Dynamics of intellectual capital and financial performance in ASEAN banks

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Abstract

Purpose – The purpose of this study is to examine the dynamic relationship between intellectual capital (IC) and its components on financial performance of banks within the selected eight countries of Association of Southeast Asian Nations (ASEAN).

Design/methodology/approach – The study utilizes the balanced panel data of 37 publicly listed banks from eight leading ASEAN economies for the period of 2017–2021. In this sense, the authors applied the Ante Pulic's typology, i.e. value-added intellectual coefficient (VAIC™) to evaluate the efficiency of intangible and tangible assets. While, investigating the dynamic nature of relationship, the authors employed the generalized system method of moments because of its power to account for the problem of endogeneity and heteroscedasticity.

Findings – The results of the study demonstrate that banks in ASEAN countries shed a varied degree of a spotlight on VAIC™ and its components to create value. The findings revealed that structural capital efficiency is significantly associated with earning per share (EPS), return on assets (ROA) and return on equity (ROE), compared to human capital efficiency (HCE) and capital employed efficiency of ASEAN banks. These results endorse the importance of resource- and knowledge-based views of organizations to leverage the financial performance of banks. However, contrary to theoretical expectations, this study found no positive relationship between HCE with ROA and ROE. Whereas, the relationship of VAIC™ is positive and significant with EPS and ROE but it remains statistically very marginal.

Research limitations/implications – There are some inherent limitations in this study that could be opportunities for future research. The current study uses the VAIC™ typology, but future researchers can use the modified value-added intellectual coefficient (MVAIC) or triangulation approach to enhance the validity and reliability of the study. Additionally, future research can investigate the similarities and differences among countries in terms of their cultural backgrounds and regulatory frameworks regarding the disclosure of intangibles. Furthermore, future research can increase the length and sample size of the study to enhance its generalizability.

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Practical implications – The robust empirical findings extend the academic debate on IC by unveiling the dynamic nature of relationship between IC and financial performance in context of ASEAN banking sector. The findings provide plausible recommendations for policy makers (managers, regulators and stakeholders) to understand how to increase the IC efficiently, especially human capital as a source to evaluate the firms' ability in determining value-added and financial performance. Further, findings of this study also suggest that how can policy makers get the benefit by investing more on structural capital as a valuable strategic source to guarantee the optimal performance returns.

Originality/value – Prior studies on IC have been country- and firm-specific, utilizing cross-sectional research designs. However, this research contributes to the limited literature by investigating the dynamic nature of the relationship between IC and financial performance of banks in the context of ASEAN countries using micro-panel data.

Keywords Financial performance, ASEAN, Banks, Intellectual capital

Paper type Research paper

1. Introduction

In this competitive era, organizations' financial well-being is more likely to be attributed to investment in intangible knowledge resources (Stewart, 1997; Hayaeian, Hesarzadeh, & Abbaszadeh, 2021; Galati, Crescimanno, Tinervia, Iliopoulos, & Theodorakopoulou, 2017). These resources, commonly referred to as intellectual capital (IC), are argued to be the most valuable strategic resource that positively influences firms' financial performance (Xu & Liu, 2021; Nadeem, Gan, & Nguyen, 2017; Firer & Williams, 2003). Recently, IC has gained significant interest as a source of competitive positioning and value creation (Asutay & Ubaidillah, 2023; Le, Ho, Nguyen, & Ngo, 2022; Dalwai, Singh, & Ananda, 2021). IC encompasses divergent views across the globe (Goh, 2005; Firer & Williams, 2003; Sharabati, Jawad, & Bontis, 2010; Paoloni, Modaffari, & Mattei, 2021) and includes valuable intangible resources that create value for the organization (Burgman, Roos, Ballow, & Thomas, 2005). Prior research viewed the level of IC efficiency measured by employees' skills and competencies, systems and programs and strategic alliances that create value for firms (Sharabati *et al.*, 2010; Roos, Roos, Dragonetti, & Edvinsson, 1997; Rehman, Sheikh, & Jalil, 2021).

Since the emergence of the knowledge-based economy, banks have been considered highly innovative and well-balanced organizations that utilize human and technological resources (Nadeem *et al.*, 2017). The primary goal of banks is to accumulate intangible assets, leading to a close integration with the dynamic IC transformation process (Ahamad, Al-Jaifi, & Ehigiamusoe, 2023; Mention & Bontis, 2013; Weqar, Khan, & Haque, 2020). With the growing importance of IC management practices, the banking industry has changed its process of value creation through investment in human resources, research and development and information technology (Ousama, Hammami, & Abdulkarim, 2020). Efficient utilization of IC enables banks to develop quality financial products and services and establish close intimacy with customers, thereby positively impacting their financial performance (Mention & Bontis, 2013).

Despite the critical role of IC in improving firms' financial performance (Asutay & Ubaidillah, 2023), existing literature on the dynamic relationship between IC and financial performance provides inconsistent and mixed findings. Some studies report a positive influence of IC on financial performance (Le *et al.*, 2022; Tan, Plowman, & Hancock, 2007), while others suggest that IC is not a significant driver of financial performance (Firer & Williams, 2003; Dalwai *et al.*, 2021). The measurement and capture of IC, which has multiple perspectives, pose challenges (Yi & Davey, 2010) and differing views may arise from the various measurement methods and typologies used. Additionally, the literature has overlooked the presence of endogeneity when explaining the causal relationship between IC and financial performance in the ASEAN financial sector (Soetanto & Liem, 2019).

The literature on IC emphasizes the importance of human, structural and relational factors (Sveiby, 1997; Pulic, 1998; Guerrero, Herrera, & Urbano, 2021), and substantial investment in these components is necessary to leverage financial performance. Firms invest in intangible

resources to enhance HCE (Rehman *et al.*, 2021; Sharabati *et al.*, 2010) and improve business processes through investments in structural capital (SC) such as systems, programs and research and development (Sharabati *et al.*, 2010). This investment positively influences financial performance (Acuña-Opazo & González, 2021; Soetanto & Liem, 2019). However, according to the pecking order theory, firms prioritize internal profitability as a source of investment in IC (Myers & Majluf, 1984). The bidirectional relationship between IC components and firms' performance indicates that past financial performance influences the current and future efficiency and utilization of IC resources (Murthy & Mouritsen, 2011; Singla, 2020).

This study proposes that the relationship between IC and the financial performance of ASEAN banks is dynamic rather than static. Static estimators like ordinary least squares (OLS) or fixed and random effects models may lead to biased results (Baltagi, 2008; Wintoki, Linck, & Netter, 2012). Limited research has addressed the endogeneity problem in the dynamic relationship between IC and firm performance (Nadeem *et al.*, 2017; Sardo & Serrasqueiro, 2018). To address this gap, this study applies diagnostic tests to address endogeneity, heteroscedasticity and autocorrelation. The dynamic panel data (DPD) estimation technique is used to capture the true relationship between IC and the financial performance of banks in the ASEAN context. This study contributes to the theoretical perspective by exploring the dynamic relationship between IC and financial performance in the ASEAN financial sector, an area that has received limited attention in prior academic discussions on IC (Nadeem, Ali, & Saarinen, 2023; Soetanto & Liem, 2019).

2. Literature review and development of hypotheses

2.1 Definition of IC

The academic literature provides various interpretations of IC. Bell (1997) describes IC as a crucial intangible resource that shapes a firm's strategic posture. Brooking (1996) highlights IC as a valuable resource in wealth and value creation. Stewart (1997) defines IC as the intellectual agility of employees. Yi and Davey (2010) view IC as a business philosophy, management processes, employees' competence and business relations. Despite these interpretations, IC remains the most valuable resource for creating wealth and driving the knowledge economy (Dalwai *et al.*, 2021; Rehman *et al.*, 2021; Cheng, Liu, & Chang, 2022).

Previous research has categorized IC from different perspectives. Edvinsson and Malone (1997) emphasize human and structural capital. Sveiby (1997) includes human, relational and structural capital. Later, customer capital was replaced with relational capital by many scholars (Stewart, 1997; Sharabati *et al.*, 2010; Cosma, Grasso, Pattarin, & Pedrazzoli, 2019), which emphasizes value-added and long-term relationships with internal and external stakeholders (Ferraris, Santoro, & Pellicelli, 2020; Helfat & Peteraf, 2015). Wang and Chang (2005) categorize IC into human, process, innovation and customer capital. Brooking (1996) recognizes intellectual property rights, human, structural and market capital. These perspectives highlight the multifaceted nature of IC and the importance of its various components for achieving competitive positioning and value creation in organizations (Cabrilo, Kianto, & Milic, 2018; Tseng & Goo, 2005).

2.2 Overview of ASEAN economies

Association of Southeast Asian Nations (ASEAN), is a political and economic integration of 10-member states in Southeast Asia (i.e. *Indonesia, Malaysia, Thailand, Vietnam, Philippines, Cambodia, Singapore, Laos, Myanmar and Brunei*). The purpose of this integration is to promote intergovernmental cooperation and enhance regional economic and financial cooperation among member emerging states. The attempt to evaluate the dynamic relationship between IC and banks' financial performance is sparse in emerging

economies, particularly in the context of ASEAN economies (Nadeem *et al.*, 2017; Le *et al.*, 2022). The banking industry plays a tremendous role in ASEAN economies as the individual country's performance influences the health of the whole ASEAN economy at large (Subramaniam, Rahim, & Selvarajan, 2019).

Since the Asian financial crisis of 1997-1998, ASEAN economies have pursued financial stability through integration and liberalization. The banking sector competes through knowledge resources or intangible assets, making research on ASEAN countries' banking sector influential. (Dalwai *et al.*, 2021). The *ASEAN Banking Integration Framework* (ABIF) and *ASEAN Economic Community* (AEC) promote collaboration in the financial sector. *ABIF facilitates Qualified ASEAN Banks* (QAB) with operational flexibility and market access. This research is valuable due to the regional economic inception of the AEC. Despite financial crises, ASEAN economies have recovered by improving their financial system and banking sector. (Sheera & Bishnoi, 2013). Table 1 presents some of the key economic and financial development indicators of ASEAN economies).

The ASEAN economic community (AEC) aims for a unified production base and market, facilitating the free movement of goods, skilled labor, services and investment (ASEAN, 2014). Over the past two decades, the ASEAN region has shifted its focus from natural products to knowledge-based industries, such as electronics (UNCTAD, 2013). Despite global financial uncertainties, ASEAN economies have shown flexibility and sustainable growth, establishing themselves as the world's most competitive region. However, the performance of banks in terms of IC in the ASEAN region remains uncertain, with limited research on this relationship (Nadeem *et al.*, 2017).

2.3 IC and financial performance

Since globalization, the knowledge economy has emerged as a new form of economy, characterized by the extensive use of soft and intangible knowledge resources, such as human, structural and relational capital (Yi & Davey, 2010; Rehman, Jalil, Saltik, & Degirmen, 2023). These resources, collectively known as IC, have transformed the process of wealth and value creation within the framework of the knowledge-based view (KBV) (Barney, 1991; Xu & Li, 2022; Arun & Shekhar, 2020). The resource-based view (RBV) suggests that intangible resources, specifically IC, are the most valuable strategic assets that positively

Table 1.
Key economic and financial development indicators of selected ASEAN economies

	Countries	Population in millions	GDP per capita (constant 2015 US$)	Goods and services (% of GDP)		Commercial banks branches (per 100,000 adults)	Depth of credit information index (0 = low to 8 = high)	Bank capital to assets ratio (%)
				Exports	Imports			
1	Indonesia	266.82	3667.69	19.84	19.14	16.35	7.00	12.83
2	Malaysia	32.36	10420.30	67.22	60.25	9.91	7.80	8.94
3	Thailand	71.04	6092.17	62.22	53.68	11.42	6.80	10.73
4	Vietnam	94.88	3054.22	82.29	79.19	3.69	7.20	5.97
5	Philippines	108.52	3278.09	27.57	36.97	9.00	6.80	9.09
6	Cambodia	16.01	1342.24	176.14	64.54	8.71	5.80	13.95
7	Singapore	5.61	59984.24	61.72	147.48	7.97	7.00	8.30
8	Laos	7.11	2408.80	33.58	46.86	3.10	6.00	4.80

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Source(s): World development indicators (2020) prepared by authors

influence firms' financial performance (Barney, 1991; Soetanto and Liem, 2019; Xu, Haris, & Liu, 2023). Long-term investment in intangible resources, including knowledge, competence, skills and unique business process capabilities, contributes to competitive positioning and ultimately leads to higher profitability for firms (Peteraf, 1993).

Several studies have investigated the relationship between IC and firms' financial performance, revealing significant findings (Le *et al.*, 2022; Baima, Forliano, Santoro, & Vrontis, 2020; Sharabati *et al.*, 2010). Nadeem *et al.* (2017) employed panel system generalized method of moments (GMM) to analyze the relationship between IC efficiency and financial performance in BRICS economies, finding that all components of VAIC efficiency significantly influence firms' financial performance. Soetanto and Liem (2019) conducted a similar study in Indonesian industries, utilizing dynamic panel regression analysis with GMM, and addressing endogeneity using the Blundell–Bond instrument. Their results indicate a significant impact of IC on firms' performance, with structural capital efficiency (SCE) and capital employed efficiency (CEE) playing crucial roles in value creation. Asutay and Ubaidillah (2023) found that human capital and CEE significantly influence the financial performance (ROA and ROE) of Islamic banks, while the relationship between SCE and financial performance was inconclusive. However, they did not identify a significant relationship between IC components and banks' productivity measured by the asset turnover ratio (ATO). Dalwai *et al.* (2021) examined the impact of IC efficiency on banks' risk-taking capability and stability in emerging Asian economies, revealing that IC efficiency has no significant relationship with risk-taking capacity and stability. They did observe a negative relationship between HCE and risk-taking capability, suggesting that diversified banks with a higher deposit to total asset ratio are more inclined to take risks.

Continuing in the same direction, Goh (2005) investigated the performance of foreign and domestic banks in the Malaysian banking sector from 2001 to 2003. The study revealed that HCE significantly influenced the performance of both foreign and domestic banks, with foreign banks demonstrating better IC performance. Rehman *et al.* (2021) evaluated the IC performance of BRICS' banks from 2010 to 2014 and found that HCE played a significant role in fostering IC performance and financial performance. Ousama *et al.* (2020) found that HCE had a more significant impact on the performance of Islamic banks in Gulf Cooperation Council countries, while the relationship between structural capital and financial performance was statistically insignificant. Similarly, Sardo and Serrasqueiro (2018) observed a positive relationship between IC and financial performance in non-financial listed organizations across 14 European countries. Mohammad and Bujang (2019) conducted a sector-specific study in Malaysia and found that CEE positively influenced ROA, while HC and SC were more critical elements of IC that created value in finance-related firms. Based on a comprehensive review of the literature, the following hypotheses are proposed.

H1. HCE positively influence the financial performance of selected ASEAN banks.

H2. SCE positively influence the financial performance of selected ASEAN banks.

H3. CEE positively influences the financial performance of selected ASEAN banks.

H4. VAIC™ positively influences the financial performance of selected ASEAN banks.

3. Research methodology

3.1 Sample and data

RBV argues that IC is a strategic resource that fosters firms' performance and creates a competitive edge over their competitors (Barney, 1991; Dalwai *et al.*, 2021). RBV posits that strategic knowledge resources (IC) correspond to higher economic growth than the tangible

assets of an organization (Vo & Tran, 2022). These resources are rare, and non-imitable, and their effective utilization leads to financial performance (Le *et al.*, 2022). Therefore, to examine the relationship between IC and financial performance, this study selected publicly listed banks from emerging economies of ASEAN, i.e. Indonesia, Malaysia, Thailand, Vietnam, Philippines, Cambodia, Singapore and Laos. Data was collected from the respective banks' consolidated annual reports for the period of five years (2017-2021). Hence, final sample consisted of 185 observations from 37 banks, i.e. five banks from each country and two banks selected from Laos. Furthermore, only those banks were selected that have a positive operating profit margin and book values because VAIC™ cannot capture the IC efficiency with negative profits and book values (Firer & Williams, 2003). Moreover, banks with missing data or information on selected variables or unavailability of consolidated annual reports were discarded from the sample.

3.2 Operationalization and descriptions of variables

3.2.1 Dependent variables:. To measure the financial performance, this study used *earning per share (EPS)* measured with net income-preferred dividend/number of outstanding shares, *return of assets (ROA)* measured with net income/total assets and *return on equity (ROE)* measured with net income/total shareholders' equity, adopted from Yao, Haris, Tariq, Javaid, and Khan (2019) and Ousama *et al.* (2020).

3.2.2 Independent variables and VAIC™ calculation:. Given that IC has become a strategic resource in the new paradigm of globalization of factors of production (Le *et al.*, 2022; Marr, Gray, & Neely, 2003), the contribution and efficiency of IC is inevitable for leveraging competitiveness and value creation of business firms (Xu & Li, 2022). Undoubtedly, the generation of wealth and value greatly relies on effective management and investment initiatives on intangible resources (Polo & Rodríguez, 2014). Over the last few years, different assessment tools have been developed to measure the efficiency of intangible assets. For instance, intangible asset monitor approach by Sveiby (1997), intangible value (market to book ratio) Tobin's Q ratio by Stewart (1997), IC services' IC-index by Roos *et al.* (1997), Skandia IC Navigator by Edvinsson and Malone (1997), the technology broker's IC audit by Brooking (1996), and VAIC™ by Pulic (1998).

Among the various IC assessment tools, this study utilized the value-added intellectual coefficient (VAIC™) typology to measure the IC efficiency of selected ASEAN banks (Tran, Dinh, Hoang, & Vo, 2022; Nadeem *et al.*, 2017). This typology, developed by Pulic (1998), is most commonly used to capture the IC efficiency of firms, together with the contributions of capital employed (tangible assets) toward value creation (Dalwai *et al.*, 2021; Ousama *et al.*, 2020; Firer & Williams, 2003). Joshi and Cahill (2010) asserted that HCE, SCE and CEE are the critical strands of the VAIC™ typology. Unlike other assessment-based typologies, VAIC™ is easy to understand, simple to apply and interpret compared to other measurement models for evaluating the IC efficiency of firms. The data used by this method is more objective and easily acquired (Firer & Williams, 2003). This method can be applied to all types of organizations for cross-comparison regardless of their size and structure (Maditinos, Chatzoudes, Tsairidis, & Theriou, 2011) and thus facilitates decision-making related to the contribution of intangibles (Firer & Williams, 2003).

Although VAIC™ is the most consistent approach to measure IC efficiency of firms, there are some limitations reported by some authors (Ståhle, Ståhle, & Aho, 2011; Vishnu & Gupta, 2014). These studies viewed that the VAIC™ model only measures the efficiency of human capital (productivity of the workforce) and capital employed (physical capital) and does not consider firms with negative book values and negative operating profit margins (Ståhle *et al.*, 2011). Another criticism that emerged was that VAIC™ cannot consider the relational and innovation capital that can make a significant contribution to value creation

(Vishnu & Gupta, 2014). Despite these limitations, the VAIC™ typology is most robustly used in many studies due to its distinct feature of objectivity, reliability and consistent measurement (Firer & Williams, 2003; Maditinos *et al.*, 2011). It provides a standardized and homogenized measure, allowing firms to make comparative analyses (Ousama *et al.*, 2020). The VAIC™ calculation is classified into four steps. The first step is to estimate the value added (VA) which can be calculated as follows:

$$VA = Output\text{-}Input \tag{1}$$

Where.

Output = operating income (all revenues from financial products and services) and

Input = All operating expenses except personal cost (human capital), interests, taxes and dividend cost.

The second step is to measure the HCE. HCE estimates how much value has been produced by investing one financial unit in the employees of banks. HC (Personal or employees' cost) refers to investment cost or initiatives incurred in the form of salaries, wages, workshops, trainings and employees' benefits (e.g. social security) (Ousama *et al.*, 2020; Acuña-Opazo & González, 2021). It is measured as follows:

$$HCE = VA/HC \tag{2}$$

The third step is to estimate the SCE. It measures how much value has been generated by SC (Joshi & Cahill, 2010). SCE is estimated as follows:

$$SC = VA - HC \tag{3}$$

$$SCE = SC/VA \tag{4}$$

The final step to calculate VAIC is to measure CEE. It estimates how much value is created by investing a single monetary unit in capital employed (CE). CE consists of financial and physical assets. CEE is calculated as follows:

$$CA = total\ assets–intangible\ assets \tag{5}$$

$$CEE = VA/CA \tag{6}$$

The VAIC™ measures firms' value creation efficiency. The greater value of VAIC™ shows the efficiency of the firm in utilizing its IC resources (Oppong, Pattanayak, & Irfan, 2019; Xu & Li, 2022). The VAIC™ is calculated as follows:

$$VAIC™ = \text{HCE} + \text{SCE} + \text{CEE} \tag{7}$$

The items used to assess HCE SCE and CEE are adopted from Nadeem *et al.* (2017) and Zhang, Duc, Burgos, and Tsai (2021)

3.2.3 Control variables. To mitigate the influence of other variables that may impact the association between IC and banks' performance, this study utilizes three control variables, i.e. size (Natural Log of Firm's total asset), age (Natural Log of the firm's age) and leverage of the banks (liabilities/total equity) adopted from (Tan *et al.*, 2007; Yao *et al.*, 2019; Oppong *et al.*, 2019; Sardo & Serrasqueiro, 2018).

3.3 Econometric model estimation

3.3.1 Arellano–Bond system generalized method of moments for dynamic panel data analysis. This study employed system generalized method of moments (SGMM), a statistical technique

proposed by Arellano and Bond (1991) to address the problem of endogeneity in panel data analysis while estimating the model parameters. SGMM is known for providing unbiased and reliable results, particularly in the presence of endogeneity and heteroscedasticity (Baltagi, 2008). It also addresses the issue of autocorrelation by incorporating lagged differencing. Compared to conventional estimators like OLS or FE, SGMM has three key advantages. First, it allows for the inclusion of firm-specific fixed effects to capture heterogeneity. Second, it considers the influence of past financial performance on current IC, unlike fixed effects. Third, SGMM helps mitigate endogeneity by utilizing valid instruments based on past events (Wintoki *et al.*, 2012).

Generally, the endogeneity problem arises when the independent variables in a model are correlated with the error term, leading to inconsistent results. To address this issue in panel data analysis, SGMM is the most appropriate technique that utilizes instrumental variables (IVs). IVs are variables correlated with the endogenous variable but not with the error term (Roodman, 2009; Wintoki *et al.*, 2012). By employing IVs, SGMM estimates the effect of the endogenous variable on the outcome variable while controlling for the correlation between them (Blundell & Bond, 1998). SGMM considers both the level equation and the differenced equation, enhancing the efficiency of results, particularly for data with limited time dimensions. Therefore, SGMM is a suitable estimator for addressing the endogeneity issue in panel data analysis, using past values of IC components to predict current financial performance. Roodman (2009) suggested certain prerequisites to ensure the absence of endogeneity in the data.

(1) We must fail to reject the null hypothesis for first-order autocorrelation (AR1) and not for second-order autocorrelation (AR2). This suggests that absence of second-order serial correlation in disturbances is not rejected.

(2) If null hypothesis for Hansen J. test (overidentifying restrictions) indicates that all instruments are valid, then that we must fail to reject null hypothesis.

(3) The null hypothesis for difference in Hansen test indicates that all the instruments are exogeneous, which advocates not to reject the null hypothesis.

The results presented in Tables 4 and 5 support the fulfillment of the prerequisites mentioned above, indicating that SGMM is an appropriate estimator for addressing the endogeneity problem. Additionally, the robustness of SGMM was further confirmed by conducting the Granger reverse causality test (Granger, 1969). The Granger causality test is a statistical technique used to determine whether one time series can predict another time series. In this study, the test was employed to examine the presence of reverse causality. Appendix reveals that there is unidirectional causality from HCE to ROA, SCE to EPS, SCE to ROE, Leverage to CEE and Leverage to SCE. No bidirectional or reverse causality was observed among any of the variables, providing further evidence of the absence of endogeneity.

$$FP_{it} = \widehat{\alpha}_i + \widehat{\beta}.FP_{it-1} + \widehat{\lambda}.Z_{it} - \delta + \partial_{it} + Tt.\widehat{\lambda} + \widehat{\mu}_{it} \tag{8}$$

i = Country dimension

t = Time Dimension

FP_{it} = Financial performance, dependent variable denoted by EPS, ROA, ROE in i^{th} banks in t^{th} time period.

FP_{it-1} = is denoted by dependent variables with one year lag.

Z_{it} = is denoted by dependent variables (HCE_{it}, SCE_{it} and CEE_{it}) and $VAIC_{it}$

δ = is denoted by K X 1 vector of parameters to be estimated

∂_{it} = is denoted by control variables (size, age and leverage)

Tt.$\widehat{\lambda}$ = is denoted by vector of time dummiesT

$\widehat{\mu}_{it}$ = is denoted by error term

4. Results and discussion

Table 2 presents the summary of descriptive statistics. The VAIC™ mean for banks operating in ASEAN countries is (174.7563). This indicates that the overall mean of VAIC™ will generate a (174.7563) units for every 1 unit employed. Among the components of VAIC™, the HEC has the highest mean value (174.0013) than from SCE (0.6960) and CEE (0.0588). This is a strong indication that banks operating in selected ASEAN countries are creating more value by using HEC. This finding is consistent with (Xu & Wang, 2018; Goh, 2005).

Table 3 presents the results of correlation matrix among independent, dependent and control variables. The correlation analysis shows that VAIC™ is positively and significantly associated with all dependent variables. Furthermore, HCE and SCE also demonstrate a positive and significant ($p < 0.01$) relationship with all financial performance measures (EPS, ROA and ROE). Additionally, CEE is positively and significantly correlated with ROA and ROE, except for EPS. This positive relationship of CEE with ROA and ROE indicates that the role of CEE cannot be eliminated as a significant contributor to the value creation process (Firer & Williams, 2003).

Table 4 presents the regression results of three models (1, 2 and 3) of dynamic panel data analysis using the two-step robust SGMM. Model 1 focuses on the relationship between IC components and financial performance (FP) measured by earnings per share (EPS). The findings indicate that HCE and SCE have a significant ($p < 0.01$) positive impact on EPS, while capital employed efficiency (CEE) has a significant ($p < 0.01$) negative effect on banks' FP. Among the control variables, leverage has a positive and significant ($p < 0.01$) influence on EPS, while size and age have a significant ($p < 0.01$) negative impact on EPS. These results align with previous research conducted in India, China and other contexts (Vishnu & Gupta, 2014; Xu & Li, 2022; Soetanto & Liem, 2019; Nadeem *et al.*, 2017). However, they differ from

Variable	N	Mean	S.D.	Minimum	Maximum
Panel 1: Independent variables					
HCE	184	174.0013	1470.196	−639.2905	16316.47
SCE	184	0.6960	0.1489	−2.8525	1.3505
CEE	184	0.0588	0.1908	0.1166	2.4497
VAIC	184	174.7563	1470.238	−1.5406	16317.57
Panel 2: Dependent variables					
EPS	184	63.2279	147.3933	−2.94	871.5
ROA	184	2.6011	4.1724	−0.5110	24.7549
ROE	184	12.1789	6.0965	−4.6684	38.3
Panel 3: Control variables					
SIZE	184	17.5784	7.4964	5.5779	29.2645
AGE	184	3.7448	0.7329	1.6094	5.1119
LEV	184	8.1189	4.6827	0.0004	27.5912

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Table 2. Summary of descriptive statistics

Table 3.
Correlation matrix

Variable	EPS	ROA	ROE	HCE	SCE	CEE	VAIC	Size	AGE	LEV
EPS	1.000	0.316*	0.261*	0.194*	0.224*	0.098	0.176**	0.190*	−0.031	−0.145**
ROA		1.000	0.609*	0.539*	0.566*	0.795*	0.554*	0.166**	−0.300*	−0.688*
ROE			1.000	0.222*	0.255*	0.439*	0.225*	−0.041	−0.057	−0.009
HCE				1.000	0.967*	0.447*	0.982*	0.296*	−0.143	−0.367*
SCE					1.000	0.414*	0.950*	0.276*	−0.133	−0.370*
CEE						1.000	0.494*	0.080	−0.349*	−0.659*
VAIC							1.000	0.302*	−0.16**	−0.407*
SIZE								1.000	0.111	−0.326*
AGE									1.000	0.274*
LEV										1.000

Note(s): *, ** sig at 0.01 and 0.05 level, respectively
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Variables	Model (1): EPS	Model (2): ROA	Model (3): ROE
Intercept	88.123***	17.64***	21.135***
HCE	0.0006967***	−0.0000745***	−0.0003063***
SCE	96.109***	0.383**	9.28***
CEE	−4.038***	0.132**	−0.005
Size	−2.414***	−0.271***	−0.193***
Age	−0.266***	0.012***	−0.003
Lev	7.953***	−1.299***	−0.261***
AR(2)	z = 1.73	z = 3.09	z = 3.61
	Pr > z = 0.084	Pr > z = 0.531	Pr > z = 0.329
Hansen test of overid. Restrictions	$\chi^2(20) = 26.75$ Prob > $\chi^2 = 0.142$	$\chi^2(20) = 19.37$ Prob > $\chi^2 = 0.498$	$\chi^2(20) = 17.04$ Prob > $\chi^2 = 0.65$

Note(s): Significant at *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$; AR: Arellano–Bond test for second order autocorrelation
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Table 4. Dynamic panel-data estimation of components of VAIC™: two-step robust SGMM results

Variables	Model (4): EPS	Model (5): ROA	Model (6): ROE
Intercept	68.382***	18.407***	20.024***
VAIC™	0.002***	−0.0000699***	0.0002078***
Size	−2.026***	−0.302***	−0.181***
Age	−0.329***	0.009***	−0.012***
Lev	5.166***	−1.393***	−0.523***
Arellano–Bond test for AR(2) in levels	z = 1.67	z = 3.00	z = 3.86
	Pr > z = 0.094	Pr > z = 0.397	Pr > z = 0.399
Hansen test of overid. Restrictions	$\chi^2(22) = 20.41$ Prob > $\chi^2 = 0.557$	$\chi^2(22) = 23.15$ Prob > $\chi^2 = 0.393$	$\chi^2(22) = 22.67$ Prob > $\chi^2 = 0.421$

Note(s): * Table can be reproduced by the permission of authors
Source(s): Prepared by authors

Table 5. Dynamic panel-data estimation of VAIC™: two-step robust SGMM results

the findings of Asutay and Ubaidillah (2023) and Firer and Williams (2003), which did not find a positive relationship between CEE and banks' profitability. Overall, the results of model 1 partially support H1.

In model 2, two IC components (SCE and CEE) and one control variable (age) exhibit a positive and significant ($p < 0.05$) relationship with the ROA of ASEAN banks. Among the IC indicators, SCE has the strongest impact on bank performance, indicating effective utilization of organizational structure, R&D facilities and equipment (Tran *et al.*, 2022; Smriti & Das, 2018). Similarly, the positive and significant relationship of CEE suggests that capital employed plays a significant role in leveraging the financial performance of ASEAN banks (Mohammad & Bujang, 2019; Firer & Williams, 2003). Conversely, HCE and the control variables of size and leverage have a significant ($p < 0.01$) negative influence on ROA. This finding aligns with previous research highlighting underutilization of employee potential in ASEAN banks (Smriti & Das, 2018). It suggests the need for increased investment in employee training and development to enhance their competence and skills (Roos *et al.*, 1997).

Model 3 results show that SCE has a more positive and significant ($p < 0.01$) impact on the ROE of ASEAN banks compared to other IC components. This indicates effective utilization of R&D-related investments to enhance ROE performance (Tripathy, Gil-Alana, & Sahoo, 2015). These findings align with Asare, Alhassan, Asamoah, and Ntow-Gyamfi (2017), who

emphasized the significance of SCE in determining organizational efficiency and firm performance. Surprisingly, HCE exhibits a negative but significant relationship with ROE, suggesting that ASEAN banks have not fully recognized the importance of human capital as a valuable resource for achieving higher financial performance. These results differ from Yao *et al.* (2019), who highlighted the positive influence of human capital investment on financial institution performance. Similarly, the relationship between CEE and ROE is statistically insignificant, contradicting the role of physical capital emphasized by Firer and Williams (2003) in the value creation process. Therefore, this study partially supports H3 based on the aforementioned results.

Table 5 presents the results of dynamic panel data analysis using the two-step robust SGMM. The table shows that VAIC™ has a positive and significant influence on the profitability, EPS and ROE of ASEAN banks. Furthermore, the results indicate that two control variables (age and leverage) make a positive and significant ($p < 0.001$) contribution to profitability (EPS) and ROA in models 4 and 5. Overall, the results presented in models 4, 5 and 6 partially validate H4, with the exception of ROA. These findings are consistent with Vishnu and Gupta (2014) and Firer and Williams (2003), who found a positive and significant relationship between IC and firms' performance. Therefore, the results strongly support the principles of RBV, which state that intangible resources are strategic resources of organizations that positively influence the performance of firms.

5. Conclusion and policy recommendations

Since the emergence of globalization, this new form of the economy, the "knowledge economy," has introduced many profound changes, including greater resilience of intangible assets (IC) or knowledge resources (Cram, Brohman, Chan, & Gallupe, 2016). In this sense, RBV posits that firm superior financial performance is determined by the level of convergence of the industrial economy into the knowledge economy in terms of greater investment initiatives on intangibles (Barney, 1991). No doubt, a firm's physical resources and cultural epidemics perform a crucial role in the sustainable performance of the financial sector. However, recent research suggests that financial diversification is relatively more driven by investment initiatives on IC (Švarc & Dabić, 2017). Therefore, academic literature on IC with firm performance has achieved significant momentum over the last few years (Asutay and Ubaidillah, 2023; Nadeem *et al.*, 2017). Nonetheless, accumulated literature on the dynamic IC relationship with banks' FP, particularly in the context of emerging ASEAN economies, remains sparse (Tran *et al.*, 2022; Dalwai *et al.*, 2021; Oppong *et al.*, 2019; Soetanto & Liem, 2019). To set the evidence from emerging ASEAN economies, this study employed the two-step robust SGMM with Blundell and Bond (1998) on dynamic panel data to address the potential problem of endogeneity.

Drawing from the results of SGMM, this study revealed a mixed relationship between VAIC™, its components, and the financial performance of banks (Firer & Williams, 2003). Among the components of VAIC™, this study found that SCE has a positive and significant influence on the financial performance (EPS, ROA and ROE) of banks. This finding validates the standpoint of RBV, which states that SC is one of the most valuable knowledge assets, and an increase in investment initiatives on SC (e.g. innovation in financial products and services) leads to superior financial performance of banks (Asutay & Ubaidillah, 2023; Nadeem *et al.*, 2017; Oppong *et al.*, 2019). The findings of this study are also beneficial to stakeholders (managers and stockholders), implying that they have recognized the importance of SC. This finding validates that banks in ASEAN economies are efficiently utilizing their organizational systems, processes and IT infrastructure, particularly mobile banking, to leverage better financial performance.

Regarding the results of HCE and CEE, study found a negative relationship and no relationship, respectively, with some performance measures of banks (ROA and EPS). This finding is consistent with Firer and Williams (2003). Although HCE and CEE positively and significantly ($p < 0.001$) influenced the EPS and ROA in models 1 and 2, respectively, the contribution of HCE remained marginal in model 1 and negative in model 2 and 3. This indicates that banks operating in selected ASEAN countries are lagging in HCE, which highlights the need for managers to improve this area. This may be due to managers prioritizing investment in SC improvement (e.g. organizational structure, systems and IT infrastructure), which negatively impacts HCE and subsequently the financial performance of ASEAN banks. The policy implications suggest that managers should focus on investment initiatives in HC to improve employee efficiency rather than their seniority and education to reap superior financial performances. These findings partially support Xu and Wang (2018) and Xu and Li (2022). Further, the negative relationship of CEE with some performance measures (EPS and ROA) draws attention to managers to focus on the effective utilization of physical resources to obtain better performance.

VAIC™ is a composite measure of IC that encompasses three components, namely HCE, SCE and CEE. Results concerning models 4, 5 and 6 are presented in Table 3, which concludes that VAIC™ has a positive and significant influence on the performance of banks (EPS and ROE). However, this relationship is statistically weak. Moreover, according to the results of model 5, ROA is not positively affected by VAIC™ (Maditinos *et al.*, 2011). In this sense, one plausible explanation might be the least contribution of HEC. This implies that management needs to make more investment initiatives on HC to achieve the optimum level of financial performance. Overall, this study reports that the role of SCE is more influential than other components of IC. This indicates that an increase in the efficiency of SC leads to superior financial performance, which validates the RBV (Díaz-Chao, Sainz-González, & Torrent-Sellens, 2015). Thus, managers, regulators and accountants can evaluate IC as an integral part of competitive positioning to leverage the sustainable position of firms (Nadeem *et al.*, 2017). Nonetheless, the current study provides a comparison of banks based on VAIC™ and its indicators among eight emerging ASEAN economies, which is useful for policymakers to evaluate investment initiatives in intangibles.

6. Limitations and suggestions for future research

Although this study has some significant contributions, particularly in the context of the ASEAN financial sector, it is not without limitations. Firstly, the study used small-scale (micro panel) data due to the inaccessibility of consolidated financial statements. As a result, this limits the generalizability of the study, as it could not include all banks operating in ASEAN countries. Thus, future research should increase the length of data and sample size to obtain more robust results consistent with the theoretical and empirical underpinnings of the study.

Secondly, despite the growing importance of knowledge-based view (KBV) which posits that IC disclosure on annual reports leads to positive financial performance, this study's mixed findings suggest that future studies need to develop a proper IC accounting framework to capture the level of investment initiatives on IC and the dynamic nature of its relationship.

Thirdly, this study employed VAIC™ typology developed by Pulic (1998) to measure the efficiency of intangible and tangible assets. Recent research on IC has raised serious criticism on VAIC™ due to the lack of its perfect superimposition (Ståhle *et al.*, 2011; Vishnu & Gupta, 2014). However, future studies must consider these criticisms and employ an extended version of VAIC™ (e.g. MVAIC™) while examining the dynamic relationship of IC with the financial performances of different sectors.

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(The Appendix follows overleaf)

Appendix

Causality test	HCE	SCE	RCE	EPS	ROA	ROE	Size	Age	Lev
HCE		0.983	0.979	0.966	0.832	0.714	0.550	0.982	0.880
SCE	0.119		0.178	0.621	0.571	0.351	0.608	0.632	0.003***
RCE	0.952	0.971		0.933	0.013	0.921	0.573	0.499	0.043***
EPS	0.924	0.007***	0.983		0.876	0.279	0.673	0.997	0.997
ROA	0.007***	0.159	0.963	0.712		0.211	0.498	0.900	0.518
ROE	0.550	0.006***	0.432	0.569	0.212		0.922	0.620	0.888
Size	0.987	0.831	0.365	0.835	0.838	0.536		0.991	0.798
Age	0.993	0.737	0.719	0.843	0.381	0.714	0.994		0.426
Leverage	0.451	0.734	0.969	0.871	0.951	0.156	0.146	0.613	

Note(s): Significance level at ***1%, **5% and *10%
* Appendix can be reproduced by the permission of authors
Source(s): Prepared by authors

Table A1.
Granger results

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