Asian Academy *of* Management Journal *of* Accounting *and* Finance

AAMJAF Vol. 20, No. 2, 297–324, 2024

INTELLECTUAL RESOURCES AND OPERATIONAL COST-EFFECTIVENESS IN BANKS: AN EMPIRICAL ANALYSIS FROM VIETNAM

Chi Huu Lu

Ho Chi Minh University of Banking, 36 Ton That Dam Street, District 1, Ho Chi Minh City, 700000, Vietnam

E-mail: chilh@hub.edu.vn

ABSTRACT

The central role of intellectual resources in business operations of banks has been recognised and unveiled in the extant literature in recent times. However, it seems to be a virtual absence of studies on the impacts of these resources on the efficiency of operational costs in the banking industry, especially in developing markets. Hence, this research aims to fulfill this research gap by employing value-added intellectual coefficient (VAIC) model and investigating its role in operating cost management of 26 local banks in Vietnam during the 2006–2020 period. After performing various econometrics methods and robustness tests, the continuing evidence demonstrates that the effectiveness of operating expenditures may be enhanced significantly by relying specially on intellectual capital. Additionally, human and structural capitals are two ingredients of VAIC that can assist banks in managing operating costs more effectively. By contrast, an increase in capital employed – the third ingredient – may accelerate costs related to operational business. Taken together, it is expected that the empirical findings can provide the helpful guidance for managers and decision-makers in banks to optimise the cost-effectiveness in daily business operations and pay new paths for academicians to dig more into the role of knowledge-based management in coming future.

Keywords: Operational costs, Knowledge-based management, Intellectual capital, Banking sector, Developing country, VAIC

Received: 13 May 2024; Accepted: 5 August 2024; Published: 27 December 2024

To cite this article: Lu, C. H. (2024). Intellectual resources and operational cost-effectiveness in banks: An empirical analysis from Vietnam. *Asian Academy of Management Journal of Accounting and Finance, 20*(2), 297–324. https://doi.org/10.21315/aamjaf2024.20.2.10

To link to this article: https://doi.org/10.21315/aamjaf2024.20.2.10

INTRODUCTION

It is an undeniable truth that when the today's world has become more unpredictable and uncertain with enormous challenges such as political tensions, detrimental effects of climate risks, higher competitions or recent emergence of AI-based solutions, most organisations have forced to "think out of the box" to gain ahead of the curve. Such landscape highlights the necessity of a radical shift from tangible resources towards intangible ones in business operations as recent studies mentioned (e.g., Adesina, 2019; Nguyen & Lu, 2023b). This fact is also true in the case of the banking industry. Indeed, while physical factors are necessary for daily business operations, knowledge-based resources are driving forces that may assist banks to advance competitiveness (Lu & Nguyen, 2023; Suciu & Năsulea, 2019) and enhance value-added creation mechanism (Al-Musali & Ku Ismail, 2016; Sullivan, 2000). Simultaneously, intellectual resources can be seen as the important signal to evaluate banks' performances compared to their rivals and being replacing conventional factors in producing financial products and services (Adesina, 2021; Meles et al., 2016; Stewert, 1999).

Unsurprisingly, the topic related to intellectual capital (IC) has come under the spotlight in recent years when researchers attempt to estimate the IC's role in banking operations in both developed and undeveloped markets. Taking the study of Meles et al. (2016) as an example, the empirical results conducted by the authors reveal that IC can assist the U.S. banks in improving their financial performances. This is almost true in the cases of banks in Portugal (Neves & Proença, 2021), Gulf countries (Buallay et al., 2020), India (Vidyarthi & Tiwari, 2019), Vietnam (Le & Nguyen, 2020), and financial institutions in China, Hong Kong and Taiwan (Nazir et al., 2021). Regardless of the positive role of IC, however, the impacts of IC's ingredients on banking performances tend to be mixed. For example, Tran and Vo (2018) find a negative association between human capital employed and banks' profitability, while the opposite finding is true in the research conducted by Meles et al. (2016). The main reason for that may come from the different characteristics and structures of the banking system in each country investigated (Nguyen & Lu, 2023b; Poh et al., 2018).

Although there are scientific endeavours to discover the role of IC in banks' business operations, to the best of the author's own knowledge, the aspect related to the relationship between IC and operational costs in the banking industry tends to be an unstudied field. In this regard, the main purpose of the paper is to ascertain two following issues:

1. Does IC help banks to enhance the efficiency of operational costs?
2. What do IC's ingredients assist banks in improving operating cost management?

To attain the chief targets mentioned above, the Vietnamese banking industry may be an ideal environment for a variety of reasons.

First, it can be said that the intense pressure on the Vietnamese banking market has occurred over the years, leading local banks to the urgent changes and reforms in business strategies to survive and adapt in new conditions. For instance, along with becoming a member of WTO (World Trade Organisation) in 2007, newcomers – occurrence of foreign financial institutions – who possess higher capacities for implementing up-to-date technologies and effective management, have put the financial market into being fiercely competitive (Nguyen & Lu, 2023b; Phan et al., 2022). To withstand and flourish in this new situation, local banks are being forced to dig much into intellectual resources to seek out new paths to fuel their business operations. Furthermore, a radical transformation from traditional revenues towards diversified incomes as one of major reforms in the banking sector has required domestic banks to offer innovative initiatives in products and services to satisfy the rapidly changing demands of their customers (Lu & Nguyen, 2023; Nguyen & Lu, 2023a). In this case, intellectual resources have emerged to serve as the effective tool that may assist banks to fulfill these requirements. Last but not least, the economic growth and development of Vietnam seem to rely specially on the sustainability and effectiveness of the banking industry due to the undeveloped equity market (Le & Nguyen, 2020; Nguyen & Lu, 2023a). Hence, investigating the extent to which intellectual resources influence the efficiency of operational costs will may give helpful guidance for managers and decision-makers in the banking sector at the current time and in the coming future.

To handle the main concerns, the article uses the data set of 26 local banks in Vietnam during the period 2006–2020 and employs various econometrics methods such as OLS, Fixed-time Effect and System GMM. The brief summary of regression results is as follows. The consistent evidence shows that IC play an imperative role in improving operational costs of banks. This finding almost withstands when performing different econometrics approaches and divided samples based on bank size and asset quality. Regarding IC's ingredients, the results indicate that while an increase in capital employed efficiency may lead banks to augment expenditures in business operations, the reverse findings, to some extent, are found in the cases of human and structural capital efficiency. Moreover, the level that IC enhances cost management tends to be more obvious in small banks and ones with higher asset quality.

There are some main ways that the findings of the article contribute to existing financial literature in the intellectual capital field. The first contribution is that the findings in this research will shed new light on a distinguished angle by examining the extent to which the influences of IC and its ingredients on operational costs of banks. In fact, although the role of IC in banking operations has been paid special attention by researchers, most of them have focused on the profitable aspect (e.g., Le & Nguyen, 2020; Meles et al., 2016; Poh et al., 2018; Tran & Vo, 2018). The second point is that the study can be seen as the first scientific endeavour to unveil the role of IC in the cost management of local banks in Vietnam. Indeed, regardless of prior efforts to find out the effects of IC on various aspects of banking operations, such as financial intermediation (Nguyen & Lu, 2023b), non-interest incomes (Lu & Nguyen, 2023), profitability (Le & Nguyen, 2020; Vo & Tran, 2021a), bank risk (Nguyen et al., 2021), and bank efficiency (Le et al., 2022), the operational costs seem to be an undiscovered area in the Vietnamese industry. Hence, by demystifying the impact of IC on the operational costs of Vietnamese banks, the current study may provide a substantial contribution to fulfill the aforementioned research gap in the existing IC studies in the banking sector. Additionally, the article conducted is to respond to recent calls for the necessity of deep explorations of how IC impacts different facets of daily business operations of banks, especially in unindustrialised countries, as some previous studies stated (e.g., Adesina, 2021; Alvino et al., 2020; Nguyen & Lu, 2023b). Eventually, it is expected that the findings will provide helpful guidance for both managers and decision-makers to optimise expenditures related to business operations in the Vietnamese banking sector.

LITERATURE REVIEW

The Concept and Measure of IC

There are determined efforts to conceptualise the intellectual capital in extant literature, however, the definitions have certain differences. Stewert (1999) asserts that IC is the total of all staffs' knowledge and will provide advantageous competition to an organisation. The author suggests that IC can be considered invaluable resources such as experiences, abilities, information, that an organisation can rely on them to reach successfulness. Meanwhile, Edvinsson and Malone (1997) consider that IC is seen as non-physical sources including technological capacities, real experiences, networking relationships, knowledge and professional abilities that eventually assist companies to gain distinct advantages in highly competitive market. Cheng et al. (2010) indicate that IC is deemed as intangible assets of an organisation, including intellectual competences,

property and resources. Simply, as Caputo et al. (2016) defined, IC has been one of the important sources that may enhance the competitiveness of a company and the confidence of multi-stakeholders.

Regarding IC's ingredients, although having certain debate on them (Keong Choong, 2008), basically, many prior studies recognise three main components embedded in IC, consisting of human capital, structural capital and relational capital. Oliveira et al. (2010) define that human capital is associated with competences of employees, structural capital is related to the cultural aspects of an organisation, and relational capital is closed with external factors such as customers and suppliers. Similarly, Harris (2000) identifies that human capital embraces distinctive characteristics that individuals or/and teams possess in a company. Structural capital is factors associated with strategy, database, information, patent, policy, invention and technology, which are controlled by firms. Meanwhile, relational capital presents connections with multiple stakeholders.

In terms of measurements, great attempts in extant studies have endeavoured to precise quantification of IC. For instance, the method used the economic value-added developed by Stewert (1999); or the measure used the intellectual capital index proposed by Roos and Roos (1997); or the approach used the intangible asset monitor propounded by Sveiby (1997); or the tool is based on the value-added intellectual coefficient model – VAIC model – constructed by Pulic (2000; 2004). It is argued that the last model (VAIC) has become the popular tool that researchers utilise to unveil the role of IC in the banking industry in both developed and undeveloped markets (e.g., Buallay et al., 2020; Neves & Proença, 2021; Vidyarthi & Tiwari, 2019). The main argument for this popularity is that VAIC is relatively simple calculation and based on the availability of financial information publicised by banks, besides it is seemingly suitable method to formulate IC in the banking sector (Adesina, 2019; Nguyen & Lu, 2023b; Poh et al., 2018). The basic assumption of VAIC method is the important role of IC in value creation process, stemming from three main resources: human, structural, and physical capital. Simply, VAIC totals the efficiency of human capital (HC), structural capital (SC), and capital employed (CE). Hence, higher VAIC means that banks achieve higher level of IC efficiency. Even though this approach has some certain limitations such as not capturing all aspects of IC, due to aforementioned advantages, this research will use VAIC as the tool to measure IC efficiency in the Vietnamese banks. The calculation of VAIC will be depicted in the next section.

The Role of IC in the Firm Industry

It is argued that in comparison with the banking sector, the imperative role of IC in the firm industry has attracted more special attention from many academicians in extant studies (Le & Nguyen, 2020; Lu & Nguyen, 2023). Accordingly, based on both the resource-based view and IC theory, most of the existing empirical studies lend their support to the bright side of IC in various aspects of firm operations. For instance, the recent work of Tjahjadi et al. (2024) examines the extent to which IC directly affects the organisational performance of state-owned enterprises in Indonesia and the mediating role of open innovation and the moderating impact of organisational inertia in this relationship. By approaching a survey method with 97 completed questionnaires collected from upper-level managers of these firms and employing PLS-SEM, the study finds a positive relationship between IC and organisational performance, which is also mediated by open innovation but moderated by organisational inertia. Previously, the study conducted by Salehi et al. (2024) examines the relationship between IC, its components, and audit fees stickiness of listed firms in Iran during the 2012–2018 period, and finds that enhancement in IC and its components consisting of human capital, organisational capital, structural capital and relational capital can help firms to reduce audit fees stickiness. Meanwhile, Moghadam et al. (2021) investigate the extent to which IC exerts the readability of financial statements of listed firms in Iran during the 2012–2018 period, and indicate that the financial statements' readability can be enhanced by IC.

Other studies have endeavoured to unlock the potential impact of IC by blending it with different factors such as social capital, digital investment and characteristics of board members. For example, the research carried out by Salehi et al. (2024) aims to explore the impacts of intellectual capital and social capital on internal control weaknesses of firms in Iran between 2014 and 2020. The results show that internal control weaknesses can be mitigated by intellectual capital and social capital that also assist firms in enhancing creativity, performance, control process and human resource exploration. In the preceding research, Salehi et al. (2022) find that both intellectual capital and social capital can minimise fraud in financial statements as well as laundering money of firms. Meanwhile, Bai et al. (2023) demonstrate that organisational value can be enhanced significantly by digital investment and this enhancement can be consolidated by the mediating role of IC. The recent result conducted by Gross-Gołacka (2024) shows that diversity management can foster and unlock the beneficial potential of IC of organisations, while Almuaqel (2024) finds that IC can enhance the level of accessible and inclusive higher education for individuals possessing intellectual and developmental differences. By contrast, the previous research of Salehi

and Zimon (2021) does not find the relationship between IC of board members (measured by experiences and education) and value creation and growth of firms. A similar finding is also true in the case of gender diversity that reflects the feature of board members. In a broader scope, based on the national intellectual capital index developed by Vo and Tran (2021b), the study conducted by Vo and Tran (2024) aims to evaluate the impact of IC on the economic growth of 23 countries in the Asia-Pacific region during the 2000–2020 period. The empirical result indicates that the economic growth in this region is enhanced significantly by the national intellectual capital.

VAIC Model in the Banking Industry and Hypotheses Development

It can be said that the impacts of VAIC and its components on the banking operations has arrested the special attention of many researchers in the recent years. Generally, a large number of studies have underscored the pivotal role of VAIC in financial performances of banks in both industrialised and unindustrialised countries. For instance, based on a huge number of nearly 5,750 commercial banks in the U.S. between 2005 and 2012 and performing OLS regression, the study of Meles et al. (2016) finds a strong association between VAIC and two performance indicators including return on assets (ROA) and return on equity (ROE). The finding means that the U.S. banks can gain more economic benefits from implementation of IC. Similarly, using the data of 12 Portuguese banks from 2009 to 2016 and employing VAIC model as a measure of IC efficiency, Neves and Proença (2021) find that VAIC can enhance three financial indicators – ROA, ROE, NIM (net interest margin) – of banks. In a similar way, the research of Buallay et al. (2020) who utilie the sample of 59 listed banks in Gulf nations during the 2012–1026 period, shows that VAIC contributes to enhancement in banking performances calculated by three indicators: ROA, ROE and Tobin's Q. Nazir et al. (2021) investigate the impact of VAIC on the profitability of 76 financial institutions in China, Taiwan and Hong Kong, and find a remarkable relationship between VAIC and profitable aspect of these organisations. Other studies that confirm these findings consist of the works of Poh et al. (2018) in the Malaysian banking sector, Le and Nguyen (2020) and Vo and Tran (2021a) in Vietnamese banks, and Kweh et al. (2022) in Taiwan.

At the same time, recent studies have tried to explore different aspects in the association between VAIC and business operations of banks. For example, by relying on the data set of 26 commercial banks in Vietnam during the 2006–2020 period and performing various econometrics methods, Nguyen and Lu (2023b) find that the more VAIC implementation, the more achievements in financial intermediation activities in banks. Meanwhile, other research emphasises the link

between VAIC and diversification strategies of banks. The work of Duho and Onumah (2019) who use the unbalanced panel data of 32 Ghanaian banks during the period 2000–2015 and the panel corrected standard error regression, shows that VAIC helps banks to improve asset diversification strategy. However, it does not support their diversified incomes. By contrast, the research of Lu and Nguyen (2023) demonstrates the imperative role of VAIC in fueling non-interest incomes of Vietnamese commercial banks. Under the risk-taking angle, Nguyen et al. (2021) indicate that increasing VAIC can lead banks to be more instable in the short term, but after reaching a certain level, an increase in VAIC can consolidate the stability of banks. Additionally, some papers focus on the aspect of banks' productivity and market value. The earlier study of Yalama (2013) who employ the data of 17 Turkish banks from 1995 to 2006 shows that VAIC can enhance both productivity and market value of banks. This finding is in line with the study of Alhassan and Asare (2016) in Ghanian banks. In a relevant dimension, using the sample of about 340 banks in 31 African countries, the regression result of Adesina (2019) demonstrates that the higher VAIC, the more technical, allocative, cost efficiency. The recent research of Le et al. (2022) also reaffirms this finding. Furthermore, Nguyen and Lu (2023a) find that the integration between VAIC and technological investments can spur deposit activities of banks.

Regardless of VAIC is acknowledged as the vital catalyst for banking operations in existing literature, the impacts of its ingredients, including human capital efficiency (HC), structural capital efficiency (SC), and capital employed efficiency (CE), are still controversial. Taking the first ingredient – HC – as a typical example, while many articles underscore the important role in fostering financial performances of banks (e.g., Adesina, 2019, 2021; Buallay et al., 2020; Meles et al., 2016), Tran and Vo (2018) find that an increase in HC can drain the profitability of listed banks in Thailand. Meanwhile, some studies suggest that mangers in banks should harness CE to strengthen their performances (e.g., Nguyen & Lu, 2023b; Ozkan et al., 2017), others do not support this view (Al-Musali & Ku Ismail, 2016). Regarding the last ingredient, SC, Haris et al. (2019) find a negative effect of this factor on the profitability of Pakistani banks. This finding is similar with the evidence shown by Ozkan et al. (2017). However the work of Lu and Nguyen (2023) indicate that SC contributes to significant enhancement in non-interest incomes of banks compared to other ingredients.

Taken together, some main points can be summarised from the extant literature mentioned as follows. First, although there are certain differences, in general, a huge number of studies highlight the crucial role of VAIC in banking operations. The second is that many researchers have endeavoured to discover various aspects of VAIC's role in banks' business operations, however the

operational costs dimension is still undiscover field. Furthermore, the impacts of three main ingredients of VAIC almost remain mixed findings. Therefore, this research aims to investigate the extent to which VAIC and its ingredients influence operational costs of banks based on the context of Vietnam. The study also creates the following hypotheses:

H1: VAIC may assist banks in enhancing operational costs.

H2: The impacts of three main ingredients of VAIC on operational costs are mixed.

METHODOLOGY

Data and Variables

Following the previous studies in Vietnam (Lu & Nguyen, 2023; Nguyen & Lu, 2023b), the data in this research is collected from two feasible sources. The first is the financial information that is gathered directly from the audited financial statements publicised annually by domestic banks. The calculation of VAIC model requires a variety of relevant costs, therefore the study has to pick up these expenditures from banks' notes to financial statements. Besides, in some cases, banks that are absence of required information will be eliminated. The second is the macro information, which is collected from the website of World Bank database. Overall, the research sample totals 26 Vietnamese commercial banks during the 2006–2020 period, suggesting that there are around 380 bank-year observations in the current analysis. When making a comparison with other empirical studies in this field in the banking industry, the sample can be seen as acceptable. Indeed, Vo and Tran (2021a) use about 14 listed banks during the 2009–2018 period in Vietnam to determine the impacts of VAIC and its ingredients on financial performance of banks, indicating that around 140 bank-year observations are analysed. Neves and Proença (2021) utilise a data set of 12 Portuguese banks between 2009 and 2016, suggesting a data set of nearly 100 bank-year observations is employed. Other typical examples consist of Le and Nguyen (2020) using around 377 observations and Buallay et al. (2020) utilising about 295 observations. At the same time, the banks' assets analysed in the present study account for over 70% of all banks in the Vietnamese banking industry, hence, to some extent, the selected banks are highly representative sample.

This article targets the long period, from 2006 to 2020, because it witnessed many the paradigm shifts in the Vietnamese banking sector, including new arrivals – foreign financial institutions and Fintech firms, adopted regulations

to meet requirements of Basel, and technologies-based sustainability (Le & Nguyen, 2020; Nguyen & Lu, 2023b; Phan et al., 2022). Also, the long period can help to draw a general picture from the role of intellectual resources in banking operations.

To build the analysis model, the study employs three kinds of variables, including the interested independent variable (VAIC), controlled variables (both bank-characteristics and macro conditions), and the dependent variable (efficiency of operational costs). As mentioned in previous section, the study uses VAIC model as the measure of IC efficiency of banks and as the key explanatory variable. VAIC is a sum of three sources: human capital efficiency (HC), structural capital efficiency (SC), and capital employed efficiency (CE). The following steps present the detailed calculation of VAIC.

$$VAIC_{it} = CE_{it} + HC_{it} + SC_{it} \quad (1)$$

$$CEE_{it} = VA_{it}/C_{it} \quad (2)$$

$$HC_{it} = VA_{it}/H_{it} \quad (3)$$

$$SC_{it} = S_{it}/VA_{it} \quad (4)$$

$$S_{it} = VA_{it} - H_{it} \quad (5)$$

$$VA_{it} = O_{it} + P_{it} + A_{it} \quad (6)$$

where, C_{it} and H_{it} are the book value of equity and the personnel expenses, respectively. The value added (VA) totals the operating profits (O_{it}), personnel costs (P_{it}) and amortisation and depreciation costs (A_{it}).

To measure the efficiency of operational costs of banks, the study utilises the traditional approach which employs the ratio of total operating expenses over total operating incomes (Expense) as some papers indicated (e.g., Adesina, 2021; Phan et al., 2022; Shaban & James, 2018). Accordingly, decreasing this ratio means that operational costs are managed more effectively. Regarding controlled variables, the research respectively includes bank-specific features and macro conditions. Following prior studies (e.g., Lu & Nguyen, 2023; Nguyen & Lu, 2023a; 2023b), the former variables group consists of the natural logarithm of total assets (ASSET), the ratio of capital over total assets (CAP), the ratio of total income before taxes, provisions recognised in income over total gross assets (RETURN) and the loan loss reserve ratio (LLRR), while the latter variables group includes the ratio of GDP growth (GDP) and the inflation rate (IFLR). The interpretations of each variable are illustrated in Table 1.

Table 1 interprets all of variables performed in the analysis models. Accordingly, to eliminate outlier factors in the sample, all of the financial variables will be winsorised at 1% and 99% degrees. The data set contains 26 commercial banks covering the 2006–2020 period.

Table 1
Variables interpretations

Variables	Interpretations
Dependent variable	
EXPENSE	The ratio of total operating expenses over total operating incomes before provisions and taxes is used as the dependent variable to measure the cost-effective management of banks in the sample.
Main explanatory variables	
VAIC	VAIC is the traditional model to measure the intellectual capital efficiency of banks, which totals the efficiency of capital employed, human capital, and structure capital.
CE, HC and SC	CE, HC and SG are three main ingredients of VAIC, which are measurements of the efficiency of capital employed, human capital and structure capital, respectively.
Control variables	
ASSET	The calculation of ASSET variable is based on the natural logarithm of total assets per year of banks in the sample.
CAP	The ratio of the book value of equity to total assets per year of banks in the sample is used to calculate CAP variable.
LLRR	The ratio of the loan loss reserve per year of banks in the sample is used to calculate LLRR variable.
RETURN	The ratio of total income before taxes, provisions recognised in income to total assets per year of banks in the sample is used to calculate RETURN variable.
GDP	GDP is the abbreviation of the Gross Domestic Product growth per year of Vietnam, which is used as the macro-control variable.
INFLR	INFLR is the abbreviation of the annual inflation rate of Vietnam, which is used as the macro-control variable.
OWNER	OWNER is used as a dummy variable, which will be determined as 1 if a bank is controlled by the state and 0 otherwise.

Empirical Model

To evaluate the extent to which VAIC and its ingredients impacts the efficiency of operational costs of banks, the empirical analysis is modelled as follows:

$$Expense_{it} = \alpha + VAIC_{it} + Bank\ Control_{it} + Macro\ Control_{it} + \theta_t + \varepsilon_{it} \quad (7)$$

$$Expense_{it} = \alpha + HC_{it} + SC_{it} + CE_{it} + Bank\ Control_{it} + Macro\ Control_{it} + \theta_t + \varepsilon_i \quad (8)$$

where $Expense_{it}$ presents the operational costs efficiency of bank i at time t, while VAIC and HC, SC, CE play as the interested independent variable in the analysis model. $Bank\ Control_{it}$ is the vector of bank-specific characteristics consisting of ASSET, CAP, RETURN and LLRR. $Macro\ Control_{it}$ is the vector of macro variables including GDP and IFLR. Also, the empirical model contains time-fixed effects, θ_t, to control the macroeconomic conditions, and ε_{it} is the error term. Before reaching final conclusions, the findings from the empirical model will be retested through some a battery of robustness tests which are illustrated in the next section.

To minimise the possible impacts of outliers, all financial variables in the data will be winsorised at the 1st and 99th percentiles. In general, there are around 380 observations in the research sample, and HC has the highest value compare with other ingredients of VAIC, which is quite accordance with prior studies (Le & Nguyen, 2020; Lu & Nguyen, 2023; Nguyen & Lu, 2023b). Panels A and B of Table 2 detail the descriptive statistics and the correlation matrix, respectively.

It is worth noting that like other extant measures, VAIC model also possesses some limitations. One of its drawbacks is that it does not yet contain all angles of IC, especially in the case of relational capital efficiency as the theoretical view suggests (Adesina, 2019; Nguyen & Lu, 2023b). Besides, this model has been criticised as confusion over the calculations of human capital and structural capital because of their inaccuracy of accounting concept view (Meles et al., 2016). To narrow these demerits, various models, namely extended and adjusted VAIC, have been developed to capture the neglected component mentioned above. Accordingly, many scholars have tried to measure relational capital efficiency by adding marketing, advertising or sales expenses to the original VAIC model (Bai et al., 2023; Buallay et al., 2020; Salehi, et al., 2023).

Regardless of the aforementioned disadvantages, VAIC is considered a favourable tool to measure IC efficiency in the banking sector due to the following reasons. First, the calculation of VAIC is seemingly simple for researchers, who can easily collect necessary financial information publicised by banks to compute it (Adesina, 2019; Lu & Nguyen, 2023). Furthermore, to some extent, this measure can be seen as an appropriate means for calculating IC efficiency in the banking sector and the firm industry as a whole (Nguyen & Lu, 2023b; Poh et al., 2018). Simultaneously, by relying especially on this model, it is easy to make a comparison between IC performance of organisations and their financial merits

(Meles et al., 2016). Based on the advantages stated above and the available data level in the Vietnamese banking industry, VAIC model is employed to measure IC efficiency of banks in the current study.

Table 2
Descriptive statistics and correlation matrix

Panel A: Descriptive statistic					
Variables	Observation	Mean	Standard deviation	Minimum	Maximum
EXPENSE	378.00	0.50	0.16	0.19	0.94
VAIC	378.00	3.41	1.01	0.77	6.65
CE	380.00	0.39	0.22	0.05	0.95
HC	378.00	2.46	0.78	1.00	5.47
SC	380.00	0.55	0.15	0.001	0.83
CAP	380.00	0.11	0.07	0.04	0.46
ASSET	380.00	24.9	1.5	20.8	27.9
LLRR	379.00	–0.01	0.04	–0.27	0.03
RETURN	380.00	0.02	0.01	4.84e-06	0.06
GDP	390.00	0.06	0.01	0.03	0.07
INFLR	390.00	0.07	0.06	0.01	0.23

Panel B: Correlation matrix								
Variables	(EXPENSE)	(VAIC)	(ASSET)	(CAP)	(RETURN)	(LLRR)	(GDP)	(INFLR)
EXPENSE	1.000							
VAIC	–0.851*	1.000						
	(0.000)							
ASSET	–0.072	0.209*	1.000					
	(0.162)	(0.000)						
CAP	–0.094	0.011	–0.710*	1.000				
	(0.067)	(0.831)	(0.000)					
RETURN	–0.709*	0.707*	0.037	0.291*	1.000			
	(0.000)	(0.000)	(0.471)	(0.000)				
LLRR	–0.413*	0.362*	–0.082	0.132*	0.287*	1.000		
	(0.000)	(0.000)	(0.110)	(0.010)	(0.000)			
GDP	–0.020	0.014	–0.086	–0.011	–0.044	–0.026	1.000	
	(0.703)	(0.786)	(0.092)	(0.825)	(0.389)	(0.614)		
INFLR	–0.165*	0.061	–0.340*	0.325*	0.116*	0.302*	–0.112*	1.000
	(0.001)	(0.233)	(0.000)	(0.000)	(0.023)	(0.000)	(0.027)	

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

HOW VAIC ASSISTS BANKS IN ENHANCING OPERATIONAL COSTS

Major Findings

To achieve a clear explanation of how VAIC and its ingredients impact the efficiency of operational costs of banks, at the first stage, the study approaches the OLS method in six models in Table 3. Model (1) starts with only the interested variable – VAIC – and shows a negative association between VAIC and the dependent variable – EXPENSE – at 1% statistical significance. In the next two models, bank-specific characteristics and macro conditions are controlled in Model (2) and Model (3), respectively. Again, both models show a similar result that VAIC negatively impacts EXPENSE.

In Model (4), which is called the Baseline model, both bank-specific characteristics and macro variables are controlled. The regression evidence continues to indicate a negative relationship between the main explanatory variable and the dependent one, meaning that an increase in VAIC may lead to a decrease in EXPENSE. In other words, banks may gain more economic benefits in operational cost management from the augmentation of VAIC or IC efficiency. In particular, as the Baseline model indicates, in a case of increasing one standard deviation of VAIC, when all others are held equally, the operational costs will be enhanced by 10.6 bps (i.e., the coefficient of VAIC, –0.104, times the standard deviation of VAIC, 1.01).

Since there are some state-controlled banks in the sample, a dummy variable (OWNER) is created to evaluate the effect of these banks on the aforementioned finding. This evaluation is quite necessary because of the following reasons. First, it can help to further test the positive impact of IC found in the previous models. Second, since the preceding research (e.g., Lu & Nguyen, 2023) indicates that state-owned banks seemingly leverage IC ineffectively compared to their peers. This step may provide an answer to whether the impact of IC on the main concern is different in public banks. Accordingly, the dummy variable will equal one in the case of state-owned banks and equal to zero if they are not. The result in Model (5) is in line with the previous finding, although the magnitude of VAIC's impact seems to be lower. Meanwhile, the coefficient OWNER is negative but not statistically significant, suggesting the present analysis does not yet conclude clearly the impact of state-owned banks on the concerned relationship.

To estimate the role of VAIC's ingredients, the study performs Equation (8) in which the VAIC will be divided into three main components (HC, CE, SC). The regression result in Model (6) indicates that while the positive impact at the 1% statistical significance is found in the case of CE, the opposite is true

in the cases of HC and SC at the 5% level. This means that human and structural capital may contribute to enhancement in managing the operational costs of banks. Meanwhile, increasing capital employed (or physical capital) can lead to augment operating expenditures.

In sum, it can be said that the evidence now demonstrates the important role of VAIC in enhancing costs related to the operating business of banks. Regarding VAIC's ingredients, on one hand, the finding illustrates that both human and structural capital can assist banks in improving cost management, on the other hand, capital employed can accelerate operating expenses. To ensure these findings, in the next sub-section, the research will employ a variety of tests.

A Battery of Robustness Tests

At the first step in the test process, the study reperforms all models in Table 3 in which the interested dependent variables (VAIC and its ingredients) are lagged one year. This approach may help to address two problems. The first is the endogeneity in the empirical analysis (Nguyen & Lu, 2023b; Phan et al., 2022), and the second is that any adaptation of business management for new circumstances may make banks need the certain amount of time to absorb (Lu & Nguyen, 2023; Phan et al., 2022). The detailed results are illustrated in Table 4.

It is obvious that all coefficients of VAIC in all models are negative and statistically significant at 1% level even though the magnitude of impact is quite lower. This signal again reaffirms the previous finding, considering that the more implementation of VAIC, the more effectiveness in operating cost management. Regarding VAIC's ingredients, Model (6) (see Table 4) indicates that the influence of both CE and HC seemingly tends to be unchanged, that of SC is negative but not statistically significant.

Table 3
Major findings

Variable	(1) Only main variable	(2) Control bank characteristics	(3) Control macro conditions	(4) Baseline	(5) Adding dummy variable	(6) Ingredients of IC
VAIC	–0.132*** (0.00654)	–0.105*** (0.00885)	–0.131*** (0.00668)	–0.104*** (0.00915)	–0.0990*** (0.0118)	
CE						0.196*** (0.0237)
HC						–0.0562** (0.0273)

(*Continued on next page*)

Table 3 (*Continued*)

Variable	(1) Only main variable	(2) Control bank characteristics	(3) Control macro conditions	(4) Baseline	(5) Adding dummy variable	(6) Ingredients of IC
SC						–0.483** (0.226)
ASSET		0.0145*** (0.00412)		0.0124*** (0.00461)	0.0200*** (0.00493)	–0.0109** (0.00528)
CAP		0.201** (0.0898)		0.212** (0.0938)	0.283*** (0.103)	0.353*** (0.0910)
RETURN		–3.626*** (0.638)		–3.636*** (0.633)	–4.167*** (0.754)	–4.992*** (0.549)
LLRR		–0.380** (0.186)		–0.323* (0.193)	–0.312* (0.183)	–0.471** (0.229)
GDP			–0.302 (0.414)	–0.286 (0.449)	–0.195 (0.422)	–0.617* (0.315)
INFLR			–0.303*** (0.0635)	–0.168** (0.0675)	–0.127* (0.0688)	–0.145*** (0.0542)
OWNER					–0.0441 (0.0297)	
Constant	0.953*** (0.0250)	0.535*** (0.0944)	0.989*** (0.0327)	0.616*** (0.120)	0.406*** (0.149)	1.195*** (0.104)
Observations	378	377	378	377	377	377
R^2	0.723	0.766	0.737	0.769	0.774	0.830

Note: Robust standard errors in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The result regressions in Table 3 present the role of IC in improving operational costs of banks. Accordingly, the asterisks ***, **, * in the table will denote significance of each variable at the 1%, 5%, and 10% level, respectively in each employed model.

Table 4
Lagging one period

Variable	(1) Only main variable	(2) Control bank characteristics	(3) Control macro conditions	(4) Baseline	(5) Adding dummy variable	(6) Ingredients of IC
L.VAIC	–0.0900*** (0.00940)	–0.0372*** (0.00917)	–0.0910*** (0.00962)	–0.0358*** (0.00993)	–0.0320*** (0.00948)	
L.CE						0.217*** (0.0462)
L.HC						–0.0389* (0.0233)
L.SC						–0.131 (0.163)

(*Continued on next page*)

Table 4 (*Continued*)

Variable	(1) Only main variable	(2) Control bank characteristics	(3) Control macro conditions	(4) Baseline	(5) Adding dummy variable	(6) Ingredients of IC
ASSET		0.00895		0.00736	0.0244***	–0.0171**
		(0.00639)		(0.00708)	(0.00680)	(0.00738)
CAP		0.482**		0.476**	0.604***	0.497**
		(0.188)		(0.188)	(0.181)	(0.199)
RETURN		–9.530***		–9.575***	–10.09***	–10.62***
		(1.115)		(1.117)	(1.048)	(1.007)
LLRR		–0.560***		–0.546***	–0.509***	–0.732***
		(0.178)		(0.181)	(0.171)	(0.192)
GDP			–0.227	0.407	–0.252	–0.360
			(0.555)	(0.493)	(0.470)	(0.446)
INFLR			0.0450	–0.0710	0.0100	0.0757
			(0.151)	(0.110)	(0.102)	(0.0976)
OWNER					–0.0885***	
					(0.0213)	
Constant	0.818***	0.521***	0.832***	0.588***	0.138	1.164***
	(0.0334)	(0.161)	(0.0493)	(0.184)	(0.186)	(0.177)
Observations	352	352	352	352	352	352
R^2	0.354	0.645	0.355	0.646	0.667	0.695

Notes: Robust standard errors in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. At the first step of performing robustness tests, all main explanatory variables (VAIC, CE, HC and SC) are lagged one years. The regression results in Table 4 continue to prove the important role of IC in enhancing operational costs of banks. The asterisks ***, **, * in the table will denote significance of each variable at the 1%, 5%, and 10% level, respectively in each employed model.

At the next step, to further retest the findings, the study continues to employ two econometrics methods including Fixed-time Effect and System GMM. These approaches are certainly important in the robustness tests. Indeed, the former method may help to minimise the possible impacts of time on the empirical analysis results (Nguyen & Lu, 2023b; Phan et al., 2022; Tran et al., 2021). Meanwhile, the latter method may contribute to mitigation of problems springing from autocorrelation and correlation, as well as the endogeneity and heteroscedasticity between independent variables (Arellano & Bond, 1991; Lu & Nguyen, 2023; Nguyen & Lu, 2023b). To condense the empirical results, the study only reperforms Equations (7) and (8), and the detailed information is presented in Table 5.

In the first two models, the Fixed-time Effect estimator shows that the impacts of both VAIC and CE are in line with the previous findings, suggesting that VAIC may improve the effectiveness of operational costs, while CE may augment

operating expenditures. Meanwhile, the signals of other ingredients of VAIC obtain a similarity with mentioned results, however, they are statistically insignificant. When approaching System GMM in the final two models, interestingly, all signals of all the interested explanatory variables (VAIC, HC, CE, SC) tend to bear a close resemblance to the findings illustrated in Table 3, indicating that VAIC and its two ingredients: HC and SC will play an essential role in enhancing operational costs of banks. However, an augmentation of physical capital can deteriorate the efficiency of operating cost management.

In the final step, the research will retest the aforementioned findings by reperforming Equations (7) and (8) according to different sub-samples based on asset quality and bank size. Regarding the former criterion, it can be said that asset quality has directly affected banks' operational expenses. Accordingly, banks' business operations can be considered effective when they manage and monitor their borrowers more effectively, leading to lower risk (Nguyen et al., 2021). In this light, they may not tend to seek alternative income resources to compensate for the higher risk of asset management (Mostak Ahamed, 2017). Hence, separating subsamples based on asset quality may help to answer the question of whether the fluctuation of this factor has led banks to delve further into IC or not. Regarding the latter criterion, meanwhile, existing empirical findings tend to vary depending on the research objectives under the impact of VAIC. Indeed, the study of Nguyen and Lu (2023b) suggests that leveraging IC for financial intermediation activities of large banks seems to be ineffective, by contrast, Lu and Nguyen (2023) find that these banks seemingly harness IC to booster non-interest incomes more effectively than small banks. Additionally, Le and Nguyen (2020) demonstrate that human capital is not yet explored effectively by big banks, however, they utilise structural capital to fuel their performance more effectually. Therefore, examining the role of bank size will provide a clear answer to whether the size factor has become an advantage for banks in leveraging IC. Simultaneously, performing a regression analysis based on these subsamples can help the current research to retest the previous findings.

To determine the impact of asset quality, following Mostak Ahamed (2017), the research sample is separated into two sub-samples consisting of banks with the loan loss reserve ratio below the median value or higher asset quality, and ones with the loan loss reserve ratio above the median value or lower asset quality. The detailed results are illustrated in the first four models in Table 6. For the effect of bank size, following Le and Nguyen (2020); Nguyen and Lu (2023b), the sample is segregated into two sub-samples including banks with total assets above the median value or big banks, and ones with total assets below the median value or small banks. The next four models present the results.

As shown in Table 6, it is easy to see that the negative impact of VAIC is found in all models and stands at 1% statistical significance. By contrast, all sub-samples illustrate the positive influence of CE with the statistical significance at 1% and 5% level. Meanwhile, the role of HC in improving operational costs is only shown in banks with higher asset quality and big banks. In contrast, that of SC is similarly presented in banks with lower asset quality and small ones and stands at 1% statistical significance.

In sum, a battery of robustness tests demonstrates the necessary role of VAIC in managing operating expenditures, supporting H1. For VAIC's ingredients, the empirical results continue to show the mixed findings, which are in line with prior studies stated and advocate H2. In particular, an augmentation of CE can lead banks to face higher operating costs, while, to some extent, HC and SC can assist them to achieve more economic benefits in cost management. The next section will give some detailed discussions and conclusions from the study's findings.

Table 5
Other econometrics approaches

Variable	(1)	(2)	(3)	(4)
	Fixed-time effect estimator		GMM estimator	
L.EXPENSE			0.126**	0.0804*
			(0.0560)	(0.0437)
VAIC	–0.106***		–0.111***	
	(0.0167)		(0.00789)	
CE		0.205***		0.189***
		(0.0519)		(0.0192)
HC		–0.0524		–0.0281**
		(0.0349)		(0.0118)
SC		-0.497		–0.704***
		(0.329)		(0.0815)
ASSET	0.0210***	0.000661	0.0120***	0.000373
	(0.00642)	(0.00663)	(0.00387)	(0.00358)
CAP	0.172	0.361***	0.118	0.564***
	(0.120)	(0.101)	(0.104)	(0.0795)
RETURN	–3.964***	–5.384***	–2.655**	–4.476***
	(1.107)	(1.044)	(1.087)	(0.581)
LLRR	–0.387*	–0.394	–0.284***	–0.329***
	(0.205)	(0.290)	(0.103)	(0.100)

(*Continued on next page*)

Table 5 (*Continued*)

Variable	(1)	(2)	(3)	(4)
	Fixed-time effect estimator		GMM estimator	
GDP	–0.143	–0.454*	–0.117	–0.119
	(0.335)	(0.274)	(0.165)	(0.110)
INFLR	–0.0632	–0.0590	0.0110	–0.0307
	(0.0732)	(0.0818)	(0.0623)	(0.0553)
Constant	0.398**	0.892***	0.557***	0.863***
	(0.187)	(0.125)	(0.124)	(0.102)
AR(1)			0.006	0.005
AR(2)			0.409	0.880
Wald chi2			50272.08	132786.08
Prob > chi2			0.000	0.000
R^2	0.763	0.822		
Observations	377	377	352	352
Number of banks	26	26	26	26

Notes: Standard errors in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. At the next step of performing robustness tests, two econometrics methods including Fixed-time Effect and System GMM are employed. Accordingly, the former approach is performed in Model (1)–(2), and the later one is employed in the rest of models. The asterisks ***, **, * in the table will denote significance of each variable at the 1%, 5%, and 10% level, respectively in each employed model.

Table 6
Evaluation of the influences of asset quality and bank size

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	High asset quality		Low asset quality		Big banks		Small banks	
VAIC	–0.102***		–0.0597***		–0.0849***		–0.105***	
	(0.0110)		(0.0158)		(0.0238)		(0.00876)	
CE		0.155***		0.244***		0.172**		0.252***
		(0.0285)		(0.0250)		(0.0667)		(0.0409)
HC		–0.0632*		–0.00745		–0.123**		–0.00335
		(0.0341)		(0.0177)		(0.0558)		(0.00928)
SC		–0.401		–0.622***		0.0620		–0.929***
		(0.305)		(0.0683)		(0.415)		(0.0678)
ASSET	0.0125**	–0.00775	0.00147	–0.00791*	–0.000523	–0.0182*	0.0284***	0.00820*
	(0.00568)	(0.00628)	(0.00615)	(0.00404)	(0.0127)	(0.00968)	(0.00876)	(0.00418)
CAP	0.149	0.274***	0.842***	1.311***	0.410	1.175***	0.354***	0.408***
	(0.0923)	(0.0822)	(0.201)	(0.141)	(0.263)	(0.416)	(0.119)	(0.0829)
RETURN	–2.465***	–3.903***	–14.04***	–12.73***	–3.578***	–6.154***	–4.737***	–4.108***
	(0.646)	(0.736)	(2.140)	(1.290)	(0.857)	(1.191)	(1.200)	(0.693)
LLRR	–0.652	–0.429	0.00978	–0.157*	–0.237	–0.625**	–0.554***	–0.0762
	(0.854)	(0.560)	(0.145)	(0.0866)	(0.289)	(0.249)	(0.195)	(0.152)
GDP	–0.663	–1.032**	0.294	–0.0571	0.0841	–0.153	–0.932	–0.735
	(0.571)	(0.465)	(0.492)	(0.238)	(0.412)	(0.285)	(0.800)	(0.605)
INFLR	–0.0118	–0.0466	0.174	–0.00633	–0.170	–0.0752	–0.197*	–0.251***
	(0.0907)	(0.0824)	(0.144)	(0.111)	(0.108)	(0.0751)	(0.100)	(0.0577)
Constant	0.591***	1.103***	0.815***	1.063***	0.842***	1.176***	0.284	0.842***
	(0.146)	(0.117)	(0.170)	(0.109)	(0.281)	(0.187)	(0.236)	(0.119)
Observations	254	254	123	123	204	204	173	173
R^2	0.711	0.765	0.892	0.964	0.695	0.777	0.845	0.941

Notes: Robust standard errors in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. At the final step of robustness tests, the impacts of both asset quality and size of banks are evaluated. Accordingly, Model (1)–(4) present the role of banks' asset quality and the other models present the role of bank size. The asterisks ***, **, * in the table will denote significance of each variable at the 1%, 5%, and 10% level, respectively in each employed model.

DISCUSSION

In the turbulent world with scarce resources and rapid changes in new technological adaptations, modern banks force (or be forced) to dig more into knowledge resources to construct suitable strategies and expand their business operations in effective ways. This is seen as a big part of the reason why the role of IC has arrested the special attention of many scholars in recent years, especially in the banking system. Even though existing empirical studies have

efforted to demystify the impacts of IC and its components on various dimensions of bank operations, the link between IC and operational cost-effectiveness in the banking industry seems to be unstudied field. Accordingly, the study's endeavor is to bridge this research gap and contribute to the extant IC literature by examining the correlation between IC, its ingredients, and the efficiency of operational cost management based on the banking system of a developing economy, namely Vietnam. The consistency of the empirical evidence manifests that banks may reap more economic benefits from relying more on IC in managing operating costs, meaning that IC not only has beneficial impacts on financial performance (e.g., Vo & Tran, 2021a), non-interest incomes (e.g., Lu & Nguyen, 2023), financial intermediation (e.g., Nguyen & Lu, 2023b), and asset diversification strategy (e.g., Duho & Onumah, 2019) but also becomes an integral part of managing cost strategy of banks. The results also provide helpful information to shed new light on some related theories such as intellectual capital theory and knowledge-based theory that emphasize the vital aspect of IC in business management of enterprises these days as preceding studies mentioned (e.g., Salehi et al., 2023; Suciu & Năsulea, 2019; Tjahjadi et al., 2024). Besides, the evidence suggests that although IC can help both big and small banks to improve their operating cost management, the magnitude of IC's impact is larger in small banks compared to big ones, which is aligned with the previous finding of Nguyen and Lu (2023b). A similar observation is also presented in banks with higher asset quality, meaning that these banks seemingly harness IC more effectually than their peers. Taken together, this finding advocates Hypothesis 1 suggesting the positive side of IC in enhancing banks' operational costs.

Regarding the three main ingredients, the findings indicate that, on the one hand, rising CE may lead banks to face higher operating expenditures; on the other hand, harnessing HC and SC may help them to enhance the ability of operational cost management effectively. The unanticipated impact of CE is seemingly contrary to the preceding findings of Nguyen and Lu (2023b) and Ozkan et al. (2017), who indicate that during the reform period, banks should further implement CE to improve their financial intermediation activities and performance, but it is in line with the previous research of Al-Musali and Ku Ismail (2016). It is true that when the Vietnamese financial market becomes fiercely competitive, married with fundamental requirements of Basel, especially the capital adequacy ratio, domestic banks have to augment their capital capacity as much as possible. Consequently, this augmentation may increase the operating expenditures of banks, and this may be a part of the reason explaining the unexpected impact of CE. Meanwhile, the positive role of HC is aligned with many extant studies that underscore this vital catalyst for banks' performance (e.g., Le & Nguyen, 2020; Meles et al., 2016), technical, allocative, and cost efficiencies (e.g., Adesina,

2019; Le et al., 2022), and other aspects. Similarly, the expected impact of SC is also acknowledged by the research of Lu and Nguyen (2023), who find that SC can assist banks in expanding non-interest income activities.

Based on the aforementioned findings, the study renders some practical directions to banks as follows. First, bank managers should deem IC a strategic tool to manage their daily business operations since it can assist them in achieving operational cost-effectiveness. Furthermore, as the positive side of both HC and SC illustrated above, taking advantage of all staff's skills, knowledge, and experiences as well as constantly refining designs, policies and standard operating procedures play a crucial role in minimising the waste of costs related to business operations of banks. It is believed that decision-makers in banks should pay special attention to these factors to strengthen their ability to manage operating expenditures more effectively. In addition, because an augmentation of CE has a detrimental impact on the operational cost-effectiveness of banks, in the long term, they should take expanding capital strategies into account carefully to optimise the effectiveness of operating costs, especially in the cases of small and lower asset quality banks.

CONCLUSION

Inspired by an absence of empirical studies on the impacts of IC and its components on operating cost management in the banking industry, the present research has tried to fulfill this research gap. Based on a data set of 26 commercial banks in Vietnam, the regression results indicate that banks' operational costs will be enhanced substantially by leaning especially on IC, while the reverse effect is observed in the case of CE component. Meanwhile, both HC and SC components, to some degree, may contribute to enhancement in managing banks' operational costs. When determining the impacts of bank size and asset quality, the study finds that the influences of both IC and CE components remain unchanged. However, the magnitude tends to be larger in small banks and ones with higher asset quality. Additionally, HC may become an advantage for improving the operational costs of big and higher asset quality banks. In contrast, a similar role is found in the case of SC in small and lower asset quality banks. It is anticipated that these findings would extend the understanding of IC's role in the banking industry by providing consistent evidence to demonstrate that banks could leverage IC to manage their operational costs effectively.

Naturally, the study also contains certain limitations that future research may fulfill these gaps. First, researchers can expand the research sample to re-evaluate the role of IC in not only local banks but also foreign ones as well as other financial institutions, especially Fintech firms. This, in turn, will help to render a

holistic picture of IC role in the banking industry and the financial system as a whole in Vietnam. Second, future studies can employ other methods to calculate the efficiency of operational costs to further examine the findings in this article. Third, it is necessary to recognise that VAIC has some drawbacks, as mentioned in Empirical Model. Therefore, academicians should approach other measures of IC (e.g., extended/modified VAIC model as stated in the previous subsection) or other analysis methods to determine the neglected aspect of IC in the original VAIC model, namely relational capital and re-investigate the empirical results in this study. It is expected that the research's endeavours will incentivise many scholars to explore more findings in this field in the coming future.

REFERENCES

Adesina, K. S. (2019). Bank technical, allocative and cost efficiencies in Africa: The influence of intellectual capital. *The 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

Alhassan, A. L., & Asare, N. (2016). Intellectual capital and bank productivity in emerging markets: Evidence from Ghana. *Management Decision*, *54*(3), 589–609. https://doi.org/10.1108/MD-01-2015-0025

Almuaqel, I. A. (2024). Intellectual capital's contribution to higher education of individuals with intellectual and developmental disabilities: A qualitative study. *Journal of Intellectual Capital* [ahead-of-print]. https://doi.org/10.1108/JIC-08-2023-0188

Al-Musali, M. A., & Ku Ismail, K. N. I. (2016). Cross-country comparison of intellectual capital performance and its impact on financial performance of commercial banks in GCC countries. *International Journal of Islamic and Middle Eastern Finance and Management*, *9*(4), 512–531. https://doi.org/10.1108/IMEFM-03-2015-0029

Alvino, F., Di Vaio, A., Hassan, R., & Palladino, R. (2020). Intellectual capital and sustainable development: A systematic literature review. *Journal of Intellectual Capital*, *22*(1), 76–94. https://doi.org/10.1108/JIC-11-2019-0259

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, *58*(2), 277–297. https://doi.org/10.2307/2297968

Bai, F., Shang, M., Huang, Y., & Liu, D. (2023). Digital investment, intellectual capital and enterprise value: Evidence from China. *Journal of Intellectual Capital*, *25*(1), 210–232. https://doi.org/10.1108/JIC-07-2022-0149

Buallay, A., Hamdan, A. M., Reyad, S., Badawi, S., & Madbouly, A. (2020). The efficiency of GCC banks: The role of intellectual capital. *European Business Review*, *32*(3), 383–404. https://doi.org/10.1108/EBR-04-2019-0053

Caputo, F., Giudice, M., Evangelista, F., & Russo, G. (2016). Corporate disclosure and intellectual capital: The light side of information asymmetry. *International Journal of Managerial and Financial Accounting*, *8*(1), 75–96. https://doi.org/10.1504/IJMFA.2016.076668

Cheng, M., Lin, J., Hsiao, T., & Lin, T. W. (2010). Invested resource, competitive intellectual capital, and corporate performance. *Journal of Intellectual Capital*, *11*(4), 433–450. https://doi.org/10.1108/14691931011085623

Duho, K. C. T., & Onumah, J. M. (2019). Bank diversification strategy and intellectual capital in Ghana: An empirical analysis. *Asian Journal of Accounting Research*, *4*(2), 246–259. https://doi.org/10.1108/AJAR-04-2019-0026

Edvinsson, L., & Malone, M. S. (1997). *Intellectual capital: Realizing your company's true value by finding its hidden brainpower.* New York: HarperBusiness.

Gross-Gołacka, E. (2024). Diversity management as an approach enhancing the formation of intellectual capital (including human capital) in organisations in order to build their competitive advantage. In N. Kumar, K. Sood, E. Özen, & S. Grima (Eds.), *The framework for resilient industry: A holistic approach for developing economies* (pp. 39–53). Emerald Publishing Limited. https://doi.org/10.1108/978-1-83753-734-120241003

Haris, M., Yao, H., 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), Article 2. https://doi.org/10.3390/jrfm12020056

Harris, L. (2000). A theory of intellectual capital. *Advances in Developing Human Resources*, *2*(1), 22–37. https://doi.org/10.1177/152342230000200104

Keong Choong, K. (2008). Intellectual capital: Definitions, categorization and reporting models. *Journal of Intellectual Capital*, *9*(4), 609–638. https://doi.org/10.1108/14691930810913186

Kweh, Q. L., Lu, W.-M., Tone, K., & Nourani, M. (2022). Risk-adjusted banks' resource-utilization and investment efficiencies: Does intellectual capital matter? *Journal of Intellectual Capital*, *23*(3), 687–712. https://doi.org/10.1108/JIC-03-2020-0106

Le, T. D., Ho, T. N., Nguyen, D. T., & Ngo, T. (2022). Intellectual capital – bank efficiency nexus: Evidence from an emerging market. *Cogent Economics and Finance*, *10*(1), 2127485. https://doi.org/10.1080/23322039.2022.2127485

Le, T. D. Q., & Nguyen, D. T. (2020). Intellectual capital and bank profitability: New evidence from Vietnam. *Cogent Business and Management*, *7*(1), 1859666. https://doi.org/10.1080/23311975.2020.1859666

Lu, C. H., & Nguyen, T. V. (2023). How does intellectual capital fuel non-interest incomes in banks? New Case from an emerging country. *Journal of Contemporary Eastern Asia*, *22*(1), 1–25. https://doi.org/10.17477/jcea.2023.22.1.001

Meles, A., Porzio, C., Sampagnaro, G., & Verdoliva, V. (2016). The impact of the intellectual capital efficiency on commercial banks performance: Evidence from the US. *Journal of Multinational Financial Management*, *36*(9), 64–74. https://doi.org/10.1016/j.mulfin.2016.04.003

Moghadam, H. M., Salehi, M., & Hajiha, Z. (2021). The relationship between intellectual capital and financial statements readability: The role of management characteristics. *Journal of Facilities Management*, *21*(2), 221–241. https://doi.org/10.1108/JFM-08-2021-0088

Mostak Ahamed, 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

Nazir, M. I., Tan, Y., & Nazir, M. R. (2021). Intellectual capital performance in the financial sector: Evidence from China, Hong Kong, and Taiwan. *International Journal of Finance and Economics*, *26*(4), 6089–6109. https://doi.org/10.1002/ijfe.2110

Neves, E., & Proença, C. (2021). Intellectual capital and financial performance: Evidence from Portuguese banks. *International Journal of Learning and Intellectual Capital*, *18*(1), 93–108. https://doi.org/10.1504/IJLIC.2021.113658

Nguyen, D. T., Le, T. D. Q., & Ho, T. H. (2021). Intellectual capital and bank risk in Vietnam: A quantile regression approach. *Journal of Risk and Financial Management*, *14*(1), 27. https://doi.org/10.3390/jrfm14010027

Nguyen, T. V., & Lu, C. H. (2023a). Distribution of deposit intermediation: Do investments in technology and intellectual capital matter? *Journal of Distribution Science*, *21*(4), 69–80. https://doi.org/10.15722/JDS.21.04.202304.69

Nguyen, T. V., & Lu, C. H. (2023b). Financial intermediation in banks and the key role of intellectual capital: New analysis from an emerging market. *Journal of Financial Services Marketing* (ahead-of-print). https://doi.org/10.1057/s41264-023-00220-0

Oliveira, L., Lima Rodrigues, L., & Craig, R. (2010). Intellectual capital reporting in sustainability reports. *Journal of Intellectual Capital*, *11*(4), 575–594. https://doi.org/10.1108/14691931011085696

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

Phan, A., Lu, C. H., & Nguyen, P. M. (2022). Spending on distribution information and communication technologies and cost-effective operation in banks. *Journal of Distribution Science*, *20*(9), 11–21. https://doi.org/10.15722/jds.20.09.202209.11

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), 1453574. https://doi.org/10.1080/23322039.2018.1453574

Pulic, A. (2000). VAIC™ – an accounting tool for IC management. *International Journal of Technology Management*, *20*(5–8), 702–714. https://doi.org/10.1504/IJTM.2000.002891

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

Roos, G., & Roos, J. (1997). Measuring your company's intellectual performance. *Long Range Planning*, *30*(3), 413–426. https://doi.org/10.1016/S0024-6301(97)90260-0

Salehi, M., Ali Mohammed Al-Msafir, H., Homayoun, S., & Zimon, G. (2022). The effect of social and intellectual capital on fraud and money laundering in Iraq. *Journal of Money Laundering Control*, *26*(2), 227–252. https://doi.org/10.1108/JMLC-12-2021-0142

Salehi, M., Asadian, A., & Khansalar, E. (2023). The effect of intellectual capital on audit fees stickiness. *Accounting Research Journal*, *36*(1), 55–76. https://doi.org/10.1108/ARJ-07-2020-0217

Salehi, M., Rajaeei, R., Khansalar, E., & Edalati Shakib, S. (2024). Intellectual capital, social capital components and internal control weaknesses: Evidence from Iran's business environment. *Journal of Islamic Accounting and Business Research, 15*(5), 838–875. https://doi.org/10.1108/JIABR-05-2022-0121

Salehi, M., & Zimon, G. (2021). The effect of intellectual capital and board characteristics on value creation and growth. *Sustainability*, *13*(13), Article 13. https://doi.org/10.3390/su13137436

Shaban, M., & James, G. A. (2018). The effects of ownership change on bank performance and risk exposure: Evidence from Indonesia. *Journal of Banking & Finance*, *88*, 483–497. https://doi.org/10.1016/j.jbankfin.2017.02.002

Stewert, T. (1999). *Intellectual capital: The new wealth of nations.* New York: Double Day.

Suciu, M.-C., & Năsulea, D.-F. (2019). Intellectual capital and creative economy as key drivers for competitiveness towards a smart and sustainable development: Challenges and opportunities for cultural and creative communities. In F. Matos, V. Vairinhos, P. M. Selig, & L. Edvinsson (Eds.), *Intellectual capital management as a driver of sustainability: Perspectives for organizations and society* (pp. 67–97). Springer International Publishing. https://doi.org/10.1007/978-3-319-79051-0_5

Sullivan, P. H. (2000). *Value driven intellectual capital: How to convert intangible corporate assets into market value*. John Wiley & Sons, Inc.

Sveiby, K. E. (1997). *The new organizational wealth: Managing & measuring knowledge-based assets*. Berrett-Koehler Publishers.

Tjahjadi, B., Soewarno, N., Sutarsa, A. A. P., & Jermias, J. (2024). Effect of intellectual capital on organizational performance in the Indonesian SOEs and subsidiaries: Roles of open innovation and organizational inertia. *Journal of Intellectual Capital* (ahead-of-print). https://doi.org/10.1108/JIC-06-2023-0140

Tran, D. B., & Vo, D. H. (2018). Should bankers be concerned with Intellectual capital? A study of the Thai banking sector. *Journal of Intellectual Capital*, *19*(5), 897–914. https://doi.org/10.1108/JIC-12-2017-0185

Vidyarthi, H., & Tiwari, R. (2019). Cost, revenue, and profit efficiency characteristics, and intellectual capital in Indian Banks. *Journal of Intellectual Capital*, *21*(1), 1–22. https://doi.org/10.1108/JIC-05-2019-0107

Vo, D. H., & Tran, N. P. (2021a). Intellectual capital and bank performance in Vietnam. *Managerial Finance*, *47*(8), 1094–1106. https://doi.org/10.1108/MF-03-2020-0143

Vo, D. H., & Tran, N. P. (2021b). Measuring national intellectual capital: A novel approach. *Journal of Intellectual Capital*, *23*(4), 799–815. https://doi.org/10.1108/JIC-06-2020-0183

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

Yalama, A. (2013). The relationship between intellectual capital and banking performance in Turkey: Evidence from panel data. *International Journal of Learning and Intellectual Capital*, *10*(1), 71–87. https://doi.org/10.1504/IJLIC.2013.052079