Research Article

The Relationship between Intellectual Capital, Firm Performance, and Sustainable Growth in Companies Listed on the Thai Stock Exchange

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ABSTRACT

The objective of this research is to study the relationship between intellectual capital, firm performance, and sustainable growth of registered companies in the Stock Exchange of Thailand. The study utilizes data from the years 2020–2023, with a sample group of 1,167 firm-years. The statistical techniques for data analysis are descriptive statistics and multiple regression analysis for testing the research hypotheses. The findings indicate a positive relationship between intellectual capital and both firm performance and sustainable growth. Firm performance is measured by the return on assets and the return on equity. This research suggests that intellectual capital is a valuable, unique, and irreplaceable resource, aligning with the resource-based view of the firm. The characteristics of intellectual capital enhance operational efficiency, contributing to the firm performance and sustainable growth of businesses.

Keywords: Intellectual Capital, Firm Performance, Sustainable Growth

บทความวิจัย

ความสัมพันธ์ระหว่างทุนทางปัญญา ประสิทธิภาพการดำเนินงานและการเติบโตที่ยั่งยืนของบริษัทจดทะเบียนในตลาดหลักทรัพย์ไทย

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บทคัดย่อ

การวิจัยครั้งนี้มีวัตถุประสงค์ เพื่อศึกษาความสัมพันธ์ระหว่างทุนทางปัญญา ผลการดำเนินงานขององค์กรและการเติบโตอย่างยั่งยืนของบริษัทจดทะเบียนในตลาดหลักทรัพย์แห่งประเทศไทย โดยในการศึกษาครั้งนี้ใช้ข้อมูลระหว่างปี พ.ศ. 2560–2563 กลุ่มตัวอย่างที่ใช้ในการวิจัย จำนวน 1,167 รายปีรายบริษัท งานวิจัยนี้ใช้สถิติเชิงพรรณนาและการวิเคราะห์ความถดถอยเชิงพหุคูณ (Multiple Regression) ในการทดสอบสมมติฐานงานวิจัย ผลการวิจัยพบว่าทุนทางปัญญามีความสัมพันธ์เชิงบวกกับผลการดำเนินงานและการเติบโตอย่างยั่งยืน โดยผลการดำเนินงานวัดจากอัตราผลตอบแทนต่อสินทรัพย์ อัตราผลตอบแทนต่อส่วนของผู้ถือหุ้น งานวิจัยนี้ชี้ให้เห็นว่า ทุนทางปัญญาเป็นทรัพยากรตามแนวคิดของ The Resource-Based View of the Firm ซึ่งยืนยันได้ว่า ทุนทางปัญญาเป็นทรัพยากรที่มีคุณค่า เป็นสิ่งที่หายาก เป็นทรัพยากรที่เป็นเอกลักษณ์และเป็นทรัพยากรที่ไม่สามารถทดแทนได้ ซึ่งลักษณะของทุนทางปัญญาช่วยเพิ่มประสิทธิภาพในดำเนินงาน ทำให้ผลการดำเนินงานขององค์กรและการเติบโตอย่างยั่งยืนของกิจการมีแนวโน้มเพิ่มขึ้น

คำสำคัญ: ทุนทางปัญญา ประสิทธิภาพการดำเนินงาน การเติบโตที่ยั่งยืน

INTRODUCTION

Corporations are grappling with fierce competition in the rapidly evolving economic environment, prompting an exploration of novel managerial strategies or approaches (Sima-iam, Phacharoen & Saowatea, 2019). Traditionally, the primary organizational focuses were on technology and capital investments. Nevertheless, due to rapid technological advancements, the ease of duplication, and the ubiquitous availability of capital, corporations have shifted towards unique, non-replicable strategies to gain a competitive advantage. This shift has given rise to a "knowledge-based economy" where knowledge serves as the principal catalyst for growth and prosperity, fostering enduring and sustainable development (Charoenviriyakul, Wangrasatong, & Tappakul, 2017).

Investments directed towards generating organizational knowledge within a knowledge-based economy give corporations a competitive edge, influencing their performance and expansion (Mukherjee & Sen, 2019; Xu & Wang, 2018). Knowledge is recognized as a pivotal resource in a knowledge-based economy, with scholars reaching a consensus on the significance of investments in knowledge creation for global competition. Intellectual capital is considered to confer a competitive advantage, making a substantial contribution to an organization's sustainable performance (Xu & Wang, 2018).

In the context of studying intellectual capital in the Thai context, there has been a disclosure of information in financial reports, indicating that Thailand places importance on reporting expenses related to intellectual capital development. This includes expenses associated with employees, investments in corporate resources, and costs related to building good relationships with stakeholders, which can add value to the business (Wiroterat, 2022). Moreover, intellectual capital is considered a significant investment in resources to create business value. Phromsuwansiri, Chutimagul, & Promnurakkij (2022) mentioned that the efficiency of intellectual capital promotes the operations of companies listed on the Stock Exchange of Thailand (SET100 group), leading to improved performance of these companies. Additionally, Intarapanich and Pakpian (2022) found that intellectual potential contributes to sustainable operational outcomes for community enterprises in the Sakon Nakhon province, Thailand. Although there have been studies on the intellectual capital's impact on business operations and the value of businesses in the context of Thailand, as well as the importance given to measuring sustainable business growth using various indicators, there is still no conclusive reference point on the study of intellectual capital's impact on the sustainability of businesses in the business environment of Thailand.

However, specifically, the absence of a literature review tailored to the Thai context is recognized as a significant gap. The dynamics between intellectual capital (IC), firm performance, and sustainable growth within the Thai business landscape require a dedicated exploration. Integrating a literature

review focused on the Thai context is deemed essential to enhance the research's relevance and appeal. This inclusion would address a notable gap by thoroughly examining the state of intellectual capital (IC) and its impact on firm performance and sustainable growth in the unique environment of Thai businesses.

By delving into existing research and developments within Thailand, the research aims to gain deeper insights into the distinctive challenges, practices, and success stories that shape the relationship between IC, firm performance, and sustainable growth in the Thai context. This approach not only provides a nuanced understanding of the subject matter but also makes the research more compelling for readers interested in the local business landscape. The comment underscores the significance of exploring specific nuances such as IC-related practices, challenges faced by Thai firms, and correlations with performance metrics and sustainable growth indicators. The proposed addition of a thorough literature review on the Thai context is considered imperative to fill the existing gap and make the research more captivating and relevant to the specific dynamics of intellectual capital, firm performance, and sustainable growth in the Thai business milieu.

"Intellectual capital" is a term used to refer to investments in these intangible assets, which have become indispensable for corporate success (Thammaprasert & Phaiboon, 2018). Various methods are available for measuring intellectual capital, including the valuation of intangible assets, the Balanced Scorecard approach, or Market Capitalization (Xu & Wang, 2018). Nevertheless, the "Value Added Intellectual Capital (VAIC)" method, proposed by Pulic (1998), is commonly used. VAIC provides a straightforward calculation applicable to businesses of all scales, utilizing data from income and financial position statements and other relevant factors specific to each business type. Intellectual capital comprises three key components: Physical Capital, Human Capital, and Structural Capital.

Due to the earlier mentioned significance, numerous national and international researchers have shown interest in investigating the impact of intellectual capital on corporate performance and sustainable growth. This involves exploring intellectual capital and its components, as research outcomes remain diverse and inconsistent. Consequently, there is a growing research interest in understanding the relationship between intellectual capital, corporate performance, and sustainable growth in companies listed on the Thai Stock Exchange. The aim is to enhance comprehension and facilitate the derivation of definitive conclusions regarding the role of intellectual capital in shaping the future operational capacities of businesses.

RESEARCH OBJECTIVES

The correlation between intellectual capital, as quantified by the Value-Added Intellectual Coefficient (VAIC), and corporate performance has been consistently supported, showing a positive correlation in multiple studies (Dženopoljac & Janoševic, 2016; Ozkan, Cakan, & Kayacan, 2016; Xu & Wang, 2018). Previous scholarly work has also highlighted a positive link between intellectual capital and the sustainable growth of firms (Mukherjee & Sen, 2019; Xu & Wang, 2018). As a result, the research objectives have been formulated as follows: The investigators have set the following research aims:

1. To explore the interconnection between intellectual capital and the performance of firms on the Thai Stock Exchange.

2. To investigate the nexus between intellectual capital and the sustainable growth of firms listed on the Thai Stock Exchange.

LITERATURE REVIEW

Resource-Based View of the Firm

Grounded in economic and strategic management principles, the resource-based view of the firm suggests that a company's distinctive and non-duplicable resources can differentiate it and provide competitive advantages over its counterparts (Xu & Liu, 2020). The resources conferring competitive advantage are characterized by four attributes, namely: value, rarity, inimitability, and non-substitutability (Barney, 1991).

The acronym "VRIN" encompasses the four attributes according to the RBV theory. It suggests that firms possessing these attributes can fend off competitive threats or erect barriers against rivals (Xu & Liu, 2020), thereby reinforcing their competitive efficacy, which is likely to enhance business performance (Nguyen, 2018). In light of this theoretical background, this study employs the RBV theory to elucidate the relationship between intellectual capital—a distinctive resource a firm possesses—and sustainable growth. Resources with all four characteristics are termed "VRIN." These resources enable businesses to deter competitors from entering the market or impede their progress (Xu & Liu, 2020), thereby enhancing competitive efficiency. The unique and non-replicable nature of resources allows entities to differentiate themselves and gain a competitive advantage. The distinctive characteristics of resources create competitive advantages compared with competitors (Mukherjee & Sen, 2019).

These resources are categorized into four characteristics: valuable resources (Valuable), rare resources (Rare), difficult-to-imitate resources (Inimitable), and non-substitutable resources (Non-substitutable) (Barney, 1991). Business performance tends to increase as a result. Therefore, based on the literature

review, the research team applied the concept of the resource-based view of the firm to elucidate the relationship between intellectual capital—a distinctive resource controlled by an entity—and sustainable growth as figure 1.

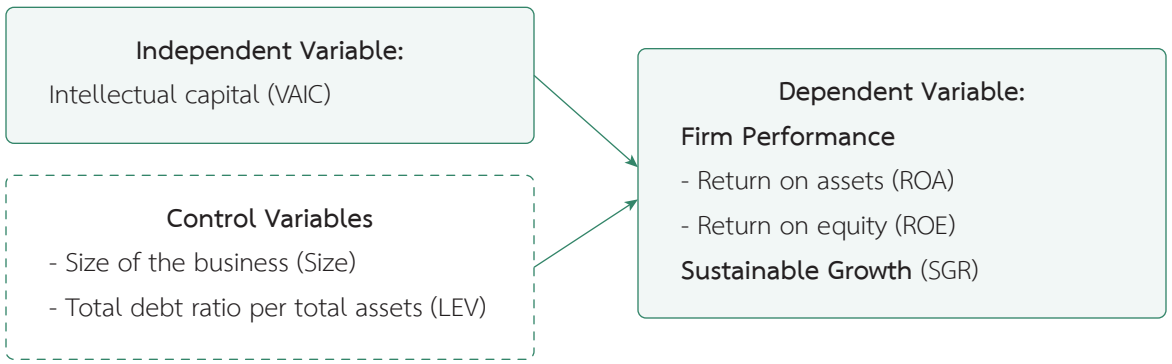

Figure 1 Conceptual Framework

Intellectual Capital

Intellectual capital (IC) enhances a business's competitiveness and sustainability, influencing its profitability (Charoenviriyakul et al., 2017; Mukherjee & Sen, 2019; Xu & Liu, 2020). Comprising various elements, intellectual capital includes human capital, structural capital, and relational capital, each with its specificities (Dženopoljac & Janoševic, 2016; Sardo, Serrasqueiro, & Alves, 2018) as follows:

Human Capital is the primary component of intellectual capital and stands as the most critical resource for a business. It enables the development of new strategies, fosters creativity, enhances innovation capabilities, and establishes sustainable competitive advantages. The measurement of human capital revolves around the abilities and skills of employees. Previous research has delved into the impact of human capital investment on business growth, considering both executive and non-executive positions. High-level human capital has been observed to positively influence business growth rates. In contrast, non-executive human capital has not been found to have such a significant impact (Sardo et al., 2018; Xu & Liu, 2020).

Human capital encompasses the current stock of talent, aptitude, education, abilities, and knowledge within a firm or a nation. It represents the intangible collective resources possessed by individuals and groups within a population. In economics, human capital refers to traits deemed valuable to a company. Companies can invest in human capital, for instance, through education and training, thereby enhancing levels of quality and production. Numerous theories explicitly link investment in human capital development to education, and the role of human capital in economic

development, productivity growth, and innovation has often been cited as a justification for government subsidies for education and job skills training (Charoenviriyakul et al., 2017; Mukherjee & Sen, 2019).

Structural Capital, a component of intellectual capital, endures within the business even after employees depart. It bolsters the effectiveness of human capital and is a pivotal factor in developing organizational capabilities to increase value and operational outcomes. Measured by capabilities, culture, processes, patents, copyrights, trademarks, databases, and other business aspects, structural capital encompasses the supportive infrastructure, processes, and databases that enable human capital to function. Owned by an organization, structural capital persists even when individuals leave, incorporating capabilities, routines, methods, procedures, and methodologies embedded in the organization (Sardo et al, 2018; Xu & Liu, 2020). The three sub-components of structural capital are:

1) Organizational Capital: Encompasses the organization's philosophy and systems for leveraging its capability.
2) Process Capital: Includes the techniques, procedures, and programs that implement and enhance the delivery of goods and services.
3) Innovation Capital: Encompasses intellectual property and certain other intangible assets. Intellectual property includes protected commercial rights such as patents, copyrights, and trademarks. Intangible assets encompass all other talents and theories by which an organization is run.

Relational Capital represents the business's capability to enhance relationships with external stakeholders. It is a challenging-to-develop component of intellectual capital, arising from the creation of human and structural capital, shaping stakeholders' perceptions of the business. The measurement of relational capital involves factors such as customer loyalty to the product, market image, market power, and business reputation (Dženopoljac & Janoševic, 2016).

Relational Capital is a subcategory of intellectual capital that focuses on the intangible value inherent in the relationships an organization maintains with business partners and other external parties, contributing to fulfilling the company's needs. It encompasses elements such as corporate reputation and customer potential. Relationship Capital is an asset that is challenging to measure, yet its importance is often underestimated. It consists of a company's extensive network of contacts and associations, including customers, partners, groups, and suppliers, all of which contribute to the value of relationship capital (Ratanacharoenchai, Rachapradit, & Nettayanun, 2018).

From past studies on intellectual capital in general, it is found that there are three components, namely Human Capital, Structural Capital, and Relational Capital (Xu & Liu, 2020). However, some research has indicated that the measurement of Relational Capital is not neutral, such as customer

satisfaction, customer loyalty to the product, market image, and market power (Kianto, Ritala, Vanhala, & Hussinki, 2020). Therefore, Pulic (1988) developed a different method for measuring intellectual capital that promotes financial performance, such as Tobin-Q, balance scorecard, and market capitalization methods. This led to the development of a model for measuring intellectual capital, known as the Value Added Intellectual Coefficient (VAIC), which consists of three components: Capital Employed Efficiency (CEE), Human Capital Efficiency (HCE), and Structural Capital Efficiency (SCE) (Xu & Liu, 2020). Capital Employed Efficiency (CEE) reflects the efficiency in generating added value from the business investment, measured by the net asset value.

Therefore, various methods exist for measuring intellectual capital, with the Value-Added Intellectual Capital (VAIC™) Model gaining popularity (Xu & Wang, 2018). This model utilizes financial statement data, incorporating information from profit and loss statements and balance sheets, along with factors tailored to each business type. The intellectual capital components used in measuring its value include:

1) Physical Capital: Measured by the efficiency of physical and financial capital (Capital Employed Efficiency).
2) Human Capital: Measured by the efficiency of investment in employee remuneration.
3) Structural Capital: Measured by the efficiency of operational systems and processes in conducting business activities.

Therefore, the researchers employ the VAIC™ Model to gauge the overall value of intellectual capital, given its popularity and applicability to businesses of all sizes.Therefore, the researchers use the VAIC™ Model to measure the overall value of intellectual capital, as it is popular and applicable to businesses of all sizes.

Firm Performance

Measuring firm performance involves evaluating the outcomes of a business's operations, encompassing both financial and non-financial aspects. Previous research exploring the relationship between intellectual capital and performance has predominantly relied on financial performance indicators. These indicators include the Return on Assets (ROA) (Xu & Liu, 2020; Xu & Wang, 2018; Sardo et al., 2018), Return on Equity (ROE) (Xu & Liu, 2020; Xu & Wang, 2018; Dženopoljac & Janoševic, 2016), return ratios from investments (Dženopoljac & Janoševic, 2016), and asset turnover ratios (Xu & Liu, 2020; Dženopoljac & Janoševic, 2016). In this research, particular emphasis is placed on measuring the firm's performance based on its ability to generate profits. Therefore, the performance metrics used include Return on Assets (ROA) and Return on Equity (ROE).

Sustainable Growth of Enterprises

In the context of Sustainable Growth, various perspectives have been applied. However, from a financial standpoint, Sustainable Growth refers to the business growth that can occur from sustainable profits in the future and also indicates the rate of business growth (Mukherjee & Sen, 2019). Therefore, sustainable growth refers to the continuous increase in a firm's value, which can only be indicated by ongoing and sustainable growth as the true reflection of an enterprise's progress (Xu & Liu, 2020). However, sustainable growth also reflects financial risks and capital flows resulting from capital management in business operations, thereby connecting value and growth from a value-added perspective. To measure a firm's sustainable growth, various concepts have been proposed. For example, Srijunpetch (2017) proposed a sustainable growth measurement method assuming that the asset-to-liability ratio and dividends remain constant while pre-tax profits, working capital, current liabilities, and other assets have increasing proportions as sales grow. Depreciation is considered as new investments in non-current assets.

Mukherjee & Sen (2019) proposed sustainable growth refers to the ability of a firm to expand and increase its performance over time in a manner that is economically viable, socially responsible, and environmentally sustainable. It involves a balanced and holistic approach that considers not only financial aspects but also social and environmental factors. To elaborate further and lead readers to a comprehensive understanding of 'sustainable growth,' delve into the following key points:

1 Triple Bottom Line Approach: Sustainable growth integrates the triple bottom line approach, which considers economic, social, and environmental dimensions. This means that a company aims not only for financial profit but also for positive social impact and environmental stewardship.

2 Long-Term Viability: Sustainable growth emphasizes the long-term viability of a firm. It goes beyond short-term gains and focuses on strategies that ensure the company's continued success while minimizing negative impacts on society and the environment.

3 Social Responsibility: Firms engaging in sustainable growth actively consider their social responsibilities. This includes fair treatment of employees, community engagement, and ethical business practices that contribute to the well-being of society.

4 Environmental Sustainability: Sustainable growth takes into account the environmental impact of business activities. Companies committed to sustainable growth adopt eco-friendly practices, reduce their carbon footprint, and consider environmental conservation in their operations.

5 Measurement Metrics: Discussing measurement metrics for sustainable growth is crucial. This can include indicators such as the company's carbon emissions, social responsibility initiatives,

employee satisfaction, and community involvement. Measurement metrics help assess the firm's progress towards sustainable growth goals.

Another approach, developed by Piriya-kun (2013), measures sustainable growth under the assumption that new shares will not increase, the profit rate from operations remains constant, increased investments respond to sales growth, the asset-to-liability ratio and dividend payout ratio remain unchanged, and depreciation represents the costs of maintaining assets (Xu & Liu, 2020). Moreover, Xu and Wang (2018) examined sustainable growth by measuring the extent to which firms can use internal capital information, enabling growth without relying on external borrowed capital, such as loans from banks or financial institutions. This approach considers factors such as net profit margin, return on assets, dividend payout ratio, and shareholder multipliers. The present study will use the model proposed by Xu and Wang (2018) for measuring sustainable growth, as it is applicable to all types of businesses.

Furthermore, depreciation is considered a new investment in non-current assets. Ratanacharoenchai, Rachapradit, & Nettayanun (2018) measure an entity's sustainable growth under the assumption that new stocks will not increase. Operating profit margin, increased investment in response to sales growth, assets-to-liabilities ratio, and dividend payout ratios remain unchanged, and depreciation represents the cost of maintaining the asset (Xu & Liu, 2020). Additionally, in Xu and Wang's study (2018), the sustainable growth of an entity is measured by the ratio that the entity can use internal funding, allowing the business to grow without relying on external financing sources such as loans from banks or financial institutions. The researchers use information about net profit, asset return, dividend payout, and equity multiplier in this research. Xu and Wang (2018) used a sustainable growth measurement model because it can be applied to all types of businesses.

Relationship between Intellectual Capital, Firm Performance, and Firm Sustainable Growth

The 'Relationship between intellectual capital, firm performance, and firm sustainable growth' section is pivotal in unraveling the intricate connections that exist among these key elements. Intellectual capital, encompassing components such as human capital, structural capital, and relational capital, plays a vital role in influencing both firm performance and sustainable growth.

Why Intellectual Capital Leads to Performance and Sustainable Growth: Innovation and Adaptability: Intellectual capital drives innovation, enabling firms to adapt to changing market conditions and stay ahead of competitors. This adaptability is crucial for both short-term performance and long-term sustainability (Mukherjee & Sen, 2019).

Knowledge Transfer: The transfer of knowledge within the organization ensures that intellectual capital is leveraged effectively, positively impacting performance metrics and contributing to sustainable growth. Strategic Decision-Making: Intellectual capital enhances the quality of decision-making processes. Informed and strategic decisions, influenced by intellectual capital, are likely to lead to improved performance and sustained growth over time. By elucidating these relationships, the research aims to provide a comprehensive understanding of how intellectual capital serves as a catalyst for enhanced performance and contributes to the sustainable growth of firms (Fengli, & Xu, 2021); Xu & Li, 2022).

Why Intellectual Capital Leads to Performance and Sustainable Growth:

Innovation and Adaptability: Intellectual capital drives innovation, enabling firms to adapt to changing market conditions and stay ahead of competitors. This adaptability is crucial for both short-term performance and long-term sustainability (Xu & Liu, 2020).

Knowledge Transfer: The transfer of knowledge within the organization ensures that intellectual capital is leveraged effectively, positively impacting performance metrics and contributing to sustainable growth (Bataineh, Abbadi, Alabood, & Alkurdi, 2022)

Strategic Decision-Making: Intellectual capital enhances the quality of decision-making processes. Informed and strategic decisions, influenced by intellectual capital, are likely to lead to improved performance and sustained growth over time (Mukherjee & Sen, 2019).

Earlier global studies exploring the influence of intellectual capital and its constituents on corporate performance have confirmed a positive correlation between intellectual capital, as assessed via the VAIC™ Model, and the financial performance of companies, signified by both Return on Assets (ROA) and Return on Equity (ROE) (Dženopoljac & Janoševic, 2016; Fengli & Xu, 2021; Ozkan, Cakan, & Kayacan, 2016; Xu & Wang, 2018). Similarly, past research conducted in Thailand on the repercussions of intellectual capital on corporate performance has also shown a favorable influence on the financial performance of companies (Bataineh et al., 2022; Thammaprasert et al., 2018; Xu & Li, 2022). Regarding the association between intellectual capital and enduring business growth, earlier investigations into the impact of intellectual capital on the prolonged growth of companies have demonstrated that intellectual capital serves as a bolstering factor for augmented operational efficacy, subsequently affecting sustainable growth (Mukherjee & Sen, 2019; Xu & Wang, 2018).

Research Hypotheses

Based on the literature review, the researcher has determined that the measurement of firm performance should include return on assets (ROA), return on equity (ROE), and sustainable business growth. Intellectual capital contributes to an increased firm performance, measured by the return

on total assets, because intellectual capital is a physical and human resource resulting from the development of a business to have capabilities in competitive advantage creation. This, in turn, affects the efficiency of the measured business performance (Bataineh et al., 2022; Xu & Li, 2022). Therefore, it is hypothesized that intellectual capital is related to the return on total assets.

H1: Intellectual capital has a positive relationship with return on assets (ROA).

Furthermore, intellectual capital also promotes an increase in firm performance, measured by the return on equity. This is because intellectual capital is a business resource that helps the company operate in response to the rapid changes in the economic environment. These changes impact the business operations positively, resulting in excellent firm performance (Fathi, Farahmand, & Khorasani, 2013). Therefore, it is hypothesized that intellectual capital is related to the return on equity.

H2: Intellectual capital has a positive relationship with return on equity (ROE).

Similarly, intellectual capital contributes to promoting sustainable growth rates for businesses. Intellectual capital is a valuable resource that enables businesses to have the capability to innovate and operate more effectively than their competitors, leading to sustainable business operations (Mukherjee & Sen, 2019). Therefore, it is hypothesized that intellectual capital is related to sustainable growth rates.

H3: Intellectual capital has a positive relationship with sustainable business growth.

RESEARCH METHODOLOGY

Population and Sample: This quantitative research investigates the relationship between intellectual capital, firm performance, and sustainable growth of companies listed on the Thai Stock Exchange between 2017 and 2020. Excluded from the study are financial sector industries, mutual funds and investment trusts, companies under rehabilitation, companies with incomplete variable data, companies with accounting periods not ending on December 31, and companies in the Market for Alternative Investment (MAI). The population initially includes a total of 1,810 firm-year observations. After excluding the specified groups, the final sample used for this research consists of 1,167 firm-year observations. This study employs a purposive sampling technique, and the sample details are outlined in Table 1 below.

Table 1 Number of Sample Groups

Companies used in the Research	Number of Companies				
	2560	2561	2562	2563	รวม
Companies listed on the stock exchange	433	443	472	462	1,810
Subtract Companies with incomplete data	(104)	(81)	(99)	(101)	(385)
Outlier data	(53)	(62)	(68)	(75)	(258)
Remaining	**276**	**300**	**305**	**286**	**1,167**

Table 2 Annual Data for Companies Categorised by Industry Group

Industry	No. of Samples	Percentage
1. Agriculture and Food Industry Group	142	12.20
2. Consumer Goods Group	87	7.50
3. Industrial Products Group	200	17.10
4. Property and Construction Group	231	19.80
5. Resources Group	105	9.00
6. Services Group	308	26.40
7. Technology Group	94	8.10
Total	**1,167**	**100.0**

Data Collection: The data for this study were sourced from the Securities and Exchange Commission (SEC) of Thailand website (www.sec.or.th). The dataset comprises financial statements, notes to the financial statements, annual reports, and Form 56-1 of publicly disclosed companies. The information was collected for the years 2017–2020 (Thai calendar years 2560–2563). During the period leading up to and the initial stages of the COVID-19 pandemic, there were no significant impacts on the Thai economic system (Widiastuti, Utami, & Purnamasari, 2022).

Research Model: The relationship between intellectual capital, firm performance, and the sustainable growth of companies listed on the Thai Stock Exchange was examined using multiple regression analysis. The testing model includes the following components:

$$ROA_{it} = \beta_1 + \beta_2 VAIC_{it} + \beta_3 Size_{it} + \beta_3 LEV_{it} \quad (1)$$

$$ROA_{it} = \beta_1 + \beta_2 VAIC_{it} + \beta_3 Size_{it} + \beta_3 LEV_{it} \quad (2)$$

$$SGR_{it} = \beta_1 + \beta_2 VAIC_{it} + \beta_3 Size_{it} + \beta_3 LEV_{it} \quad (3)$$

Variable Measurment

From the research equation, the definitions of each variable can be described as follows:

1. VAIC refers to Intellectual Capital, the business resource that enhances the firm's potential for sustainable competitive advantage, resulting in increased profitability. This is calculated using Public (1988) variables, which comprise three components:

1.1 VACA is Physical Capital, measured by the efficiency of physical and financial capital (Capital Employed Efficiency).

1.2 VAHC is Human Capital, measured by the efficiency of the cost incurred in employee compensation.

1.3 VASC is Structural Capital, measured by the efficiency of the operational systems and processes in the business.

Intellectual Capital (VAIC)

VAIC = CEE + HCE + SCE

VACA = VA / CE

VAHC = VA / HC

VASC = SC / VA

Where: VA = C + D + A + OP

C = Employee compensation

D = Depreciation

A = Disposal cost

OP = Operating profit

CE = Physical and financial capital (Total assets – Total liabilities)

HC = Human Capital (Salaries and wages of employees)

SC = Structural Capital (VA – HC)

2. Assessing operational performance and sustainable growth entails evaluating the outcomes of business operations, encompassing both financial and non-financial results, including:

2.1 Return on Assets (ROA): Calculated by dividing the earnings before interest and taxes (EBIT) by the total assets of company i at year t, where t corresponds to the years 2017–2020 (Xu & Wang, 2018).

2.2 Return on Equity (ROE): Computed by dividing the earnings before interest and taxes (EBIT) by the shareholder's equity of company i at year t, where t corresponds to the years 2017–2020 (Xu & Wang, 2018).

2.3 Sustainable Growth Rate (SGR): Calculated using the variables of Xu and Wang (2018), employing data from company i at year t, where t corresponds to 2017–2020.

SGR = Net profit ratio × Asset turnover ratio × Retention rate × Equity multiplier

Where: Net profit ratio = Net Income / Revenue
Asset turnover ratio = Revenue / Total asset
Retention rate = Total asset / Equity
Equity multiplier = 1 – Dividend Yield

The Sustainable Growth Rate (SGR) formula takes into account a company's profitability. A higher SGR suggests that a company can achieve sustainable growth at an accelerated rate without the necessity of increasing its financial leverage or issuing new equity.

3. Control variables

While this study examines the relationship between intellectual capital, operational performance, and sustainability, the analysis incorporates control variables that influence operational performance and the sustainability of the business. The control variables used include the size of the registered company and the debt-to-equity ratio.

Firm size (Size) measured by the logarithm of total assets of company i at year t, where t is equal to the years 2017–2020 (Thai calendar years 2560–2563)

As the total asset value reflects investments, it is anticipated that the size of the business would have a positive relationship with operational performance and the sustainability of the business in the market (Ozkan et al., 2016; Xu & Wang, 2018).

Debt-to-Asset ratio (LEV) calculated by dividing total debt by total assets of company i at year t, where t is equal to the years 2017–2020 (Thai calendar years 2560–2563).

Total debt to total assets is expected to have a negative relationship with operational performance and the sustainability of the business in the market (Ozkan et al., 2016; Xu & Wang, 2018).

RESEARCH FINDINGS

The presentation of basic data and distribution of performance outcomes, measured by return on total assets (ROA) ,return on equity (ROE) and intellectual capital (VAIC), is shown in Table 3. The results indicate differences in the studied variables, and the data distribution varies. It can be inferred that intellectual capital, its components, firm performance outcomes, and other variables during the study period significantly differ.

Table 3 Mean, Maximum (Max), Minimum (Min), and Standard Deviation (SD) Values of the Variables used in the Research.

Variables	n	Minimum	Maximum	Mean	StdDev
ROA	1,167	–.1238	.2504	.0604	.0612
ROE	1,167	–.2333	.4445	.1092	.1091
SGR	1,167	–.2330	.3086	.0401	.0791
VAIC	1,167	–2.8550	26.0353	6.7633	4.6524
SIZE (THB)	1,167	391,739,218	749,380,878,000	25,337,145,873	68,835,857,174
SIZE (Ln)	1,167	19.7900	27.3400	22.6641	1.4588
LEV	1,167	.0007	.8860	.4180	.1986

In the analysis, correlation values of the variables used in the tests are examined to determine the direction and significance of relationships among different variables. This helps identify potential multicollinearity issues among the independent variables. The assessment relies on the Pearson correlation coefficient, with a correlation value not exceeding 0.80, and the statistical Tolerance value not approaching 0. Additionally, the Variance Inflation Factor (VIF) should not exceed 4 or 5 (Piriya-akul, 2013) to indicate the absence of multicollinearity problems.

Table 4 Pearson Correlation Coefficients for the Test Variables

Variable	ROA	ROE	SGR	VAIC	SIZE	LEV
ROA	1	.866**	.711**	.140**	.080**	–.207**
ROE		1	.761**	.168**	.256**	.149**
SGR			1	.122**	.201**	.008
VAIC				1	.266**	.067*
SIZE (Ln)					1	.494**
LEV						1
Tolerance				.924	.630	.668
VIF				1.083	1.588	1.498

* Correlation is significant at the 0.10 level (2-tailed).

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

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

Table 4 presents the correlation coefficients for the variables used in the hypothesis testing, ranging between –0.207 and 0.761. The examination of two variables for hypothesis testing involves distinct models. Considering the Tolerance values, which range from 0.630 to 0.924, and the Variance Inflation Factor (VIF) values, which range from 1.083 to 1.588, it is evident that there is no multicollinearity issue among the variables used for hypothesis testing.

Testing the congruence of the relationship equation by considering the Sig. Value ≥ 0.05 indicates that the data for the variables are consistent with the model of the equation, allowing for the examination of variable relationships (Tapsiriakul, 2012). A significant value of 0.000 implies that the independent variables can explain the dependent variables in every equation. In addition, the investigation of the relationship between intellectual capital, firm performance, and sustainable growth of companies is shown in Table 5.

Table 5 Testing the Congruence of Relationship Equation and Hypothesis Testing Results

Variable	Model 1			Model 2			Model 3		
	Coef.	t-stat	p-value	Coef.	t-stat	p-value	Coef.	t-stat	p-value
Constant		–5.175	0.000***		–5.115	0.000***		–6.292	0.000***
$VAIC_{it}$	0.106	3.656	0.000***	0.110	3.757	0.000***	0.066	2.232	0.026**
$Size_{it}$	0.206	6.284	0.000***	0.208	6.183	0.000***	0.240	7.064	0.000***
LEV_{it}	–0.317	–9.874	0.000***	0.039	1.186	0.236	–0.115	–3.511	0.000***
Adjusted R^2	**0.095**			**0.075**			**0.053**		
F-test	41.821***			32.588***			**743.22*** **		

*, **, *** Correlation is significant at the 0.10, 0.05, 0.01 level (2-tailed).

Table 5 presents the research results aimed at addressing research objective 1. The findings reveal a significant positive relationship (P-value = 0.000) between intellectual capital and the return on assets (ROA), with a correlation coefficient of 0.106. This relationship is statistically significant at the 0.01 level. The control variable, firm size, also exhibits a similar positive relationship with ROA (P-value = 0.000). In contrast, the debt-to-asset ratio shows a significant negative relationship (P-value = 0.000) with ROA, reaching the 0.01 level of statistical significance.

Furthermore, the correlation test examining the relationship between intellectual capital and the return on equity (ROE) revealed a significant positive association (P-value = 0.000) with a correlation coefficient of 0.110. This positive relationship is statistically significant at the 0.01 level. Firm size, as a control variable, also exhibits a similar positive relationship with ROE (P-value = 0.000). However, no statistically significant relationship was observed between the debt-to-asset ratio and ROE.

In the section addressing the second research objective, the results indicate that the correlation test between intellectual capital and the sustainable growth rate (SGR) revealed a significant positive relationship (P-value = 0.026) with a correlation coefficient of 0.066. This positive relationship is statistically significant at the 0.05 level. Firm size, serving as a control variable, similarly demonstrated a positive relationship with SGR (P-value = 0.000). In contrast, the debt-to-asset ratio exhibited a significant negative relationship (P-value = 0.000) with SGR at the 0.01 level of statistical significance.

DISCUSSION

This research delving into the role of intellectual capital in firms listed on the Thai Stock Exchange brought to light the significance of value-added intellectual capital (VAIC), which emanates from investments in human capital (VAHC), encompassing personnel development and performance-related remuneration, as well as structural capital investments (VASC). These structural capital investments include the development of customer relationships, the establishment of knowledge-enhancing processes and systems, and tangible and financial assets or physical capital (VACA). The inferential statistical analysis of the data revealed a positive correlation between intellectual capital (VAIC) and the return on assets (ROA) for listed companies, even after considering potential influencing variables. This finding not only supports Hypothesis H1 but also aligns with the observations of Ozkan et al. (2016), who identified a statistically significant positive correlation between VAIC and ROA. This reinforces the conceptual model that posits intellectual capital's positive impact on ROA. However, it's noteworthy that this research diverges from the findings of Phondet (2020), who reported no significant relationship between VAIC and ROA. In sum, our research underscores that intellectual capital, comprising investments in human resources, internal processes and systems, and organizational resources, contributes to enhanced organizational performance by augmenting total assets.

This study affirms a positive correlation between the Value Added Intellectual Coefficient (VAIC) and Return on Equity (ROE) for firms listed on the stock market, thereby providing support for research hypothesis H2. This hypothesis posits a statistically significant positive relationship between VAIC and ROE, aligning with the conclusions of prior studies conducted by Luckanapisast, Sutthachai, & Likitwongkajon (2019) and Xu and Wang (2018). Our findings substantiate the notion that intellectual capital positively influences return on equity, highlighting a corresponding impact.

Furthermore, this study validates research hypothesis H3, suggesting that intellectual capital exhibits a positive correlation with the sustainable growth rate (SGR) of firms listed on the stock market, even when controlling for additional factors that might influence the SGR. This finding is consistent with prior studies conducted by Srijunpetch (2017), Thanjunpong, Chaiwong, & Awirothananon (2021), Xu and Wang (2018), and Ratanacharoenchai et al. (2018), which similarly identified a statistically significant positive relationship between VAIC and SGR.

Building upon the resource-based view of the firm, this study underscores intellectual capital as a resource, emphasising its value, rarity, uniqueness, and non-substitutability. These qualities of intellectual capital contribute to enhancing operational efficiency, which in turn drives superior performance and sustainable growth in firms.

CONCLUSION AND DIRECTION OF FUTURE RESEARCH

This research provides empirical evidence supporting the positive influence of intellectual capital on corporate performance and sustainable growth in firms listed on the Thai stock exchange. These findings align with the theoretical underpinnings of the resource-based view of the firm, which asserts that resources such as intellectual capital are critical determinants of competitive advantage and long-term corporate performance.

Intellectual capital emerges as a unique and invaluable resource that proves resistant to easy replication. Investments in intellectual capital have demonstrated a positive correlation with enhanced operational efficiency and overall firm performance. Notably, capital investments in the human, structural, and physical aspects have been observed to positively impact both firm performance and sustainable growth.

1. Theoretical Contribution

The findings from this research emphasize the importance for companies to focus on investments in intellectual capital to achieve sustainable growth and gain a competitive advantage. Companies are urged to develop strategies that facilitate the growth of employees' expertise, competencies, and capacities, establish internal processes to enhance operational efficiency, and nurture customer relationships to strengthen organizational resources. This research contributes to the scholarly discussion on intellectual capital and firm performance by providing empirical evidence that supports the resource-based view of the firm. The results suggest that intellectual capital is a critical factor in attaining competitive advantage and sustaining firm performance.

2. Managerial Contribution

For organizations, intellectual capital plays a crucial role in driving business productivity and ensuring sustainable growth. It encompasses three interrelated elements: human capital, physical capital, and structural capital. Hence, corporations should prioritize investments in human resources, internal systems, and structural resources. This strategic approach strengthens a corporation's operational capabilities, fostering continuous business expansion and achieving established goals. In addition, investors and shareholders can use information about investments in intellectual capital of a company to assess the development potential in the company's operations continuously. This aids in making decisions regarding future investments.

Future Research

Suggestions for Future Research: Scholars should evaluate business performance by gauging return on assets (ROA) and equity (ROE). Researchers intrigued by the correlation between intellectual capital and business performance could consider introducing other performance metrics, such as market-to-book value, economic value added (EVA), and Tobin's Q ratio. Additionally, future studies could corroborate the role of intellectual capital in ascertaining business worth through alternative methodologies. Exploring the nexus between intellectual capital and sustainable growth, particularly by contrasting developed and developing countries, should be considered for subsequent research.

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