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Research Article

VALUE-ADDED INTELLECTUAL CAPITAL AND FINANCIAL PERFORMANCE: EVIDENCE FROM TECHNOLOGY COMPANIES PERFORMANCE IN MALAYSIA

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Abstract

"This study investigates the impact of value-added intellectual capital (VAIC)" on the financial performance (FP) of technology companies in Malaysia. The objective is to empirically assess how VAIC influences corporate financial success using parametric analysis methods, specifically Pearson's correlation coefficient. "The findings reveal that VAIC has a positive effect on financial performance, with a particularly strong long-term impact." This study identifies human and structural capital as key drivers of financial performance, highlighting their critical role in organizational success within the Malaysian technology sector. Practically, managers are encouraged to focus on both tangible and intangible assets to improve financial outcomes, underscoring the importance of effective intellectual capital management. This study contributes to the existing literature by applying parametric methods to explore the VAIC-financial performance relationship in a novel context technology firms in Malaysia.

Keywords: Intellectual capital, Technology Companies, Human capital, Structure Capital, Value added intellectual capital, Financial performance.

INTRODUCTION

In modern economies that rely on information and technology, the primary means of creating value has shifted significantly from physical resources to intangible resources (Inkinen, 2015). The transition towards intangible resources as the main driver of wealth creation is apparent in today's fast-changing economy (Elina *et al.,* 2022). In addition, as organizations shift from relying on physical resources to knowledge-based methods, investing in intangible assets, namely intellectual capital (IC), has become crucial (Amalyan, 2022). Furthermore, intellectual capital is essential for improving financial prosperity because it empowers personnel to convert knowledge into groundbreaking items and services, thereby increasing the worth of company partners and the whole organization (Catalin *et al.,* 2021; Abireza *et al.,* 2022). Likewise, in today's culture, it is crucial to prioritize the development, control, and evaluation of intellectual capital. Meanwhile, this is necessary to achieve long-term growth and maintain a competitive edge in an economy that is increasingly influenced by information and technology (Milenko *et al.,* 2021). Pike and Roos (2005) defined IC as "all intangible resources that are within the control of the organization and contribute to its value generation, excluding monetary and physical assets." Consequently, the corporation should accord intellectual assets the same level of importance as physical and financial capital. Since then, people have recognized intellectual capital as a crucial factor influencing a firm's value. Prior research conducted by Bontis (1998) and Tiwari and Vidyarthi (2018) has extensively examined the crucial function of intellectual capital (IC) and its influence on financial success. "As a result, in the last 25 years, a significant amount of theoretical literature has been created to explain the notion of IC and its impact on improving the financial performance of organizations (Sumedrea, 2013).

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From an empirical standpoint, there is conflicting data on the notion that VAIC (Value Added Intellectual Coefficient) enhances the financial performance of companies. Several studies have shown that VAIC (Value Added Intellectual Coefficient) has increased the financial performance (FP) and competitiveness of local companies. These studies include the works of Yaseen *et al.* (2016), Maji and Goswami (2016), Narwal and Yadav (2017), and Nassar (2018). However, there are also previous papers that have found no evidence of a positive or significant relationship between VAIC and firm performance. These papers include the studies conducted by Kujansivu and Lonnqvist (2007), Maditinos *et al.* (2011), and Ozkan *et al.* (2017). Furthermore, established nations have been the focus of most empirical research. To succeed in the knowledge-based economy, however, developing economies must prioritize investments in knowledge, education, research and development, and new, sophisticated technologies. To attain intelligent, environmentally friendly, and equitable expansion, it is essential to channel the elements that contribute to economic progress in these countries towards knowledge and intellectual capital." "The study's model is based on the resource-based theory (RBT) and the knowledge-based theory (KBT), which both explain the direct link between intellectual capital (IC) and financial performance (FP). The model also draws on previous research, including the work of Clarke *et al.* (2011) and others. In this model, the FP framework, which connects the VAIC coefficient to FP, represents enterprises. The return on assets (ROA), return on equity (ROE), and quantify FP. The dataset used consists of 28 technology companies in Malaysia, covering the period from 2015 to 2020." "This study stands out by investigating the dynamic interconnections between the value-added intellectual coefficient (VAIC) and financial performance (FP), while also considering endogeneity and causation and analyzing possible dynamic impacts. Prior research has mostly disregarded these elements, instead concentrating on unchanging connections. Research has extensively shown that intellectual capital (IC) has a beneficial effect on financial performance in several

industries, including insurance businesses in Jordan (Enas *et al.,* 2022). Similarly, food and beverage firms in Indonesia have demonstrated a positive impact on financial performance (Leny *et al.,* 2023). At the same time, Odat (2022) examines Jordanian industrial and service enterprises. The study also discusses the relationship between VAIC (value-added intellectual coefficient) and FP (financial performance)." It demonstrates that managers may be more likely to improve staff performance if they have a high return on assets (ROA). This could create a feedback loop that benefits both sides. In Indian and Pakistani enterprises, Gupta *et al.* (2023) conducted research that demonstrates the significant influence of human capital, structural capital, and used capital on financial performance. This study is unique because it looks at how the value-added intellectual coefficient (VAIC) and financial performance (FP) change over time. It also looks at endogeneity and causation, as well as possible changes in the way things work. Prior research has mostly disregarded these elements, instead concentrating on unchanging connections. Research has extensively shown that intellectual capital (IC) has a beneficial effect on financial performance in several industries, including insurance businesses in Jordan (Enas *et al.,* 2022). The same applies to Indonesian food and beverage companies (Leny *et al.,* 2023). At the same time, Odat (2022) focuses on Jordanian industrial and service enterprises. The research also discusses the relationship between VAIC (value-added intellectual coefficient) and FP (financial performance). It demonstrates that managers may be more likely to improve staff performance if they have a high return on assets (ROA). This could potentially establish a positive feedback loop. Gupta *et al.* (2023) conducted research demonstrating that human capital, structural capital, and used capital significantly influence financial performance in Indian and Pakistani enterprises.

LITERATURE REVIEW

Theoretical evidence: "the relationship between intellectual capital and financial performance"

"The knowledge-based view (KBV) and resource-based theory (RBT) provide the theoretical foundation for this investigation. According to both schools of thought, an organization's success is directly proportional to the quality of its human capital. Penrose (1959) and Wernerfelt (1984) put out the resource-based viewpoint hypothesis, which questions the idea that the external environment is the only determinant of a firm's success. On the contrary, it maintains that a company's competitive advantage and its valuable and distinctive assets are the primary factors that determine the firm's success." The emphasis was on the importance of a company's resources, which can give it a competitive advantage, over its individual items in determining its value and performance. Strategic assets, according to this idea, are a mix of tangible and intangible assets that are vital to improving performance (Riahi and Belkaoui, 2003). Physical resources, including plant and equipment, land and buildings, furniture and furnishings, and more, are all part of what are known as tangible assets. The intangible assets, on the other hand, include things like cash, trade relationships, in-house technical expertise, reputation, brand image, and patents. According to Resource-Based Theory (RBT), the difficulty of duplicating an intangible asset increases as its degree of invisibility increases. Using this resource can lead to a lasting competitive advantage. This hypothesis proposes that IC is a priceless asset that may provide a company a long-term edge in the market. It enhances the business's efficacy and efficiency, poses a challenge for competitors to imitate, and remains immovable or irreplaceable by other resources. The RBV views IC as a strategic asset, a perspective that originates from Seethamraju's (2000) proposal linking IC and FP. Empirical research by Bharadwaj (2000) theoretically links the resource-based view (RBV) to company success. The study specifically focused on the relationship between a firm's IT competence (considered as an intangible strategic resource) and its performance. The findings are consistent with the Resource-Based View (RBV) theory since businesses with strong IT capabilities beat other firms in the sector due to their greater returns.

"Contemporary enterprises often see knowledge as a significant advantage. Grant (1996) posited that the knowledge-based viewpoint of business originated from the resource-based view (RBV), resulting in the formulation of knowledge-based theory (KBT). The KBT sees human labour as a dynamic resource and the firm as a dynamic entity that engages with all stakeholders in its surroundings. Understanding the interplay between an organization's internal resources and its external environment essentially produces knowledge. Knowledge-Based Theory (KBT) elucidates the relationship between a company's internal resources and its capacity to adapt to the environment. The KBT considers persons to be the primary asset in strategy development. Individuals use their skills to create value both inside and outside. Through knowledge creation, employees may facilitate the advancement of more efficient procedures, improved computer and administrative systems, and new products and designs inside the organisation. Furthermore, they may aid in the formation of new intangible assets, including enhanced customer and supplier connections, the company's reputation, and others (externally). According to Nonaka and Toyama (2015), the generation of value and the consequent success of a firm significantly rely on the transmission and transformation of knowledge, in addition to holding information and the capability to use it. Scholars have used Knowledge-Based Theory (KBT) to clarify the conceptual relationship between intellectual capital (IC) and business performance. Researchers have asserted that knowledge management significantly impacts a firm's intellectual capital, which in turn affects its performance. Huang (2009) posited that direct causal relationships exist among knowledge, intellectual capital (IC), and performance. Kengatharan (2019) validated the legitimacy of the knowledge-based theory (KBT) by asserting that information embedded in intellectual capital (IC) boosts productivity, resulting in organisational success."

Empirical evidence: Intellectual capital and a firm's performance

"Past academics have extensively used the VAIC model to examine the influence of intellectual capital (IC) on performance. After a thorough review of the literature, it is evident that there is a substantial and expanding collection of empirical data that establishes a clear connection between these two factors. Moreover, two primary analytical approaches establish the connection between VAIC, a representative measure of intellectual capital (IC), and a company's performance. The primary emphasis is on data-gathering techniques such as interviews, questionnaires, case studies, and focus groups (Bontis, 1998; Chen *et al.,* 2005;

Gupta et al.,2023) to assess VAIC and its influence on FP. The second and more prevalent approach involves using public secondary data to create the VAIC index. Regression analysis methods are then used to examine the potential correlation between VAIC and FP (Dzenopoljac *et al.,* 2017; Tiwari and Vidyarthi, 2018, among others). Pulic (2000) conducted a study where he used the VAIC model on 30 firms that were listed on the Financial Times Stock Exchange 100 Index."
Empirical data constantly shows a substantial correlation between intellectual capital (IC) and the success of companies in different sectors and geographies. Research has shown that Intellectual Capital (IC), which can be quantified using methodologies like the Value-Added Intellectual Coefficient (VAIC), has a favourable influence on financial performance metrics like as return on assets (ROA) and return on equity (ROE) (Cristaldo, 2023; Fanny, 2023). In addition, more precisely, some aspects of IC, such as Human Capital Efficiency, have been shown to greatly improve corporate performance. However, in certain situations, Structural Capital Efficiency may have a detrimental effect (Muhammad *et al.,* 2023).

"Within the automotive industry, intellectual capital (IC) plays a crucial role in enhancing financial performance, which therefore has a beneficial influence on the overall value of a company." However, it should be noted that the direct effect of IC on firm value may not be considerable, as stated by Aftab *et al.* (2023). Likewise, within the banking industry, intellectual capital (IC) has a significant influence in determining performance outcomes, highlighting the crucial importance of human resources (Znar, 2022). Moreover, IC has a moderating role in the connection between corporate governance factors, such as board characteristics, and business performance, indicating that efficient governance may enhance the advantages of IC (Shafi *et al.,* 2022). Meanwhile, the study conducted by Ranty *et al.* (2022) found a significant correlation between the efficiency of intellectual capital (IC), which includes human, structural, and relational capital, and company performance in non-financial enterprises in Pakistan and Malaysia. This highlights the significance of making strategic investments in IC. Furthermore, the influence of intellectual capital (IC) on performance is moderated by financial policies and ownership arrangements. Specifically, government and foreign ownership have been shown to have a favourable impact.

In addition, the study covered the period from 1992 to 1998. The findings indicated a strong link between a company's market worth and the average values of the VAIC. This suggests that organizations with greater levels of VAIC are more effective in using their existing resources, leading to increased value generation. Major publicly traded corporations across various economic sectors such as manufacturing, construction, and commerce often examine the relationship between VAIC (value-added intellectual coefficient) and corporate performance. This is primarily due to the ease with which these organizations can access accurate data. Firer and Williams (2003) were the first to examine the relationship between intellectual capital (IC) and financial performance (FP) in listed companies. They used the VAIC method to analyze 75 South African listed companies. They measured FP using traditional measures like return on assets, turnover of total assets, and market-to-book value ratio of net assets. Their findings align with our premise that IC has an impact on performance.

"Chen *et al.* (2005) used the VAIC index to examine the relationship between intellectual capital (IC), a firm's market value, and the performance of enterprises listed on the Taiwan Stock Exchange from 1992 to 2002." Their findings provided actual evidence that investing in intellectual capacity not only increased the business's market value, but also improved profitability and revenue growth as measured by FP. Sami *et al.* (2014) also used the same approach to conduct a sectoral study in Pakistan and showed that IC has a direct correlation with a company's productivity and profitability. Clarke *et al.* (2011) found a significant and direct relationship between the VAIC Index and the success of Australian firms, both in the present and future eras. Their research concluded that workers are vital resources that should not be overlooked, as they contribute to improving performance and maintaining competitiveness in the marketplace. Uwuigbe and Uadiale (2011) further strengthened the existing empirical evidence, demonstrating the favorable influence of intellectual capital (IC) on corporate success. Komnenic and Pokrajcic (2012) corroborate the finding of a strong correlation between VAIC and FP in Mauritian enterprises (489), demonstrating a positive correlation between VAIC and profitability indicators like "ROA, ROE", and average revenue.

Additionally, "Sumedrea (2013) used the VAIC model to examine the composition of intellectual capital (IC) and its impact on the financial performance of 62 non-financial enterprises publicly traded on the Bucharest Stock Exchange from 2010 to 2011."The regression study indicated that VAIC is a crucial factor influencing corporate development and performance in times of crisis. Under such conditions, organisations rely significantly on their workforce's ability to adapt to changes and absorb new expertise. Celenza and Rossi (2014) performed a research to ascertain the significant impact of intellectual capital (IC), as assessed by VAIC, on the performance of 23 publicly listed companies from 2003 to 2008. The multiple linear regression model analysed the relationship between the variables and identified a statistically significant association between VAIC and accounting performance measures. Nuryaman (2015) performed a research to investigate the influence of intellectual capital (IC) on corporate value. The research examined 93 publicly traded manufacturing businesses on the Indonesian stock exchange in 2012, using financial performance (FP) as a metric. The results demonstrated that intellectual capital (IC) positively influenced both the value and profitability of the enterprise.

Moreover, the coefficients denoting used capital and structural capital had the most substantial impact on business value. Vishnu and Gupta (2015) identified a clear association between intellectual capital (IC) and performance metrics, including return on assets (ROA) and return on sales, within the pharmaceutical business. Nadeem *et al.* (2016) used the dynamic panel system generalised method of moments estimator to investigate the dynamic relationship between intellectual capital (IC) and corporate performance in Brazil, Russia, India, China, and South Africa. The research examined data from 6,045 publicly traded companies from 2005 to 2014. Their results indicated a robust link between IC efficiency and both ROA and ROE. Ariff *et al.* (2016) assessed the impact of intellectual capital (IC) on the market performance of US-listed multinational corporations engaged in research and development (R&D) from 2006 to 2013. They evaluate market performance using the market-to-book ratio and Tobin's q ratio. The research uses the VAIC model to assess the

comprehensive efficiency of intellectual capital, including its elements: human capital, structural capital, and physical capital. The study's results indicate a robust positive association between VAIC and both the market-to-book ratio and Tobin's q ratio. Moreover, Hejazi *et al.* (2016) performed a research to investigate the impact of intellectual capital (IC) on the market value of companies, using both Tobin's Q and Pulic's Model. The researchers concluded that intellectual capital (IC) is the principal catalyst for wealth creation among the 100 enterprises examined, all of which are listed on the Iranian stock market. Dzenopoljac *et al.* (2017) conducted a study revealing that the value-added intellectual coefficient (VAIC) significantly influenced profitability, as indicated by return on assets (ROA) and return on equity (ROE), for companies listed on the Arabian Stock Exchanges from 2011 to 2015. Nonetheless, using other performance metrics produced divergent outcomes. Idyarthi (2018) performed a research using panel fixed effects methodologies on 39 public and private banks listed on the Bombay Stock Exchange from 1999 to 2015. Their empirical results indicated a favourable correlation between intellectual capital (IC) and the performance of Indian banks.

Tarigan *et al.* (2019) conducted a research on 93 industrial enterprises listed on the Indonesian stock market. Evidence was discovered that substantiates the idea that enhancing intellectual capital (IC) efficiency results in heightened production and profitability inside these organisations. The assessment was conducted using many measures, including return on assets (ROA), return on equity (ROE), revenue growth, and asset turnover. Furthermore, in 2020, Saddam did a research to examine the influence of intellectual capital (IC) on the financial performance (FP) of firms within the Malaysian banking sector. His studies demonstrated a significant and favourable correlation between intellectual capital and the success of diverse industries, including banks and insurance firms. In addition, Desoky and Mousa (2020) highlighted the substantial influence of intellectual assets on performance metrics, including "ROA and ROE," across Bahrain's banking and services sectors.

Researchers have performed a comprehensive investigation on the correlation between the value-added intellectual coefficient (VAIC) and corporate success, resulting in diverse conclusions. Although some research indicates a positive correlation between VAIC and financial success, others reveal no significant relationship. Alabood *et al.* (2023) found that human and employed capital significantly enhance the financial performance of publicly traded insurance companies in Jordan. This underscores the strategic importance of intellectual capital. Moreover, Ahmad's investigation into non-financial firms in the United States validated the efficacy of a modified VAIC model, revealing a substantial beneficial influence on both corporate performance and market value (Fawad, 2023). Furthermore, Gupta *et al.* (2023) found that intellectual capital improves both financial and market performance. The revised VAIC model offers a more precise elucidation of performance. Conversely, the research conducted by Odat and Bsoul on Jordanian manufacturing and service firms revealed that the variable added intellectual coefficient (VAIC) had a beneficial impact on financial performance. However, they found no significant correlation with market value (Odat *et al.,* 2022). Meanwhile, according to Prasojo *et al.* (2022), the study found that VAIC has a favorable impact on Islamic banks' performance, namely by improving human capital and capital utilization efficiency. However, Prasojo and Shalihin's research on Indonesian enterprises showed that the value-added intellectual coefficient (VAIC) did not significantly impact market performance. Only the efficiency of capital employed has shown a beneficial impact (Prasojo *et al.,* 2022). Marzo and Bonnini found that the VAIC formula has a non-linear relationship, which means that new testing methods are needed to accurately measure how it affects performance (Marzo *et al.,* 2022). Furthermore, research on Indian enterprises revealed a strong correlation between VAIC and profitability, while other performance indicators showed no significant relationship (Harish, 2020).

"Although several studies have shown empirical evidence endorsing the beneficial influence of VAIC on a firm's performance, other research has yielded contradictory findings, either disputing this claim or failing to demonstrate any statistical association between VAIC and performance." Kujansivu and Lonnqvist's 2007 research identified a vague association between an organization's value and the efficacy of its intellectual capital (IC) among Finnish firms. The research included 11 unique industries and analysed data from 2001 to 2003. Maditinos *et al.* (2011) used the VAIC methodology and discovered no significant link among VAIC, market value, and the financial performance of knowledge-based Greek firms listed on the Athens Stock Exchange (ASE). Likewise, Hang's (2009) study revealed no substantial link between the performance of VAIC and the financial success of publicly listed companies in Hong Kong, save for a little association between profitability and VAIC. "Nowacki and Staniewski (2012) performed a research in which they surveyed six energy companies from 2008 to 2010."Their results were similar to those of another research. A research by Janošević and Dženopoljac (2011) shown via simple regression analysis that the Value-Added Intellectual Coefficient (VAIC) had little or no influence on the performance of 100 companies in the Serbian real sector in 2010.

In addition, a study by Janošević and Dženopoljac (2012) looked into the relationship between VAIC (value-added intellectual coefficient) and three performance indicators: employee productivity, return on assets (ROA), and return on equity (ROE). This study focused on 15 publicly traded firms in Serbia, with 6 functioning in the financial sector and 9 in the real sector. Their findings did not establish a direct correlation between IC and the three performance indicators. Mosavi *et al.* (2012) provided support for the same claim, stating that there is no definitive evidence to prove a connection between VAIC and the performance of listed firms in Iran across five distinct economic sectors. According to actual evidence, Guenther and Beyer (2003) demonstrated that the VAIC metric has little or no influence on enterprise valuation. Chu *et al.* (2011) obtained similar findings for a sample of Hong Kong enterprises within the same time frame. Ozkan *et al.* (2017) further supported these findings by demonstrating that the variable added intellectual coefficient (VAIC) has no meaningful impact on return on assets (ROA) for banks. Empirical investigations, grounded in these theoretical underpinnings, have mostly validated that intellectual capital (IC) leads to enhanced firm performance (FP) and competitiveness. The investigations include contributions by Bontis (1998), Mehralian *et al.* (2012), Meles *et al.* (2016), Dzenopoljac *et al.* (2017), Narwal and Yadav (2017), and Xu and Liu (2020). However, several researches indicate that intellectual capital (IC) has a little influence on organisational

performance, as shown by various samples and contexts (Kujansivu and Lonnqvist, 2007; Dzenopoljac *et al.,* 2017; Ozkan *et al.,* 2017). Consequently, the evidence on the influence of IC on FP remains ambiguous. The research intends to do an empirical examination of the influence of intellectual capital (IC) on corporate financial performance (FP) for Malaysian enterprises. Moreover, current theoretical and empirical research underscores the substantial significance and contribution of intellectual capital in propelling financial performance. Our empirical study results may underscore the significance of intellectual capital (IC) in enhancing organisational efficiency in Malaysia and, therefore, augmenting profitability.

METHODOLOGY

Sampling Methods

The sample for this query includes all the firms listed in the technology sector on Bursa Malaysia's Main Market. The IT industry was selected because of its significant reliance on intellectual capital for its operations, in contrast to businesses in traditional industries. The data collection procedure started by acquiring annual reports spanning from 2015 to 2020, a timeframe marked by notable variations in performance (Siew *et al.,* 2018). In addition, the COVID-19 pandemic had a further influence on market dynamics, affecting various sectors in different ways. The healthcare industry, for example, saw a combination of investor confidence and stock performance during lockdowns, resulting in a mixed outcome (Xie *et al.,* 2022). There is a total of 30 technology businesses that are officially listed on Bursa Kuala Lumpur. This research encompasses a total of 28 technology businesses that are listed on Bursa Malaysia. The firms were chosen based on their larger market capitalization, in accordance with the sample size determination rules outlined by Krejcie and Morgan (1970). This methodology guarantees a sample that is both comprehensive and strong for examining the link between VAIC-FP in the specific context of technology businesses in Malaysia.

Variables and Their Measurements

This study utilizes both independent and dependent variables to examine the relationship between intellectual capital and firm performance."

Independent Variables

The following intellectual capital measurements serve as representations of the independent variables:

Human capital (HC): This represents the cost of human resources. Pulic (2000) states that the firm's employees' benefits, such as salaries, wages, insurance, and other financial benefits, serve as a measure of human capital.

HC=wages + financial benefits (1) HC = \text{wages} + \text {financial benefits} \tag {1} HC=wages+ financial benefits (1). Deducting the cost of human capital from the firm's value-added yields the measurement of structural capital (SC) (Pulic, 2000).

SC=VA−HCSC = VA - HCSC=VA−HC

Where:
SC is structural capital.
VA is value-added.
HC is human capital.

For the calculation of human capital, Equation (1) will be used. To calculate the value added from intellectual capital, we modify the formula used by Makki et al. (2009) to suit Malaysian financial reporting practices. According to IAS36, IT technology is classified under impairment plus amortization. Therefore, the value added is calculated as follows:

"VA=OP+EC+AVA = OP + EC + AVA=OP+EC+A"

Where:
"OP is Operating Profit"
"EC is Employee Cost"
"AAA is Amortization"

Dependent Variables

The dependent variables in this study are measures of firm performance, calculated as follows:

1. Return on Assets (ROA)

This ratio measures the efficiency of a firm's use of its assets to generate profit. ROA is calculated by dividing net income by total assets. The formula is:

1."ROA = Net Income / Total Assets"
(Needles *et al.,* 2013).
2. Return on Equity (ROE)

This ratio indicates the return generated on shareholders' equity. ROE is calculated by dividing net income by total equity. The formula is:

"ROE = Net Income / Total Equity"
(Needles *et al.,* 2013).

3. "Earnings Per Share (EPS)"

This measure reflects the portion of a company's profit allocated to each outstanding share of common stock. EPS is calculated by dividing net income by the number of outstanding shares. The formula is:

"EPS = Net Income / Outstanding Shares"
(Needles *et al.,* 2013).

Data Collection

The data gathering for this research relied on secondary data sources. The data were collected from the publicly accessible information of the specific firms listed on Bursa Malaysia. More precisely, the data was acquired from the yearly reports of these firms covering the period from 2015 to 2020. The chosen time frame was based on its increased level of volatility in performance, which offers a strong foundation for examining the connection between intellectual capital and company success. The yearly reports included extensive information about the financial and intellectual resources required for this project.

Variables used in the model

This research primarily examines the intellectual capital (IC) of the organizations. Pulic (1998) created the VAIC technique, which calculates the VAIC index as a proxy for measuring the IC. He believed that investing in information that generates value has become the primary factor in gaining a competitive advantage in a contemporary economy. Consequently, he endeavored to develop a metric to evaluate the performance of such intangible assets. In 1998, he developed the VAIC, the most widely used metric for evaluating the effectiveness of corporate intellectual capacity's value contribution. The VAIC model aims to quantify the extent to which a firm generates value by leveraging its intellectual resources, or IC efficiency. The VAIC index consists of two components: human capital efficiency (HCE) and structural capital efficiency (SCE).

Data analysis

"The process involves examining, purifying, altering, and structuring data to uncover valuable insights, formulate conclusions, and facilitate decision-making. We construct the database from the financial reports published by Malaysian firms listed on the Malaysian Stock Exchange. The statistical analysis was conducted with SPSS version 23." Three linear regression models are developed to examine the link between intellectual capital indicators and their components with financial performance.

"Model 1"
"ROA=a_1+β_1.HC+ β_2.SC+ ε" (1)
"Model 2"
"ROE=a_1+β_1.HC+ β_2.SC+ ε" (2)
"Model 3"
"EPS=a_1+β_1.HC+ β_2.SC+ ε " (3)
Where:
"ROA= return on assets"
"ROE= return on equity"
"EPS = earnings per share"
"HC= human capital"
"SC= structural capital"
"E= standard error"

RESULTS

Descriptive statistics

"Table 4.1 displays the average and variability of the study variables, namely human capital, structural capital, return on assets, return on equity, and profits per share." Between 2015 and 2020, the proportion of human capital in the technology sector varied from 32% to 53%, with an average of 42% during the period. This indicates that human capital accounts for approximately 42% of the industry's total capital. The technology industry's structural capital accounted for 68% to 90% of the total capital, with an average of 80% for the specified time. This indicates that managers prioritise structural capital above human capital. The performance indicators for the technology industry during the period 2015–2020 show that the mean return of assets is 8%, while the mean return of equity is 14%. Both ratios imply consistent performance over this time. Additionally, the average profit per share for the technology sector is 45 cents, indicating a consistent profit.

Table 1. Descriptive statistics

	Min	Max	Mean	Std. Deviation
"HC"	".32"	".53"	".4283"	".07317"
"SC"	".68"	".90"	".7993"	".08071"
"ROA"	".06"	".12"	".0801"	".00189"
"ROE"	".11"	".15"	".1309"	".01428"
"EPS"	"18.00"	"62.00"	"45.500"	"14.745"

Graphic 1 depicts the trajectory of the intellectual capital components, namely human capital and structural capital, from 2015 to 2020. The graphic presents the trend on a semi-annual basis. This demonstrates a decrease in both components from 2015 to 2018, followed by an increase in 2019.

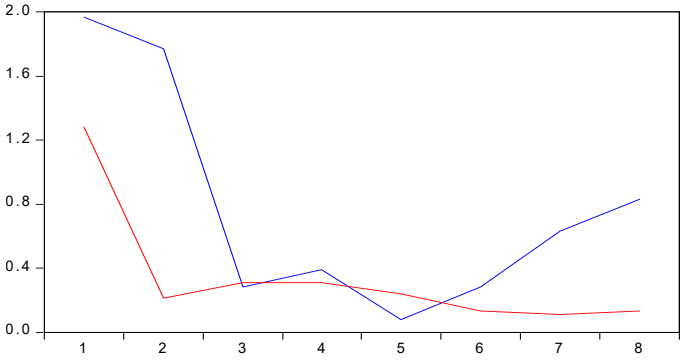

Figure 1. Intellectual Capital (Human & Structural) Trend 2015-2020

"Figure 2 illustrates the trends of key performance indicators—Return on Assets (ROA), Return on Equity (ROE), and Earnings Per Share (EPS)—for the technology sector from 2015 to 2020, based on semi-annual data represented by eight observation points." The graph reveals a significant correlation between the performance of the technology sector and its intellectual capital. Initially, there is a sharp decline in all three performance indicators from Q1/2015 to Q2/2016, indicating a challenging period for the sector. However, from Q3/2016 to Q4/2017, a stabilization phase is observed, where performance metrics plateau, suggesting a period of adjustment and consolidation. Notably, in 2018, as the technology sector intensified its focus on intellectual capital, there was a marked improvement in performance indicators. This trend underscores the critical role of intellectual capital in enhancing the performance of technology firms, highlighting the importance of strategic investments in human and structural capital to drive financial success.

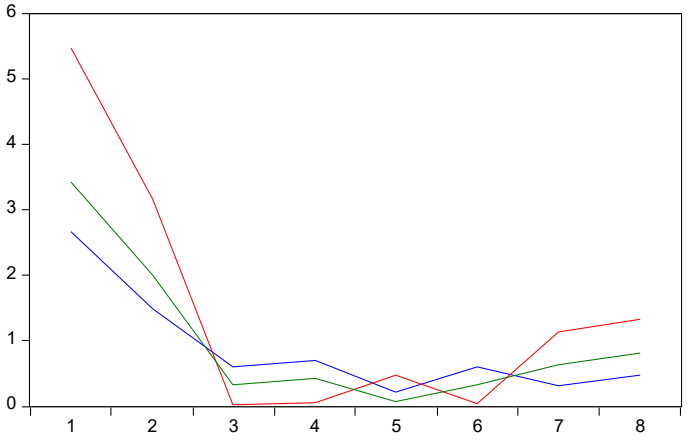

Figure 2. Performance indicators trend 2015-2020

Cross-correlation analysis of human capital and structural capital

"A cross-correlation test to investigate the potential for autocorrelation between the independent variables in this research, which are human capital and structural capital. The presence of autocorrelation within these two-data series throughout a certain time frame might make it difficult to identify significant correlations between them (Guedes *et al.,* 2018)."

Table 4.2 shows the analysis of the cross-correlation coefficients for both leading and trailing values. The findings suggest that there is no noticeable autocorrelation since all lag values are above the 5% threshold. The lack of substantial autocorrelation indicates that the data sets for human capital and structural capital are not reliant on each other over the observed time frame. This enables a more dependable and relevant examination of their influence on company performance.This discovery proves that the later studies were correct, making sure that there isn't a hidden correlation in the data that changes the links found between the different parts of intellectual capital and company performance.

Table 2. Cross Correlation Test

Sample: 1 8
Included observations: 8
Correlations are asymptotically consistent approximations

HC,SC(-i)	HC,SC(+i)	i	lag	lead
		0	0.6274	0.6274
		1	0.5670	0.0836
		2	-0.1952	0.1711
		3	-0.1343	0.1063
		4	-0.3040	-0.0676
		5	-0.2328	-0.1927
		6	-0.0756	-0.2489

Correlation Analysis of Intellectual Capital and Firm Performance

The table below shows the Pearson correlation coefficients and their 2-tailed significance levels for the performance indicators return on assets (ROA), return on equity (ROE), and earnings per share (EPS). The variables are human capital (HC) and structural capital (SC).

Examination

According to the Pearson correlation analysis, there are statistically significant positive associations between the components of intellectual capital and the indices of company success in the technology industry. Human capital (HC) has a robust positive association with all performance measures. The correlation coefficients for ROA and ROE are very strong, with values of r =.950 (p <.01) and r =.958 (p <.01), respectively. This implies that allocating more resources towards developing the skills, knowledge, and abilities of employees, including higher salaries, compensation, and other perks, has a substantial positive impact on a company's financial results. Structural capital, which refers to an organization's intangible assets and resources, such as patents, trademarks, and databases, has strong positive associations with all performance measures. The most significant association is shown with EPS (r =.881, p <.01), indicating that enhancements in structural capital are associated with increased profits per share. This emphasises the significance of effective internal procedures and systems in propelling financial prosperity. Performance Indicators: The performance indicators have a strong correlation with each other. Remarkably, there is a very strong connection (r =.984, p <.01) between ROA and ROE, suggesting that companies with greater returns on assets are also likely to have greater returns on equity. The constancy of these financial performance criteria highlights the interconnectedness between them.The results validate that intellectual capital, which includes both human and structural capital, is essential for improving the financial performance of technology companies. Investing strategically in intellectual capital is very likely to result in significant returns, as shown by the robust positive correlations with important performance measures.

Table 3. Correlation Test

		HC	SC	ROA	ROE	EPS
HC	"Pearson Correlation"	1				
	"Sig. (2-tailed)"					
SC	"Pearson Correlation"	.627	1			
	"Sig. (2-tailed)"	.096				
ROA	"Pearson Correlation"	.950**	.787*	1		
	"Sig. (2-tailed)"	.000	.020			
ROE	"Pearson Correlation"	.958**	.819*	.984**	1	
	"Sig. (2-tailed)"	.000	.013	.000		
EPS	"Pearson Correlation"	.882**	.881**	.916**	.966**	1
	"Sig. (2-tailed)"	.004	.004	.001	.000	

**"Correlation is significant at the 0.01 level (2-tailed)."
*. "Correlation is significant at the 0.05 level (2-tailed)."

DISCUSSION

The notable findings of Ståhle *et al.* (2011) confirm the advantageous influence of both labor and capital investments for enterprises in Malaysia, by the resource-based view (RBV) approach. This perspective highlights the importance of using both physical and non-physical assets to improve the overall performance of a company "(Brennan and Connell, 2000; Marr, 2004; Uwuigbe and Uadiale, 2011; Alipour, 2012; Alhassan and Asare, 2016)." Likewise, more proof for this claim comes from studies by Kamal *et al.* (2012) and Shamsudin and Yain (2013), which found a strong link between the value-added intellectual coefficient (VAIC) and return on assets (ROA). Moreover, studies by Bontis (1998), Clarke *et al.* (2011), and Denopoljac *et al.* (2016) underscore the importance of intangible assets, specifically human capital, in creating value for organizations. Researchers see the combination of tangible and intangible resources as a key factor in gaining a competitive edge in the knowledge-based economy. Al-Hamadeen and Suwaidan (2014) emphasize the importance of human and structural capital in the VAIC framework

Furthermore, research shows a positive correlation between an organization's future success and its investment in both physical and non-physical assets. This finding supports the resource-based view theory. Nevertheless, it is crucial to recognize the divergent results shown by Maditinos *et al.* (2011) and Celenza and Rossi (2014), which indicate that VAIC does not have a substantial influence on performance measures. In a study conducted by Janošević and Dženopoljac *et al.* (2011), it was discovered that there is a limited or negligible connection between VAIC (Value Added Intellectual Coefficient) and the performance of companies in

the Serbian real sector. This suggests that the link between resource investments and performance results is intricate and not easily understood.

Conclusion

The Value Added Intellectual Coefficient (VAIC) model used in this research provides significant information for managers and investors, assisting in decision-making. Managers may use the VAIC approach to evaluate the effectiveness of their company's intellectual capital (IC), enabling them to compare it with rivals in the sector and make well-informed strategic choices. Moreover, including VAIC computations in financial statements may improve the level of clarity in terms of IC efficiency. The VAIC model is a useful tool for investors to find firms that regularly generate value. By using this model, investors may reduce risks and maximise rewards while making investment choices. Regularly analyzing the VAIC index allows managers to enhance their strategy for developing intellectual capital, leading to better overall organisational performance. Managers are advised to prioritise the management of IC because of its crucial role in driving performance improvement. Furthermore, the VAIC index offers significant information for rating agencies, allowing them to conduct thorough assessments of intangible assets and intellectual capital performance in various geographical areas. In addition, implementing the VAIC technique in intellectual capital (IC) management not only improves profitability, but also boosts the firm's overall financial performance (FP). Managers must acknowledge the crucial connection between IC (intellectual capital) and FP (financial performance), highlighting the need for allocating resources to projects that strengthen IC. Furthermore, the VAIC index has the potential to serve as a framework for reporting intellectual capital within Mauritian companies, promoting openness and accountability. Furthermore, based on the empirical evidence, future studies may focus on comparing the link between VAIC (value-added intellectual coefficient) and financial performance in particular industries. This would provide detailed insights into how physical and intangible assets contribute differently in different economic sectors. Furthermore, investigating the possible impact of macroeconomic variables on business performance might enhance our comprehension of the wider factors that determine how well a company performs.

Limitation

This study acknowledges some limitations in analyzing the relationship between value-added intellectual capital (VAIC) and financial performance in Malaysian technology firms. The research focusses on a particular sample of technology enterprises in Malaysia, which may restrict the generalizability of the findings to other industries or regions. Future research may expand the sample to include organizations from other sectors or geographical regions to enhance the external validity of the results.

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