yet consensus remains elusive. Various studies have explored this relationship with mixed results. Positive impacts are noted in several studies. Goh (2005) investigated Malaysian commercial banks and identified a link between financial performance and human resources using the VAIC model, suggesting that investments in intellectual capital can enhance bank efficiency and profitability. Afroze (2011) applied the VAIC model to a sample of 13 Bangladeshi banks from 1988 to 2009, finding a positive correlation between intellectual capital and financial performance. Bagorogoza et al. (2011) developed a model examining the relationship between knowledge management processes and the efficiency of Ugandan banks. Their findings indicate that effective management and organization of knowledge acquisition, dissemination, and application can be a long-term competitive edge, boosting bank efficiency. Latif et al. (2012) analyzed the impact of ICE on conventional and Islamic banks in Pakistan, revealing that HCE is a key determinant for Islamic banks, while capital efficiency is more crucial for conventional banks. Kamal et al. (2012) observed

a positive relationship between capital efficiency and profitability in Malaysian banks, recommending an increase in capital efficiency to enhance performance. Śledzik (2013) utilized the VAIC index to compare domestic and foreign banks in Finland, finding that foreign banks more effectively added value through efficient human resource utilization. Ulum et al. (2014) employed a modified VAIC (M-VAIC) model, to rank Indonesian banks from 2009 to 2012, concluding that state-owned banks outperformed domestic private banks in resource utilization.

Conversely, Firer and Williams (2003) applied the VAIC model across various sectors, including banking, and discovered a complex relationship between intellectual capital components and performance metrics like ROA, asset turnover, and market value. They found a positive link between SCE and profitability but a negative association between HCE and productivity. Mavridis (2004), in a study on Japanese banks, noted a positive correlation between capital efficiency and the Best Performance Index but a negative impact of HCE on the same index. Ozkan et al. (2017) analyzed 44 Turkish banking organizations from 2005 to 2014, highlighting the significant contribution of intellectual capital, particularly human capital, to financial performance, though tangible and structured capital were less effective in value creation.

Overall, while numerous studies affirm a positive relationship between intellectual capital and the financial performance of commercial banks, inconsistencies persist. Some research, like Firer and Williams (2003), found no impact of intellectual capital on financial performance metrics such as ROA and ROE in Southern African banks. Moreover, studies like Mavridis (2004) indicated potential negative effects of certain intellectual capital components on bank performance. This article aims to assess the impact of intellectual capital and its components on the financial performance of Vietnamese commercial banks, addressing these research gaps. Le et al. (2022) analyzed the impact of intellectual capital on the risk of 30 Vietnamese banks with unbalanced panel data, including 353 observations from 2007 to 2019. The study used the GMM method. The results showed that the bad debt ratio was negatively correlated with the VAIC. However, the results also emphasized that the relationship between the intellectual value-added coefficient and bank risk was nonlinear (U-shaped). Moreover, regarding the components of the VAIC, the efficiency of human resource use is positively related to the bad debt ratio and capital structure efficiency has a negative impact on the risk of banks. In particular, the impact of capital structure efficiency is significant.

3. RESEARCH DATA AND METHODOLOGY

The study utilizes annual data from 26 Vietnamese commercial banks spanning from 2012 to 2021, encompassing a total of 260 observations. We selected these commercial banks for the research after excluding banks with insufficient data and banks that have been merged or consolidated. Therefore, this research sample includes commercial banks that have complete data and are individual banks. In addition, the scope of the research in Vietnam is considered suitable for our limited capacity and resources (in terms of time and human). Additionally, Vietnam is a country with a bank-based financial market. Thus, economic research within the scope of Vietnamese commercial banks is relatively common and necessary. The data set was meticulously compiled from the S&P Capital IQ Pro database and the audited financial reports of these Vietnamese commercial banks. As of December 30, 2021, the cumulative assets of Vietnam's commercial banking sector amounted to 13,023,214 billion dong (VND). Notably, the total assets of the 26 banks included in this study reached VND 10,812,774 billion, representing a substantial 83% of the entire commercial banking system's assets. This significant coverage underscores the appropriateness and high representativeness of the research sample. Financial data were winsorized at the 1% and 99% levels to mitigate the impact of outliers.

To measure intellectual capital, we use the VAIC model and perform regression on the research sample. The VAIC is calculated as the sum of the HCE, CEE, and SCE (Pulic, 2000). The VAIC model has been used in various studies such as Firer and Williams (2003), Goh (2005), Afroze (2011), Śledzik (2013), and Ulum et al. (2014). Additionally, to measure bank performance, we apply return on average assets (*ROAA*) as the proxy following prior literature such as Berger et al. (1993), Firer and Williams (2003), Calisir et al. (2010), and Ozkan et al. (2017). Besides *ROAA*, we also use return on average equity (*ROAE*) as the alternative measurement for bank performance, in accordance with Mohiuddin et al. (2008), Calisir et al. (2010), and Maditinos et al. (2011). Finally, the control variables including bank size (*SIZE*), capital (*CAP*), deposits (*DEP*), and loan portfolio (*LOAN*) are primarily derived from Gul et al. (2011).

After accumulating the data and calculating the indicators, we propose a model to analyze the relationship between intellectual capital and the financial performance of Vietnamese commercial banks. Next, we estimate the panel data regression model (including the POLS, FEM, and REM), and perform testing, defect diagnosis and model calibration to obtain the best results. Based on these results, we evaluate the relationship between intellectual capital and financial performance of Vietnamese commercial banks.

Table 1 presents the descriptive statistics of the dataset. The *ROAA* shows a mean of 0.0088, with a standard deviation of 0.0068, ranging from a minimum of 0.0001 to a maximum of 0.0291. This variable indicates differing levels of asset efficiency among the entities studied. Similarly, the *ROAE* varies significantly, with an average value of 0.1027 and a standard deviation of 0.0753, the values spanning from 0.0007 to 0.3007. This wide range in *ROAE* suggests notable differences in how effectively entities manage shareholder equity. *VAIC* has a mean of 3.0265 and a standard deviation of 0.9619, with values ranging between 1.2881 and 5.6553. The broad spread in *VAIC* scores highlights the varying degrees of intellectual capital utilization among the subjects.

The *SIZE* variable, presumably indicating the size of the entities, shows a mean of 25.5843

and a standard deviation of 1.1244, with the smallest and largest values being 23.4393 and 28.0476, respectively. This relatively narrow range suggests a sample of entities of somewhat similar sizes. The *CAP* has a mean of 0.0898 and a standard deviation of 0.0353, ranging from 0.0438 to 0.2203, which indicates a moderate variation in capitalization among the entities. *DEP*, representing deposits, has a mean of 0.6732, a standard deviation of 0.1035, and ranges from 0.4201 to 0.8837, which suggests a modest diversity in deposit volumes. Lastly, the *LOAN* has a mean of 0.5826 and a standard deviation of 0.1137, with the lowest and highest values being 0.2559 and 0.7569, respectively, indicating a range of lending practices.

These statistics provide a foundational understanding of the intellectual capital landscape within the Vietnamese commercial banking sector during the specified period. The average *VAIC* value, combined with its standard deviation, offers insights into both the typical level of ICE and the degree of disparity among the banks in our study.

Table 1. Descriptive statistics

Variable	*Number of observations*	*Mean*	*Standard deviation*	*Minimum*	*Maximum*
ROAA	260	0.0088	0.0068	0.0001	0.0291
ROAE	260	0.1027	0.0753	0.0007	0.3007
VAIC	260	3.0265	0.9619	1.2881	5.6553
SIZE	260	25.5843	1.1244	23.4393	28.0476
CAP	260	0.0898	0.0353	0.0438	0.2203
DEP	260	0.6732	0.1035	0.4201	0.8837
LOAN	260	0.5826	0.1137	0.2559	0.7569

4. EMPIRICAL RESULTS

4.1. Baseline models

To quantitatively assess the relationship between intellectual capital and the financial performance of Vietnamese commercial banks, the study draws upon the methodologies used by Ozkan et al. (2017) involving the *VAIC* model and Gul et al. (2011) regarding factors influencing commercial banks' financial performance. The proposed equation for this analysis is as follows:

$$ROAA_{it} = \beta_0 + \beta_1 VAIC_{it} + \beta_2 SIZE_{it} + \beta_3 CAP_{it} + \beta_4 DEP_{it} + \beta_5 LOAN_{it} + u_{it} + \varepsilon_{it} \quad (1)$$

where, *ROAA* for each bank *i* at time *t* is expressed as a function of various factors: *VAIC*, *SIZE*, *CAP*, *DEP*, and *LOAN*, along with a random error term.

The study employs several estimation models for panel data to analyze the impact of intellectual capital on the performance of Vietnamese commercial banks. These models include: POLS (assumes that the effect of the independent variables on the dependent variable is constant across time and entities); FEM (accounts for time-invariant characteristics of the individual banks, thus controlling for any bank-specific traits that might influence the dependent variable); REM (assumes that the individual bank effects are random and uncorrelated with the independent variables).

To determine the most suitable model for the dataset, the study will utilize the Breusch-Pagan Lagrange multiplier (LM) test for random effects and the Hausman test to decide between fixed and random effects. These tests will identify the most appropriate model by examining the nature of the unobserved individual effects. Finally, the study will conduct the modified Wald test for group-wise heteroskedasticity in the fixed effects model and the Wooldridge test for autocorrelation. These tests are crucial for detecting and addressing potential issues of heteroskedasticity and autocorrelation in the panel data, ensuring the robustness and reliability of the regression results.

We report our results in Table 2. After conducting regression of the research equations based on POLS, FEM, and REM methods, we conduct tests such as the Breusch-Pagan LM, Hausman, and modified Wald tests for heteroscedasticity. Wooldridge conversion and testing for autocorrelation, we calibrated and corrected errors in the models to get the most accurate results. The regression results are shown in Table 2 below.

Table 2. Main results

Variable	*Baseline*	*Additional variables*	*FEM*	*GMM*	*Prais-Winsten*	*Newey-West*	*Two-way cluster*
	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*	*Model 7*
ROAA				0.0424			
				(0.035)			
VAIC	0.0063***	0.0050***	0.0050***	0.0048***	0.0050***	0.0051***	0.0051***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SIZE		0.0022***	0.0029***	0.0018***	0.0009	0.0011***	0.0011***
		(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)
CAP		0.0474***	0.0498***	0.0338***	0.0252*	0.0491***	0.0491***
		(0.010)	(0.007)	(0.009)	(0.014)	(0.007)	(0.007)
DEP		-0.0088**	-0.0085***	-0.0206***	-0.0052**	-0.0115***	-0.0115***
		(0.004)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
LOAN		0.0123***	0.0124***	0.0111***	0.0096***	0.0077***	0.0077***
		(0.004)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	-0.0104***	-0.0679***	-0.0859***	-0.0477***	-0.0331**	-0.0352***	-0.0352***
	(0.001)	(0.018)	(0.021)	(0.009)	(0.015)	(0.007)	(0.007)

*Note: This table reports the regression results of Eq. (1). Robust t-statistics are reported in parentheses. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.*

According to the data presented in Models 1 and 2 in Table 2, intellectual capital, measured as *VAIC*, exhibits a significant positive impact on the average *ROAA* for Vietnamese commercial banks, with a statistical significance at the 1% level. This result aligns with the findings of Pulic and Bornemann (1999) and Phan and Nguyen (2023), suggesting that banks with more substantial investments in intellectual capital tend to achieve higher financial efficiency. Intellectual capital enables banks to more accurately and comprehensively assess risks associated with loans, investments, and other business ventures, leading to more informed financial decisions and minimized risks. Additionally, banks rich in intellectual capital are better equipped to understand and meet customer needs, offering tailored financial services. This customer satisfaction often translates into increased deposits and utilization of the bank's various offerings, thereby boosting profits. Intellectual capital also facilitates the adoption of advanced technology and business tools, sparking the discovery of new business opportunities and the development of innovative financial products and services, further enhancing process optimization and financial efficiency.

Concerning control variables, the results indicate that larger bank scales correlate positively with financial efficiency, which is supported by both the *SIZE* variable's significant impact at the 1% and 5% levels and previous studies by Kigen (2014) and Velnampy and Nimalathasan (2010). The *CAP* also shows a positive relationship with financial performance, significant at the 1% level, implying that higher equity ratios reduce reliance on external debt, thereby lowering interest expenses and boosting profits. This finding is also consistent with the conclusions of Havrylchyk and Jurzyk (2006) and Gul et al. (2011). In contrast, the *DEP* negatively impacts the average *ROAA*, significantly at the 5% level. Though this result is relatively different from previous studies such as Naceur and Goaied (2001) and Gul et al. (2011), it provides a new insight into the impact of deposits on bank performance. In particular, larger customer deposits necessitate higher interest payments, particularly for smaller banks offering high interest rates to attract deposits. However, the *LOAN* is positively related to the average *ROAA* and significant at the 1% level, reflecting the income generated from the difference in interest rates for deposits and loans. This result is similar to the research of Gul et al. (2011) and Abreu and Mendes (2001).

In Model 3, we incorporate both bank and quarter fixed effects to address specific characteristics unique to each bank and period in our study. Despite these additions, the findings remain consistent with the base model, underscoring their robustness.

Panel data regression often grapples with the issue of endogeneity, which can skew the accuracy of model estimates (Schultz et al., 2010). To mitigate this, our study employs a two-step GMM regression approach. The outcomes observed in Model 4 (referenced in Table 4) align with those of earlier models, further validating the base model's reliability.

Additionally, we utilize the Prais-Winsten regression technique in Model 5 to address autocorrelation, and the Newey-West regression method in Model 6 to yield consistent estimates in the presence of autocorrelation and potential heteroscedasticity. Model 7 employs two-way clustering by bank and quarter, which helps to mitigate the effects of heteroscedasticity and autocorrelation in panel data. The results across these models are consistent with the base model, indicating a positive correlation between intellectual capital and the operational efficiency of Vietnamese commercial banks. This consistency across various econometric methods reinforces the credibility of our research findings.

4.2. Quantile regressions and alternative measure of bank performance

To delve deeper into the effect of intellectual capital on the performance of Vietnamese commercial banks, our research utilized the method of moments quantile regression. According to the findings presented in Table 3, there is a notable increase in the impact of the *VAIC* on the *ROAA* at 90%. Specifically, at 10%, the *VAIC*'s regression coefficient is 0.004, but this value escalates to 0.006 at 90% of the *ROAA* — a 30% increase. This indicates that banks with higher *ROAA* levels benefit more significantly from investments in intellectual capital, enhancing their performance.

Table 3. Quantile regressions

Variable	*Q10*	*Q50*	*Q90*
	Model 1	*Model 2*	*Model 3*
VAIC	0.004***	0.005***	0.006***
	(0.000)	(0.000)	(0.000)
SIZE	0.001*	0.001***	0.002***
	(0.000)	(0.000)	(0.000)
CAP	0.046***	0.049***	0.053***
	(0.010)	(0.007)	(0.009)
DEP	-0.006**	-0.011***	-0.018***
	(0.002)	(0.002)	(0.005)
LOAN	0.005***	0.008***	0.012***
	(0.002)	(0.002)	(0.003)
Constant	-0.026***	-0.035***	-0.046***
	(0.008)	(0.007)	(0.009)
Observations	260	260	260

*Note: ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.*

Furthermore, to validate the robustness of our model, we employed an alternative measure of bank performance — the *ROAE*. The outcomes presented in Table 4 reaffirm the reliability of our study's estimates, suggesting a consistent correlation between intellectual capital and bank performance across different performance metrics. The results for this alternative measure are also similar to prior literature such as Pulic and Bornemann (1999), Calisir et al. (2010), and Maditinos et al. (2011).

Table 4. Regression results with alternative measurement (*ROAE*)

Variable	*Baseline*	*Additional variables*	*FEM*	*GMM*	*Prais-Winsten*	*Newey-West*	*Two-way cluster*
	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*	*Model 7*
ROAE				0.1103***			
				(0.029)			
VAIC	0.0622***	0.0575***	0.0566***	0.0582***	0.0545***	0.0560***	0.0560***
	(0.006)	(0.006)	(0.003)	(0.004)	(0.004)	(0.003)	(0.003)
SIZE		0.0139	0.0214**	0.0027	0.0097	0.0114***	0.0114***
		(0.010)	(0.010)	(0.004)	(0.006)	(0.003)	(0.003)
CAP		-0.4129**	-0.3856***	-0.5366***	-0.3105**	-0.2895***	-0.2895***
		(0.175)	(0.089)	(0.112)	(0.155)	(0.076)	(0.076)
DEP		-0.0652	-0.0500*	-0.0829***	-0.0442	-0.1196***	-0.1196***
		(0.040)	(0.028)	(0.030)	(0.028)	(0.027)	(0.027)
LOAN		0.1795***	0.1709***	0.1673***	0.1303***	0.1315***	0.1315***
		(0.035)	(0.030)	(0.023)	(0.031)	(0.020)	(0.020)
Constant	-0.0854***	-0.4501*	-0.6465**	-0.1472	-0.3287**	-0.3284***	-0.3284***
	(0.017)	(0.252)	(0.263)	(0.098)	(0.165)	(0.071)	(0.071)

*Note: This table reports the regression results of Eq. (1). Robust t-statistics are reported in parentheses. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.*

5. CONCLUSION

In this study, we delve into the intricate relationship between intellectual capital and operational efficiency in Vietnamese banking. Our investigation spans a decade (2012–2021), involving an in-depth analysis of 260 observations across 26 banks. The empirical evidence uncovered is striking, highlighting a robust correlation where enhancements in intellectual capital significantly boost operational efficiency, predominantly via increased interest income and profits. This vital finding underscores a key strategy for commercial banks: to amplify their market value and cash flow, active investment in the components of intellectual capital is imperative. This strategy not only augments financial returns but also provides a competitive edge in an evolving and challenging market landscape.

Delving deeper into the components of intellectual capital, our research indicates that capital efficiency — particularly in terms of investments in physical infrastructure and advanced equipment — exhibits the strongest correlation with financial efficiency. This insight is a call to action for commercial banks to rethink their resource allocation and investment strategies, potentially leading to a paradigm shift in their approach to sustainable growth. Alongside physical capital, the role of systems, processes, and data management emerges as pivotal. Investment in these areas goes beyond incremental improvement; it is a transformative step that cultivates a culture of innovation, efficiency, and strategic foresight within the banking sector.

Moreover, the study brings to light the critical importance of structured capital, especially in the management and development of intellectual property. In an era dominated by information and innovation, a nuanced approach to intellectual property — not just safeguarding it but actively nurturing and expanding it — can help banks carve a unique position in the competitive landscape. This requires a forward-thinking mindset, where investments in system upgrades and process optimization are not seen as mere expenditures but as vital steps towards higher profits and enhanced market positioning.

Beyond these tangible aspects, the study advocates a more comprehensive and holistic approach toward human capital. It suggests that banks should not only invest in their workforce's traditional technical skill enhancement but also foster a culture of creativity and well-being. This involves implementing sophisticated training programs, promoting mental and physical relaxation, and establishing extensive employee welfare schemes, including healthcare and long-term remuneration plans. Such a multifaceted focus on human capital is not just an ethical imperative; it is a strategic one that can lead to a workforce that is not only technically proficient but also creatively dynamic, emotionally engaged, and fully aligned with the bank's overarching goals of operational excellence and market dominance.

Furthermore, the study emphasizes the need for banks to pay greater attention to the practicality and importance of intellectual capital within their resource pool. Banks should prioritize protecting and developing their intellectual property as a part of future development strategies. This approach will not only improve their competitiveness in the market but also result in better profits, thereby enhancing the bank's position in the financial sector. The focus on investing in system and process development, along with data management, is shown to bring about more significant profits and, in turn, a stronger market stance.

In addition, the study highlights the significance of human capital, particularly the intellectual aspect of human resources within the banks. Banks are encouraged to engage more profoundly in training and fostering their employees' expertise and skills. However, the focus should be on more than just technical skills. The study advocates for a more rounded development approach, including creativity training and activities that support the emotional and spiritual well-being of employees, such as relaxation exercises and addressing practical needs like healthcare. Long-term employee remuneration policies are also suggested as a means to support and motivate the workforce, aligning employee goals with the bank's goals.

This study's conclusions and management implications offer Vietnamese banks a nuanced and multi-dimensional roadmap. It not only sheds light on the critical intersection of intellectual capital and operational efficiency but also provides a strategic guide for banks aiming to navigate the complexities of the modern financial landscape. By adopting a holistic approach that encompasses physical and structured capital, system and process

enhancements, and a comprehensive focus on human capital, banks can achieve operational excellence and secure a commanding position in the competitive banking sector. In essence, the study serves as a beacon, guiding banks toward a future where financial acumen, visionary leadership, and a human-centric approach coalesce to define success in the ever-evolving banking world.

In terms of limitations, this study only evaluates the impact of five factors on the banks' financial performance. Some other variables, such as macroeconomic variables (inflation, gross domestic product growth, etc.), may impact bank performance but have not been included in the model. Besides, this study could only collect data from 26 out of 35 Vietnamese banks because several banks were in the process of restructuring and did not disclose information in their financial reports during the research period. Therefore, future studies can accumulate data from all Vietnamese commercial banks and use macroeconomic parameters to analyze the impact of intellectual capital on the performance of commercial banks more comprehensively. Moreover, future research can expand into a larger region, such as investigating commercial banks in Southeast Asia or Asia, and prolong the period with more recent years to provide the most updated and exhaustive results.

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APPENDIX. VARIABLES DEFINITIONS

Variables	***Definitions***
	Dependent variables
ROAA	Return on average assets (%), equals net income before taxes over total assets.
ROAE	Return on average equity (%), equals net income before taxes over total equity.
	Variables of interests
CEE	Capital employed efficiency, equals added value over total capital employed. Joshi et al. (2013) indicate that among the components contributing capital to a firm's performance, capital employed has the largest contribution and has a positive impact on results. Phan (2023b) also concludes that *CEP* positively affects business results.
HCE	Human capital efficiency, equals added value over labor cost. The positive impact of intellectual capital on organizational performance is demonstrated in the studies of Chen and Maxwell (2007), which show that the results increase when employees increase their expertise and experience. The direct and significant positive impact of human capital on business performance is demonstrated by Sharabati (2013) and Phan (2023a).
SCE	Structural capital efficiency, equals one minus labor cost divided by added value. Structural capital is a component that has a direct impact on organizational performance, as proven by Jardon and Martos (2009). According to Cabrita and Bontis (2008), the direct impact on bank performance and the indirect impact on bank performance through relational capital were demonstrated.
VAIC	Intellectual capital, equals the total of *CEE*, *HCE*, and *SCE*. Kridan and Goulding (2006) argue that in the banking sector, knowledge management (including intellectual capital) can support the delivery of bank business strategies, as well as improve bank financial efficiency. Afroze (2011) uses the VAIC model and shows that intellectual capital has a positive impact on financial performance (return on total assets and earnings per share).
	Control variables
SIZE	Bank size, equals the natural logarithm of total assets. Kigen (2014) and Velnampy and Nimalathasan (2010) show that the larger the business scale, the higher the financial performance of the firm.
CAP	Equity-to-total assets ratio (%). Gul et al. (2011) prove that banks' capital has a strong influence on banks' profitability. Havrylchyk and Jurzyk (2006) find a positive and direct relationship between capital and banks' profits.
DEP	The ratio of deposits to total assets (%). According to Tuyishime et al. (2015), there is a positive relationship between deposit mobilization and the financial performance of commercial banks.
LOAN	The ratio of loans to total assets (%). According to Gul et al. (2011), banks mobilize deposits at low-interest rates and provide credit at high-interest rates to earn income. Thus, the more banks lend, the higher the income they earn.