The Effect of Intellectual Capital Efficiency on Malaysian Firm Performance: A Dynamic Panel Estimation

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ABSTRACT

Even though reviews of intellectual capital (IC) and firm performance have been made, their role in developing markets has remained ambiguous. Prior research has typically concentrated on a particular industry while ignoring the contribution of the non-financial firms as a whole. This study aimed to investigate the influence of IC efficiency and firm performance in 11 industries of Malaysian non-financial firms. The study utilized panel data from 370 firms (1850 observations) listed in Malaysia from 2016 to 2020. The adjusted value-added intellectual coefficient (A-VAIC) model with new components (Relational and Innovation capital) was used to measure IC. This study applied a dynamic GMM approach to solve the issue of endogeneity and heteroscedasticity. The empirical findings revealed that IC efficiency was significantly and positively related to the performance of Malaysian listed firms. Moreover, three elements (human, relational and financial capital) positively influenced performance. Specifically, financial capital had the most influential component. The study will be beneficial to investors and policymakers on how IC investments improve performance. Also, the results of this study will help managers adopt new and innovative strategies to get ahead competitively among non-financial firms by using the IC as a premise.

Keywords: Intellectual Capital, Financial Performance, Innovation Capital, GMM, Malaysia.

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INTRODUCTION

Companies typically own two categories of assets: physical and intangible assets. Currently, the global economy has transitioned into a knowledge-based economy. In economies that rely on knowledge (K-based), traditional elements and tangible assets like land, buildings, and machinery have been replaced by intangible resources such as skills, employees' talents, innovation, and comprehensive knowledge (Ahmed & Hussin, 2023; Nadeem et al., 2019). The impact of intangible assets on economic development and productivity is growing in the context of the knowledge economy (Ståhle et al., 2015). In doing so, the technologically and fast-shifting advanced firms have increased the vital role of intangible assets, particularly intellectual capital (IC) (Smriti & Das, 2018). IC is the most significant element in value generation and sustainable competitive advantage (Sardo et al., 2018). Smriti and Das (2018) suggested that expertise and skills in K-based industrial economies have replaced physical assets. Sardo et al. (2018) described IC as the amount of information a business organization can use to obtain a competitive advantage in its activities.

Over the last twenty years, scholars have directed their attention towards a multitude of evolving factors that impact the success of the organisation. Scholars assert that IC is regarded as a catalyst for a pivotal endeavour to improve the performance of organisations, including profitability, productivity, and working system efficiency (Nimtrakoon, 2015; Soetanto & Liem, 2019). The study conducted by Chen et al. (2005) provided evidence that the many sub-components of intellectual capital (human, structural, and R&D investment), as well as physical capital, significantly influence the performance of a company. Although integrated circuit (IC) goods are commonly perceived as investments, researchers argue that they have the potential to enhance corporate performance. Consequently, the significance of innovation is progressively escalating as a crucial factor in the sustained prosperity of corporate expansion. IC plays a vital role in driving innovation, organisational strategy, and development, hence enabling firms to improve their performance and create value (Amin & Aslam, 2017).

Despite extensive prior studies, the findings regarding the correlation between intellectual capital (IC) and firm success remain inconclusive and ambiguous. Several empirical investigations have revealed that IC

has the potential to improve company performance (Joshi et al., 2013; Nadeem et al., 2017; Nimtrakoon, 2015; Vishnu & Kumar Gupta, 2014; Xu & Wang, 2018). Nevertheless, several research studies have failed to establish a correlation between IC and performance (Weqar et al., 2020). The presence of inconsistent findings in the literature might be attributed to the variability in measurement, particularly in relation to value-added intellectual capital (VAIC). The VAIC methodology was introduced by Pulic (2000) and has been extensively employed in the literature to assess the efficiency of integrated circuits (Nadeem et al., 2016; Soetanto & Liem, 2019). According to Pulic (2000), a firm's overall value-added factors are determined by two types of resources: physical capital and intellectual capital efficiency. Although the significance of intellectual capital (IC) has been overlooked as a pivotal determinant of a company's performance (Nadeem et al., 2017). The primary cause of this negligence can be attributed to conventional accounting laws that impose restrictions on the inclusion of intangible assets in a company's balance sheets, with the exception of goodwill (Nadeem et al., 2019). IC in Malaysia, being a prominent emerging nation, is currently in its nascent phase (Ahmed et al., 2022). A significant number of organisations in Malaysia may lack awareness regarding the significance of IC and its potential to enhance their economic performance and tend to prioritise tangible assets (Poh et al., 2018).

The current study aimed to further research the efficiency of IC, its constituent elements as a crucial factor for gaining a competitive edge, and how IC enhances the performance of non-financial enterprises in Malaysia. Furthermore, the current investigation will contribute to the existing literature and provide insights into this potential correlation. First, previous research conducted in the Malaysian context was analysed specifically in relation to the finance industry. Moreover, the scope of this study encompassed non-financial companies in Malaysia that are publicly listed on Bursa Malaysia. Second, this study enhances the existing body of literature by employing the A-VAIC framework, wherein structural capital is substituted with innovation capital, and relational capital is incorporated as an extra element alongside the original VAIC. Hence, both the capital invested in innovation and the efficiency of relational capital are crucial components of a company's overall performance in the K-based economy. Innovation serves as the driving force behind competitiveness, and establishing strong stakeholder alliances enables long-term sustainability

and success. Lastly, To mitigate potential challenges related to endogeneity, the present study utilised the panel two-step system generalized method of moments (GMM) as suggested by Arellano and Bond (1991). Moreover, this research offers valuable insights and information for management, stakeholders, and regulators of Malaysian listed companies seeking to incorporate IC efficiency into their decision-making procedures.

This paper consists of five sections. Part 2 provides an overview of the existing literature and the hypothetical theories. The third section encompasses the data collecting and technique employed in the study. The subsequent part presents diagnostic examinations, outcomes, and a comprehensive analysis. The final portion culminates with recommendations.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Intellectual Capital

IC is widely acknowledged as a crucial factor that can significantly influence financial performance. Despite several attempts by scholars to elucidate the abstract and intricate characteristics of IC, a definitive definition or classification of IC remains elusive. Multiple definitions and perspectives on IC have been presented and elucidated in the literature. IC, as previously described by scholars, refers to the knowledge that can be converted into value (Edvinsson & Sullivan, 1996). According to Bontis et al. (2018), IC can be defined as a resource capability and competency that plays a crucial role in driving organisational success and generating business value.

Sardo et al. (2018), IC refers to the activities and operations within a firm that contribute to creativity, value development, competitive advantages, and prospective benefits, ultimately providing value to company stakeholders. Currently, financial and non-financial organizations are encountering a highly competitive atmosphere in the global economy. These enterprises and groups had challenges, and IC reporting altered financial statements that did not accurately reflect the circumstances. Previous scholars have provided a concise definition of IC, which encompasses

intangibility, wealth creation, and knowledge (Ahmed et al., 2022; Bontis et al., 2018; Nimtrakoon, 2015; Vishnu & Kumar Gupta, 2014). Consequently, IC plays a crucial role in evaluating and measuring the effectiveness and performance of a company, and these organizations have authority over the level of IC (Bontis et al., 2018; Poh et al., 2018). Based on the definitions provided above, this study has defined IC as the complete and exclusive intangible assets that encompass the knowledge and expertise of employees, customer relationships, and unique processes that allow organizations to innovate, adjust to evolving market conditions, and generate value for their stakeholders.

The literature has categorized IC into various components. Gaining knowledge about IC components enhances our comprehension of IC and enables organizations to effectively oversee and disclose IC information to their stakeholders (Bontis et al., 2018). For instance, scholars have classified IC as human capital (HC), structural capital (SC), and relational capital (RC) (Ahmed et al., 2022; Aljuboori et al., 2022; Tiwari et al., 2023). Human capital (HC) is a crucial strategic asset for achieving ongoing success, and human resources should strive to enhance workers' skills and knowledge in order to improve corporate efficiency (Ahmed & Hussin, 2023; Bontis et al., 2018). HC encompasses the knowledge and abilities that allow humans to operate in many situations, including their values and motivation. Human resource competence is considered the most crucial intangible asset (Soetanto & Liem, 2019; Sultan et al., 2021). Structural capital (SC) refers to the organisational systems and structures that allow employees to contribute to the firm's profits. It includes infrastructure assets relating to processes, techniques, and technology that enable the organization to function (Abdullah & Othman, 2019; Bontis et al., 2018). Relational capital (RC) refers to the economic value derived from the relationships between individuals and organizations engaged in business activities (Ahmed et al., 2022; Nimtrakoon, 2015; Vishnu & Kumar Gupta, 2014). RC includes interaction with consumers, suppliers, community members, culture, and the government (Ahmed & Hussin, 2023; Ge & Xu, 2021). Innovation capital refers to all the factors that foster growth and provide the necessary enhancements to create innovative outcomes inside an organization's competitive edge in the marketplace (Scafarto et al., 2016).

HYPOTHESIS DEVELOPMENT

Intellectual Capital and Firm Performance

The importance of IC and its impact on corporate performance has significantly grown over the past twenty years, particularly in the k-economy (Aljuboori et al., 2022). IC is seen as a key contributor that can influence financial performance. Previous research has demonstrated the significance of IC in attaining a competitive edge for organizations. This study examined the Resource-based View (RBV) hypothesis in order to gain insight into the influence of IC on company performance. According to Barney (1991), Resources refer to the collective skills, expertise, information, and procedures possessed by firms that aid in the development of strategies to enhance efficiency and effectiveness in corporate operations. Furthermore, assets must satisfy the following requirements, as recognized by the (VRIN) framework, in order to bolster the firm's competitive advantage: These are the key characteristics: value, rarity, imperfect imitability, and non-substitutability (Barney, 1991). The RBV demonstrates how firms can gain a competitive edge by leveraging their internal resources and capabilities and how they can preserve this advantage over time (Barney, 1991).

Extensive studies have been conducted on the impact of IC on the success of firms; however, the results have been inconclusive. Previous research has demonstrated a positive correlation between IC and company performance (Sardo et al., 2018; Xu & Wang, 2018), whereas IC does not impact performance according to (Kehelwalatenna, 2016; Weqar et al., 2020). However, Clarke et al. (2011) state that ICT has a direct impact on the performance of Australian firms, namely in terms of improving the efficiency of both human and physical capital. In contrast, the study by Maditinos et al. (2011) did not successfully demonstrate the correlation between the majority of VAIC hypotheses and each company's ROA, growth revenues, ROE, and M/B ratio from 2006 to 2008. The analysis was conducted on a sample of 96 Greek-listed firms. Joshi et al. (2013) It was discovered that VAIC is correlated with ROA as a performance metric. Moreover, Vishnu and Kumar Gupta (2014) utilized RC in a study investigating the influence of IC on the pharmacy industry in India. The authors demonstrated that IC has a favorable impact on performance, while the newly included component of relational capital had no discernible effect.

Amin and Aslam (2017) examined the correlation between IC and the financial performance of pharmaceutical companies listed on the stock exchange in the United Kingdom. The authors asserted a direct correlation between IC efficiency and innovation capital and performance. Similarly, Xu and Wang (2018) found that the sub-components of IC had a substantial impact on the performance of 390 manufacturing enterprises listed on the Korean Stock Exchange. As a result, the authors discovered that relationship capital had the greatest impact. Bontis et al. (2015) examined the impact of IC on firm performance in the Serbian hospitality industry from 2009 to 2012. It was reported that the relationship between IC and firms' profitability was insignificant, with financial capital being the most influential factor in determining the profitability of a hotel. Bayraktaroglu et al. (2019), there was no documented effect of RDE on the profitability of companies in the Turkish manufacturing sector. In a more recent study, Ahmed et al. (2022) discovered that IC benefited publicly traded companies in Malaysia. Furthermore, the authors observed that this suggested a positive correlation between IC and the success of enterprises.

On the other hand, they reported that innovation capital directly affected firms' productivity. Xu and Li (2019) implemented the enhanced VAIC model by incorporating RCE and utilizing alternative performance metrics. More precisely, IC was associated with increased firm profits, profitability, and operational efficiency. They established that HC, CE, and SC had the greatest impact on improving firm performance, whereas an RC was of lesser significance. Costa et al. (2020) determined the impact of ICs on Portuguese tourism firm performance (ROA). Recently, Nguyen (2023) recently reported that there exists a substantial correlation between IC efficiency and the performance of Vietnamese firms, with human capital efficiency exhibiting the most pronounced positive influence on performance. Sohel Rana and Hossain (2023) discovered a significant and positive correlation between IC efficacy and the performance of listed non-financial companies in Bangladesh. Based on the findings of the study, organizations can enhance their overall performance by placing emphasis on the development and maintenance of their internal organizational resources and relationship initiatives. The conclusions showed that only CEE and HCE had a positive effect, but SCE related negatively to performance. In comparison, there was no effect of RCE on business performance. As stated in the preceding discourse, IC positively influences the performance of an organization. The preliminary hypothesis read as follows:

H1: *IC efficiency has a positive impact on firm performance.*

This research also examined the impact of each component of IC on the performance of the firm. Literature from the past has had a substantial effect on the efficacy of IC components. Human capital efficiency (HCE), for instance, was a significant component of IC that aids businesses in preserving their competitive advantage (Aslam & Haron, 2020). Scholars assert that HC was an indispensable and strategic asset in achieving a competitive edge and exerted an impact on the organizational structure of the firm (Bontis et al., 2018; Kweh et al., 2019). Prior studies reported a positive influence of HCE on performance (Ahmed et al., 2022; Kweh et al., 2019; Yao et al., 2019). The process by which an organization gains a competitive edge through the adoption and development of novel products, information, capabilities, work procedures, or management systems is commonly known as innovation capital efficiency (RDE) (Scafarto et al., 2016). In addition, RDE positively and significantly influenced performance (Nadeem et al., 2019).

Capital employed efficiency (CEE) illustrates the extent of new value creation with a unit of capital employed (Kweh et al., 2019). Furthermore, CEE reflects the effectiveness of both physical and financial capital. Previous research has found that CEE significantly impacted corporate performance (Mohammad & Bujang, 2019; Soetanto & Liem, 2019; Vishnu & Kumar Gupta, 2014). Relational capital efficiency (RCE) refers to an organization's powerful ability to strengthen constructive engagement with community stakeholders to increase asset-generating capacity by enhancing HC and SC (Ahmed et al., 2022; Soetanto & Liem, 2019). Additionally, RCE positively affected performance (Ahmed et al., 2022; Tripathy et al., 2015; Xu & Wang, 2019). This research explored how the modified VAIC and its components affected firm performance. The research hypotheses were:

H1a*: HCE has a positive impact on firm performance.*
H1b: *RDE has a positive impact on firm performance.*
H1c: *CEE has a positive impact on firm performance.*
H1d: *RCE has a positive impact on firm performance.*

Conceptual Model

The analytical foundation for the investigation was derived from underlying theories and earlier research.

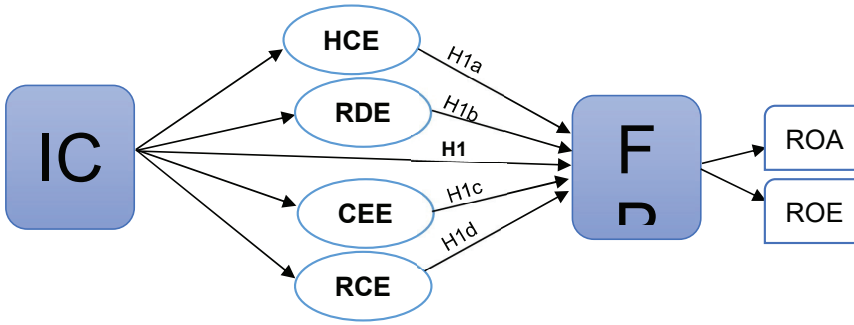

Figure 1: Research Model

METHODOLOGY

Sample and Data

This study used a balanced panel data of 370 (1850 observations) Malaysian non-financial firms from 2016 to 2020. The sample selection details are reported in Table 1. The sample companies ranged are Industrial Products 106, Consumer Products 104, Construction 22, Energy 21, Health Care 8, Plantation 30, Property 16, Technology 24, Telecommunications and Media 9, Transportation & Logistics 22, and Utilities 8. The present study obtained data from the published annual reports in Bursa Malaysia and the Thomson Routers DataStream database. Additionally, the current study used the STATA version 17.0 for data analysis.

Table 1: Sample Selection Procedure

Industry	No of Firms	Obs.
Industrial Products & Services	106	530
Consumer Products & Services	104	520
Construction	22	110
Energy	21	105
Health Care	8	40
Plantation	30	150
Property	16	80
Technology	24	120
Telecommunications & Media	9	45
Transportation & Logistics	22	110
Utilities	8	40
Total	370	1850

Dependent Variables

There are two main indexes to measure firm performance: Return on Assets (ROA) and Return on Equity (ROE). Different scholars utilize different profitability indexes for measurements of profitability, such as ROA (Hariem Abdullah & Tursoy, 2023; Ahmed et al., 2022; Hamad & Cek, 2023; Karem et al., 2021) and ROE (Amin & Aslam, 2017; Hamad & Cek, 2023; Nadeem et al., 2019; Scafarto et al., 2023; Xu & Liu, 2020). Both indicators formula is shown below as per the equation:

$$ROA = \frac{Net\ Income}{Total\ Assets} \quad (1)$$

$$ROE = \frac{Net\ Income}{Total\ Equity} \quad (2)$$

Independent Variables

Although the VAIC has been widely accepted, scholars and researchers have criticized it for its inability to collect all information regarding intellectual capital resources. There exist two primary ideologies. Initially,

certain researchers have highlighted the omission of a crucial element, namely relational capital, in the paradigm. After Pulic (2000) developed this model, Ulum et al. (2017) augmented it by incorporating relational capital as a supplementary element. However, an alternative perspective argued that the VAIC model's SCE metric is indefensible because it deducts HC from the overall value added (Nadeem et al., 2019; Scafarto et al., 2023; Vishnu & Kumar Gupta, 2014). Nevertheless, previous research endeavors have sought to tackle this issue by focusing exclusively on a single variable. These studies modified the proxy measurements of variables or introduced additional factors as independent components (Ahmed et al., 2022; Bayraktaroglu et al., 2019; Nadeem et al., 2019; Vishnu & Kumar Gupta, 2014).

Moreover, scholars have confirmed that the enhanced VAIC model for assessing intellectual capital, incorporating the concept of RCE, is more dependable than the original one (Nimtrakoon, 2015; Yao et al., 2019). In addition, this study utilized an enhanced version of the VAIC model by incorporating RCE as a fourth component. Additionally, it replaced the SCE with RDE. The VAIC model was built systematically, following a sequence of processes. Value-Added (VA) model calculation was the model's first step:

$$\textit{Value-Addes (VA)} = \textit{Total revenue} - \textit{Total expenses} \tag{3}$$

Total revenue is collected from the goods, while expenses are all costs, including depreciation and amortisation (Ahmed et al., 2022; Nimtrakoon, 2015; Soetanto & Liem, 2019). HC is expenses such as Salaries, wages and training costs.

$$HCE = \frac{VA}{HC} \tag{4}$$

RDE's calculation is the RD expenses of firms (Bayraktaroglu et al., 2019; Nadeem et al., 2019). So, the RDE was calculated as follows:

$$RDE = \frac{R\&D\ Expenses}{VA} \tag{5}$$

The CEE can be calculated as below:

$$CEE = \frac{VA}{CE} \quad (6)$$

As explained in the previous sections, this study used the A-VAIC. Currently, added RCE was an extra component for the original model (Ahmed et al., 2022; Mohammad & Bujang, 2019; Ulum et al., 2017; Vishnu & Kumar Gupta, 2014). However, the RC was advertising and marketing expenses.

$$RCE = \frac{RC}{VA} \quad (7)$$

The aggregate of the A-VAIC model in the current study was the sum of four IC elements. Table 2 describes all the variables in this study.

$$A\text{-}VAIC = HCE + RDE + CEE + RCE \quad (8)$$

Table 2: Variable Measurements

Variables	Acronyms	Measurements
Dependent Variables		
Return on Assets	ROA	Net income ÷ Total Asset
Return on Equity	ROE	Net income ÷ Total Equity
Independent Variables		
Human Capital Efficiency	HCE	VA ÷ HC
Innovation capital efficiency	RDE	R&D expenses ÷ VA
Capital Employed Efficiency	CEE	VA ÷ CE
Relational Capital Efficiency	RCE	RC ÷ VA
Adjusted VAIC	A-VAIC	HCE + RDE + CEE + RCE
Control Variables		
Firm Size	SIZE	Ln of total assets
Firm Age	AGE	Number of years the firm established
Leverage	LEV	Total debt ÷ Total assets

Model Specification

The current study utilized dynamic panel regression to evaluate the correlation between IC, its constituents, and performance metrics. Furthermore, the literature highlighted the presence of endogeneity difficulties in the relationship between IC and performance (Ahmed et al., 2022; Sardo & Serrasqueiro, 2018; Yao et al., 2019). In addition, the current study employed the two-step generalized method of moments (GMM) system. The GMM technique permits the inclusion of a time delay in the dependent variable, as well as the consideration of any external influences (Ahmed et al., 2022; Arellano & Bond, 1991; Yao et al., 2019). Moreover, in the presence of serial correlation and heteroscedasticity in the error terms, the GMM estimation method is more efficient (Arellano & Bover, 1995). So, the following regression models were formulated:

Model (1)

$$ROA_{it} = \alpha_0 + \beta_1 ROA_{it-1} + \beta_2 A\text{-}VAIC_{it} + \beta_3 SIZE_{it} + \beta_4 AGE_{it} + \beta_5 LEV_{it} + \varepsilon_{it}$$

Model (2)

$$ROE_{it} = \alpha_0 + \beta_1 ROE_{it-1} + \beta_2 A\text{-}VAIC_{it} + \beta_3 SIZE_{it} + \beta_4 AGE_{it} + \beta_5 LEV_{it} + \varepsilon_{it}$$

Model (3)

$$ROA_{it} = \alpha_0 + \beta_1 ROA_{it-1} + \beta_2 HCE_{it} + \beta_3 RDE_{it} + \beta_4 CEE_{it} + \beta_5 RCE_{it} + \beta_6 SIZE_{it} + \beta_7 AGE_{it} + \beta_8 LEV_{it} + \varepsilon_{it}$$

Model (4)

$$ROE_{it} = \alpha_0 + \beta_1 ROE_{it-1} + \beta_2 HCE_{it} + \beta_3 RDE_{it} + \beta_4 CEE_{it} + \beta_5 RCE_{it} + \beta_6 SIZE_{it} + \beta_7 AGE_{it} + \beta_8 LEV_{it} + \varepsilon_{it}$$

Where, performance indicators are profitability measurements such as ROA was the return on assets, and ROE is the return on equity. IC efficiency (A-VAIC) was an Adjusted Value-Added Intellectual Coefficient. HCE,

RDE, CEE and RCE (Human, Innovation, Capital employed, and Relational capital efficiency, respectively) were components of IC efficiency. SIZE is Firm size, AGE is Firm age, LEV was Leverage, and ε was an error term.

RESULTS AND FINDINGS

Descriptive Statistics

From the descriptive statistics, as shown in Table 3, the mean value ROA value was 2.786, which was somewhat higher than the result of Mohammad & Bujang (2019), indicating that the firms were able to turn a profit. The mean value of ROE was 3.389. The mean value of the A-VAIC was 2.733, showing the value creation capability of non-financial companies in Malaysia with every RM 1.00 invested. In addition, HCE, with a mean value of 1.901, was the most significant A-VAIC component, whereas RDE, CEE, and RCE had average values of 0.002, 0.150, and 0.616, respectively.

These results confirmed earlier findings that HCE was the most efficient component of wealth generation (Joshi et al., 2013; Nimtrakoon, 2015). Furthermore, the HCE, RDE, and RCE were all intangible assets. At the same time, the tangible component was the CEE. Therefore, the total mean value of intangible elements was 2.52, which was much greater than CEE's mean value of 0.150. These variations implied that non-financial firms generated value from intangible assets more effectively than physical assets. Hence, it is consistent with Buallay et al. (2019) and Nimtrakoon (2015), who believed that firms in developing nations build value through intangible rather than tangible. Lastly, the mean values of SIZE, AGE, and LEV were 13.211, 36.851, and 0.195, respectively.

Table 3: Descriptive Statistics

Variables	N	Mean	SD	Minimum	Maximum
ROA	1850	2.786	10.079	-104.43	62.23
ROE	1850	3.389	12.112	-25.36	26.7
A-VAIC	1850	2.733	2.361	-3.942	7.462
HCE	1850	1.901	1.423	-0.745	5.380
RDE	1850	0.002	0.008	0	0.037
CEE	1850	0.150	0.116	-0.026	0.417
RCE	1850	0.616	0.884	-1.566	2.791
SIZE	1850	13.211	1.534	6.073	19.015
AGE	1850	36.851	19.842	1	137
LEV	1850	0.195	0.1636	0	1.296

Correlation Matrix

Table 4 illustrates the Pearson correlation matrix of the study's variables. As expected, A-VAIC positively correlated with ROA (0.446) and ROE (0.320). Therefore, regarding the components, HCE and CEE were positively connected with firm performance. At the same time, RDE and RCE were insignificantly correlated with firm performance indicators. Likewise, SIZE and AGE had a positive correlation with firm performance. HCE had the greatest connection with A-VAIC (0.563), followed by CEE (0.388), RCE (0.245), and RDE (0.149). The coefficient with the greatest value in the results was 0.718 between ROA and ROE. This was less than the 0.8 recommended by Hair et al. (2010), which showed no multicollinearity issues in the current study. Furthermore, this study again tested the multicollinearity issue by the variance inflation factor (VIF). The results are shown in the last column of Table 4. The greatest value of VIF was 1.56, which was less than 10, confirming that multicollinearity was not a concern in sample data.

Table 4: Correlation Matrix

Variables	ROA	ROE	A-VAIC	HCE	RDE	CEE	RCE	SIZE	AGE	LEV	VIF
ROA	1										
ROE	0.718***	**1**									
A-VAIC	0.446***	0.320***	**1**								1.13
HCE	0.406***	0.329***	0.563***	**1**							1.56
RDE	0.038	0.024	0.149***	0.028	**1**						1.04
CEE	0.519***	0.383***	0.388***	0.304***	0.056*	**1**					1.33
RCE	-0.025	-0.025	0.245***	-0.007	0.013	-0.028	**1**				1.12
SIZE	0.211***	0.156***	0.241***	0.251***	-0.009	0.052*	-0.023	**1**			1.46
AGE	0.095***	0.091***	0.0602**	0.02	-0.029	0.026	0.004	0.115***	**1**		1.03
LEV	-0.094***	-0.115***	0.0701**	0.036	0.028	-0.108***	0.001	0.382***	0.022	**1**	1.21

Regression Results

Table 5 illustrates the outcome of a 2-step GMM regression on the effect of IC efficiency on ROA and ROE. In the first and second models, the composite of A-VAIC was used as a comprehensive measurement of IC. In contrast, individual components were used as independent variables in the third and fourth models. Table 5 shows that in all four regressions, the lagged values of ROA and ROE were positive and were strongly associated with the current year for the ROA and ROE at the 1% level. Similarly, the IC efficiency (A-VAIC) positively and significantly affected ROA and ROE in the model (1) and (2). Those findings showed that IC efficiency was vital in enhancing firm performance and creating value for non-financial firms in Malaysia. Moreover, based on the results reported in the current study, IC efficiency was a vital source of any firm's competitive advantages since IC was strongly related to firms' profitability.

Indeed, the results support the H1 that IC efficiency positively influenced Malaysian non-financial companies. These results aligned with Smriti and Das (2018) and Ahmed et al. (2022). They proved that IC was the primary resource for enhancing profitability and market value. Nonetheless, our findings support the RBV Theory that IC efficiency significantly affects firm performance. The findings also showed that the modified VAIC accurately assessed IC efficiency.

Models 3 and 4 show the findings of individual components of the A-VAIC model. Hence, each HCE, CEE, and RCE was significantly and positively associated with ROA and ROE. Moreover, these results supported hypotheses H1a, H1c, and H1d. The results for the effect of components of IC on Malaysian non-financial firms were consistent with (Kweh et al.,

2019; Mohammad & Bujang, 2019; Nadeem et al., 2019). Also, the findings demonstrated that physical capital had the highest coefficient in both models (Coeff. = 28.671 and 15.218), indicating that financial capital was the most powerful contributor. This result supported Nadeem et al. (2017) claim that financial capital cannot be ignored as having a significant role in a company's value development in developing countries. Moreover, HCE was one of the key sources for firms. Investing in employees' knowledge and abilities boosts a firm's ability to innovate on processes, products, and services. These findings corroborated the RBV Theory that IC resources greatly enhanced firm performance.

Table 5: Two-step System GMM Direct Relationship

Variables	Model 1 (ROA)		Model 2 (ROE)		Model 3 (ROA)		Model 4 (ROE)	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
Lag of DV	0.515	0.000***	0.383	0.004***	0.302	0.000***	0.267	0.000***
A-VAIC	1.293	0.003***	3.387	0.000***				
HCE					1.326	0.001***	3.836	0.000***
RDE					-58.813	0.452	-14.486	0.068*
CEE					28.671	0.000***	15.218	0.056*
RCE					0.994	0.074*	2.534	0.012**
SIZE	-2.094	0.11	-4.316	0.128	-0.467	0.467	1.339	0.29
AGE	0.006	0.89	-0.061	0.556	-0.03	0.351	-0.223	0.008***
LEV	7.951	0.171	16.7	0.203	0.467	0.883	18.338	0.017**
CONSTANT	23.539	0.138	48.694	0.155	1.896	0.803	-22.004	0.142
No. of groups	*370*		*370*		*370*		*370*	
No. of instruments	*25*		*25*		*40*		*40*	
Prob > F	*0.000***		*0.000***		*0.000***		*0.000***	
AR (1)	*0.000*		*0.000*		*0.000*		*0.000*	
AR (2)	*0.203*		*0.957*		*0.403*		*0.797*	
Hansen-J test	*0.133*		*0.232*		*0.169*		*0.366*	

Note: *Significant at the 10% level, ** 5% level, * 1% level.**

As shown in Table 5, there was an insignificant association between RDE and ROA in Model 3. Also, RDE negatively and significantly impacted ROE in Model 4. This result did not support H1b, which predicted a positive relationship between them. This finding revealed that increasing RDE reduced company profitability. The possible reason for the negative results could be that R&D expenditures are an expense item in the firm and should be expensed as incurred, which causes the firm's profit to decrease, thus negatively affecting the current financial performance. On the other

hand, only a few Malaysian listed firms disclosed R&D expenditure in their income statements. Hence, the study's data set for RDE was very small. Another possible reason is that in the study period (2016-2020), Malaysia's gross expenditure on R&D to GDP was 1.04% compared to that of other neighboring countries (Trading Economics, 2020). This figure illustrated that Malaysian firms had yet to fully recognize the significance of R&D expenditure (Ting et al., 2016). Nevertheless, the results aligned with Xu and Liu (2020) and Xu and Wang (2018), who indicated that RDE negatively affected profitability.

The inclusion of the RCE component in the A-VAIC model has a favourable impact on a company's profitability. The results of this study suggest that investing in RC enables organisations to establish relationships with their external stakeholders, including suppliers, clients, and partners. This investment also facilitates the expansion of their relational networks, which are crucial for enhancing firm performance and optimising value creation. Thus, RC is the most significant resource that may aid an organisation in establishing and sustaining long-term relationships, resulting in sustainable performance. This outcome is similar to Buallay et al., (2019), Tripathy et al., (2015) and Xu and Wang (2019), while it is different from (Mohammad & Bujang, 2019; Soetanto & Liem, 2019). Finally, firm size (SIZE) was insignificantly related to ROA and ROE in all models, consistent with (Xu & Wang, 2018). In addition, firm age (AGE) insignificantly and negatively affected ROE in model (4) only. Moreover, the firm leverage sign was positively significant with ROE in model 4.

Validity of Results

Since the two-step system of GMM relies on instruments, the dependability of these tools is vital to the accuracy of GMM results (Roodman, 2009). In doing so, the two-step system GMM method employs many instrumental factors created by the lagged variables, which may fix endogeneity issues for other independent variables, not just firm performance (Roodman, 2009). Moreover, several parameters must be met to validate the results of system GMM, according to Roodman (2009), who recommended robustness procedures such as the Hansen for overidentification and first and second-order serial correlation tests. For example, the null hypothesis for the Hansen test was that instruments were valid, and there was no correlation

between them and the error term. In addition, a large probability value of AR (2) indicated that the disturbances were not serially correlated in all models.

Table 5 provides the results of the two diagnostic tests, which are reported under the GMM estimator's key conclusions. The results of the Hensen-J test suggested the null hypothesis could not be rejected, and all used instruments in models were exogenous and showed a probability value above the threshold of significance. Similarly, the AR (2) test revealed that the *p-values* for all models were (0.203, 0.957, 0.403, and 0.797, respectively) and were greater than 0.01, indicating no serial connection. Additionally, based on the outcomes of the diagnostic tests of the GMM approach were robust and could be utilized in the empirical analysis of the current study (Abdullah & Tursoy, 2019; Roodman, 2009; Smriti & Das, 2018).

Sensitivity Analysis and Robustness Check

The primary findings of this research were based on the GMM approach. In addition, the robustness test was used to assess the reliability and consistency of the results of the primary regression. This research employed the two-stage least square (2SLS) method as an alternate method. Table 6 details the findings of the alternate estimate. Hence, the outcome of the robustness method showed the same outcomes that were almost related to the results of the main analysis using two-step GMM regression. Specifically, the coefficient of A-VAIC was positively and significantly in both analyses. In addition, the coefficient and direction of RDE were insignificant in both alternative and main findings. Generally, the Hansen test p-values were insignificant, suggesting that the results were unaffected by the endogeneity issues and that all instruments were not weak in all models.

Table 6: Alternative Multiple Regression Result Using 2SLS

Variables	Model 1 (ROA)		Model 2 (ROE)		Model 3 (ROA)		Model 4 (ROE)	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
A-VAIC	2.259	0.000***	4.126	0.000***				
HCE					0.784	0.000***	1.68	0.000***
RDE					0.93	0.498	3.679	0.179
CEE					23.693	0.000***	37.841	0.000***
RCE					-0.475	0.002***	-0.657	0.031**
SIZE	0.342	0.004***	0.869	0.000***	0.436	0.000***	0.925	0.000***
AGE	0.001	0.904	0.014	0.355	0.014	0.043**	0.037	0.006***
LEV	-7.7	0.000***	-19.022	0.000***	-4.536	0.000***	-13.343	0.000***
CONSTANT	-6.354	0.000***	-16.472	0.000***	-7.363	0.000***	-16.556	0.000***
R^2	*0.081*		*0.132*		*0.368*		*0.303*	
Prob > chi2	*0.000*		*0.0000*		*0.0000*		*0.0000*	
Hansen J-statistic	*0.186*		*0.220*		*0.479*		*0.302*	

CONCLUSION

In the last two decades, the association between IC, its subcomponents, and performance has received much attention. Data from 370 Malaysian firms from 2016 to 2020 were used. The current study examined the effect of IC and its components on Malaysian non-financial firms' performance. In the current study, A-VAIC was used to measure IC efficiency by replacing SCE with RDE and adding RCE as an extra component. The literature has shown that investing in R&D benefits businesses in the long term. The findings add to the current investigation by suggesting that IC plays a significant role in the value development of listed companies in Malaysia. Further, the findings of individual components revealed that HCE, CEE, and RCE had a positive association with firms' performance. The physical capital (CEE) is the major component of A-VAIC. It indicated that tangible assets remained the most significant source for Malaysian firms.

The study results are beneficial for non-financial firms in Malaysia. In the K-based economies, firms that can adequately manage their IC and its components will have enhanced firm performance. These firms should also take notice of the results and strive to improve their competitive advantage via IC. This research would aid managers in using IC components to discover, capture, and quantify the different IC kinds that must not be missed to boost business performance. Additionally, policymakers can

practice the study's findings as a preliminary idea to understand the essentials of each sub-component. Specifically, innovation capital efficiency should acknowledge the significance of R&D and, as a result, raise innovation investments in products and ideas to compete in global markets.

The present study has certain limitations and recommendations for future studies. Firstly, the A-VAIC model was used in this research to analyse IC efficiency. Future research should re-investigate the original VAIC model to assess the accuracy of the IC measure. Moreover, future investigations should add new components such as social capital, process capital, etc. Secondly, the sample of this research was limited to non-financial firms only. Therefore, the present results may not be relevant to financial firms. Thus, future studies should expand the sample to financial firms and examine these relationships to make results generalizable to all firms. Finally, the study was also limited in using accounting and market-based measure indicators as a proxy of firm performance. Thus, another alternative measure, i.e., the M/B ratio and Tobin's Q, can be used for performance measurement in future studies.

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