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Investigation of intellectual capital and firm performance in Thailand: Mediating role of earnings quality

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ABSTRACT

This study was conducted to investigate two main aspects. First, it seeks to analyze how intellectual capital impacts firm performance. Second, it examines how intellectual capital impacts firm performance through earnings quality. To achieve these objectives, 114 financial datasets from service businesses listed on the Stock Exchange of Thailand (SET) during the period from 2019 to 2020 were utilized. The hypotheses were tested through various analytical techniques, including descriptive statistics, normality tests, a correlation matrix, structural equation models, and path analysis. The findings revealed that earnings quality indirectly impacted firm performance, as assessed by Tobin's Q and return on assets. The study demonstrated that earnings quality, measured through discretionary accruals, served as a partial mediator between intellectual capital and return on assets. Furthermore, earnings quality was identified as a full mediator in the association between intellectual capital and Tobin's Q. After analyzing the data during the COVID-19 pandemic, it was found that businesses that utilized information technology systems and employed efficient distribution channels demonstrated high relational capital efficiency (RCE). This efficiency positively affected market value. The practical contribution of this study provides managers with measurement methods for intellectual capital development, enabling them to enhance operational efficiency in intellectual capital and generate high earnings quality that reflects market value. Additionally, it highlights the importance of adapting to digital-era economic changes. Regulatory bodies can further promote and support intellectual capital to increase market value.

Contribution/Originality: The study has made significant contributions to the field of business administration by examining the relationships among intellectual capital, earnings quality, and firm performance. These actions contribute positively to profitability and reflect the market value of businesses, particularly within the context of the digital economy.

1. INTRODUCTION

Businesses have actively embraced digital transformation and leveraged intellectual capital to attain a competitive edge. The term "intellectual capital" gained prominence and sparked extensive discussion within business circles during the 20th century (Garanina, Hussinki, & Dumay, 2021). It encompasses the knowledge and skills of individuals, offering opportunities for learning from both personal experiences and the expertise of others (Wang, Jin, & Banister, 2019). Human capital, which includes work experience, can be further developed through training initiatives (Joshi, Cahill, Sidhu, & Kansal, 2013). This strategic focus on intellectual capital contributes to maximizing

overall value and enterprise worth (Kaplan, 2009). Nevertheless, organizations maintain a vigilant approach in managing their technological investments, aiming to modernize operational processes and maximize outcomes.

According to Boonchukham, Dampitakse, and Pholkaew (2023), intellectual capital positively impacts performance. The outcomes of this study validate the presence of direct positive impacts between intellectual capital and performance, focusing on the examination of direct impacts affecting the dependent variables. The study also explored the factors influencing operating results in the COVID-19 pandemic context and investigated how changes in accounting standards for revenue recognition would affect Thai listed companies.

In 2019, the International Accounting Standards Board (IASB) and the United States Accounting Standards Board (FASB) collaborated to develop new financial reporting standards to address inconsistencies in core revenue recognition criteria between the IFRS and the US Generally Accepted Accounting Practices (GAAP). The objective was to reduce financial problems and enhance the quality of financial statements. This initiative aimed to eliminate past flaws and conflicts in accounting standards, resulting in the establishment of a comprehensive framework and unified guidelines for revenue recognition across all contract types (Hammad, 2019). The modified value added intellectual capital (MVAIC) model was employed to determine intellectual capital, which comprises the following components: Human capital efficiency (HCE), structural capital efficiency (SCE), capital employed efficiency (CEE), and relational capital efficiency (RCE).

In this study, the impact of intellectual capital on operational performance was investigated, specifically through the lens of earnings quality, during the COVID-19 pandemic. In addition, the impact of adopting financial reporting standards within the context of listed companies in the service industry was investigated.

1.1. Research Objectives

The primary objectives of this study are as follows:

1. To investigate the impact of intellectual capital on firm performance.
2. To investigate the impact of intellectual capital on firm performance through earnings quality.

2. REVIEW OF LITERATURE

2.1. Intellectual Capital

Ulum, Ghozali, and Purwanto (2014) outlined the constituent components of intellectual capital. These elements encompass the extent of intellectual capital through the evaluation of the effectiveness of human capital, structural capital, relational capital, and employed capital components, all of which are explained below.

2.1.1. Human Capital Efficiency (HCE)

Human capital efficiency shows added value created by a firm through fund allocation in the forms of salary and labor wages. Knowledge, the ability to innovate, commitment, and wisdom of employees make human capital a crucial component of intellectual capital and a crucial strategic resource for success, since employees' skills and knowledge is crucial in a linear competitive atmosphere and a fast-changing pace. However, several studies have shown that the characteristics of many employees and managers seem to be associated with corporate innovative capabilities (Akhter, 2020; Albertini & Berger-Remy, 2019; Andes, Nuzula, & Worokinasih, 2020; Wang et al., 2019).

2.1.2. Structural Capital Efficiency (SCE)

Structural capital consists of knowledge in the forms of databases, organization charts, guidelines, strategies, and high-value activities to build corporate processes and values that reflect the external and internal compositions and value for future renewal and development. Support structure funding is based on systematic and explicit internal knowledge, such as values, culture, routine, processes, protocols, procedures, technological innovations, and intellectual property. Determining the knowledge generated by organizations that cannot separate juristic persons,

such as structural capital, can be an invention of the licensing process, patents, and technology system strategies. In addition, funds with structures of all types of intellectual property are valuable strategic assets consisting of non-human assets (Costa, Fernández-Jardon Fernández, & Figueroa Dorrego, 2014; Joshi et al., 2013).

2.1.3. Capital Employed Efficiency (CEE)

Capital employed efficiency is the value-adding work unit and actual value of asset capital (Andes et al., 2020; Ulum, Kharismawati, & Syam, 2017). Capital employed efficiency is included in physical capital and financial measurement by the VAIC™ approach despite the fact that the value added to these assets can be measured individually (Akhter, 2020).

2.1.4. Relational Capital Efficiency (RCE)

Relational capital refers to the steady performance of responding to market intelligence, analyses, and loyalty to customer relationships. It is also an intellectual asset related to the management and organization of external relationships of a company (Akhter, 2020).

The MVAIC model is shown as follows:

MVAIC model = Human Capital Efficiency + Structural Capital Efficiency + Relational Capital Efficiency + Capital Employed Efficiency.

Table 1. MVAIC variables and measurement.

Variables	Symbol	Measurement
Independent variables		
• Human capital efficiency	HCE	VA/HC
• Structural capital efficiency	SCE	SC/VA
• Relational capital efficiency	RCE	RC/VA
• Capital employed efficiency	CEE	VA/CE
MVAIC model	MVAIC	HCE+SCE+RCE+CEE

Note: VA = Value Added (operating profit + employee expenditures + depreciation + amortization).
HC = Human Capital (total salaries and wages).
SC = Structural Capital (VA-HC).
RC = Rational Capital (marketing costs, and cost distribution channel and network).
CE = Capital Employed (book value of total assets)

Table 1 shows how this study addressed the gap in the traditional VAIC™ model by adopting the modified value added intellectual capital (MVAIC) model as a measurement tool for intellectual capital.

2.2. Firm Performance

Based on the literature review, two dependent variables that are impacted by intellectual capital were used: ROA, which assesses profitability based on accounting and financial information, and Tobin's Q, which evaluates market value.

2.2.1. Return on Assets (ROA)

Return on assets serves as a metric for evaluating management efficiency by gauging the ability of all assets to generate profits or returns for the business relative to the factors of funds or the cost of funds. A higher percentage signifies stronger company performance, indicating effective utilization of assets to drive operations and generate improved sales.

2.2.2. Tobin's Q

This study used the concept of Chung and Pruitt (1994) for Tobin's Q, the Nobel Prize concept proposed by Tobin (1969). This concept is a useful indicator for integrating knowledge through financial statements and market

value data of joint ventures. Such an improvement introduced the use of the book value of assets instead of the asset replacement price, while the Tobin's Q value is similar to the concept of Lindenberg and Ross (1981), which is complex and takes a long time to collect the data.

Thus, Tobin's Q developed by Chung and Pruitt (1994) was suitable for this study to calculate the organizational market value using the data from the stock market.

Table 2. Firm performance variables and measurements.

Variables	Symbol	Measurement
Dependent variable		
• Return on assets	*ROA*	$\frac{\text{Profit (Loss) before Interest and Income Tax Expense)}}{Total\ Assets\ (average)}\ x\ 100$
		(Aras, Aybars, & Kutlu, 2010)
• Tobin's Q	*TBQ*	$\frac{MVE + PS + DEBT}{TA}$ Where MVE represents the outcome of multiplying the steady share price by the total outstanding common shares; PS denotes the liquidation value attributed to the company's exclusive preference shares; DEBT refers to the net amount of short-term liabilities adjusted by the short-term assets and expanding the inclusion of the long-term debt's book value within the company; and TA represents the book value associated with the corporation's overall assets.
		(Antonio, Laela, & Darmawan, 2019)

The indicators of this variable (return on assets and Tobin's Q) were obtained from the literature review and were therefore chosen for this study.

2.3. Earnings Quality

Earnings quality is a metric that reflects the quality of financial statements (Dechow, Ge, & Schrand, 2010). It provides insights into maintaining earnings levels across different time periods and impacts investor perceptions of capital market decisions (Dechow et al., 2010), thus assisting financial lenders in decision-making.

Multiple approaches exist to measure earnings quality through earnings management, including DeAngelo (1986); Francis, LaFond, Olsson, and Schipper (2005); Healy (1985); Jones (1991); and Sloan (1996). However, in this study, the Modified Jones model developed by Dechow, Sloan, and Sweeney (1995) was chosen. According to this model, there are non-discretionary accruals and discretionary accruals for earnings management. The study focused on examining earnings quality utilizing the Modified Jones model due to its robustness compared to the DeAngelo (1986) and Jones (1991) models (Alareeni & Aljuaidi, 2014). This study explores how the management discretionary backlog affects earnings quality.

Previous literature has pointed out that earnings quality (discretionary accrual) is impacted by several factors (Alareeni & Aljuaidi, 2014). The formula shown in Table 3 can be used to calculate earnings quality.

Table 3. Earnings quality variable and measurement.

Variable	Symbol	Measurement
Mediating variable		
• Discretionary accruals	*DA*	$DA_{it} = \frac{TA_{it} - NDA_{it}}{A_{it}}$

Note: DA_{it} = Firm i's discretionary accruals in year t.
TA_{it} = Firm i's total accruals in year t.
NDA_{it} = Firm i's non-discretionary accruals in year t.
A_{it} = Firm i's total assets in year t.
Source: Sarea and Alansari (2016)

2.4. Control Variables

In order to enhance the clarity, additional variables, known as control variables, were incorporated. Table 4 details the control variables of firm size, age, and leverage.

Table 4. Control variables and measurement.

Variables	Symbol	Measurement
Control variables		
• Firm size	LnSize	Logarithm of the total assets of the firm (Beekes & Brown, 2006; Brown & Caylor, 2009)
• Firm age	AGE	The number of years the firm has been listed on the Stock Exchange of Thailand (SET) (Ariff, Islam, & Van Zijl, 2016; Idris, 2020)
• Leverage	LEV	Total debt x100 / Total assets (Ariff et al., 2016; Magnanelli & Izzo, 2017)

2.5. Agency Theory

The relationship between an owner and a manager (agent) was described as the identification of a conflict of interest between both parties (Jensen & Meckling, 1976). Earnings management was used to control revenue for the benefit of the agent and temporarily increases firm value. In addition, agency theory was applied, since intellectual capital assessment is under the management of the company. In other words, the power to exercise decision-making capabilities and effectively run the organization is based on the policies and strategies to generate income. Thus, earnings from intellectual capital management are assessed to reveal the earnings quality.

2.6. Intellectual Capital Theory

According to Sveiby (1997), in addition to knowledge management, intellectual capital also focuses on human capital management and organizational structure to strengthen organizations and create a competitive advantage. Organizations have valuable tangible and intangible resources, such as knowledge, technology, human resources, current assets, non-current assets, together with the associations with current customers and business collaborators. Intellectual capital theory indicates that intellectual capital can be developed based on ideas and practices that impact organizations.

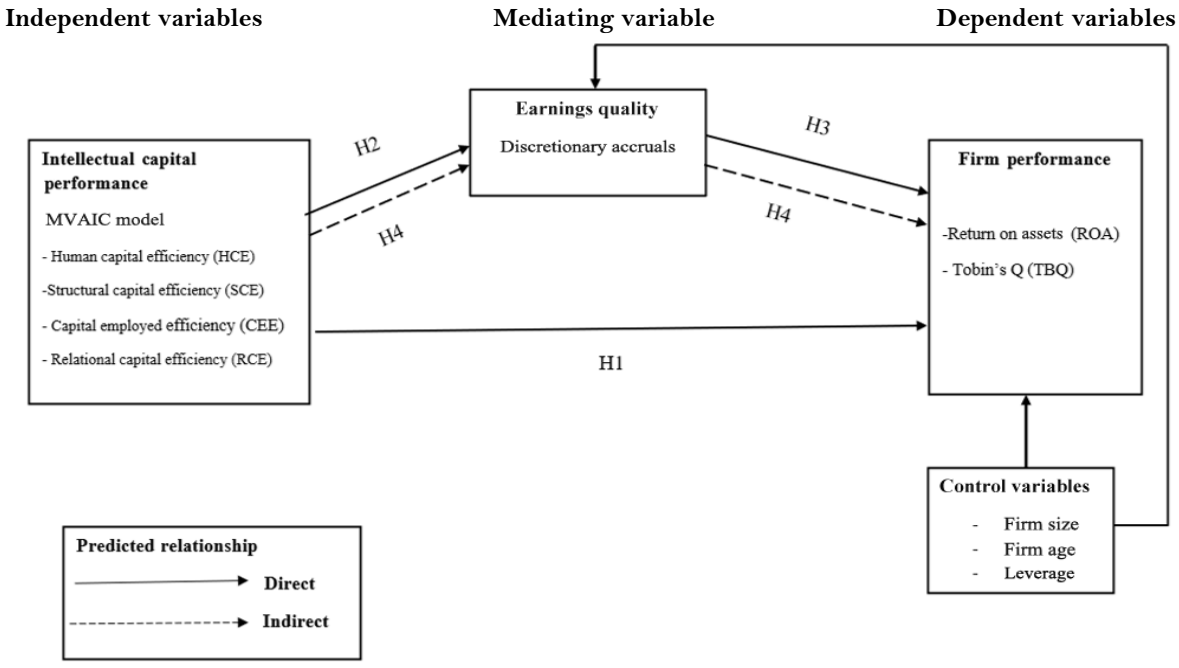

Figure 1. Conceptual framework.

Figure 1 shows the conceptual framework of the two perspectives that were considered: the financial perspective, which includes return on assets (Ariff et al., 2016), and the market value perspective, measured by Tobin's Q (Antonio et al., 2019). The study focused on four independent variables: human capital, structural capital, capital employed, and relational capital (Ulum et al., 2014). These variables were computed using the MVAIC model before being utilized in the testing model. The mediator variable is earnings quality, measured by discretionary accruals (Dang, Nguyen, & Tran, 2020). To reduce deviation, control variables of size (Brown & Caylor, 2009), age (Nimtrakoon, 2015) and leverage (Ariff et al., 2016) were added.

2.7. Research Questions and Hypotheses

Research Question 1: How does intellectual capital impact firm performance?

Ariff et al. (2016) suggested that combined intellectual capital positively impacts marketing performance. Thus, the hypotheses were developed as follows:

Hypothesis 1: Intellectual capital positively impacts firm performance.

H1a: Intellectual capital positively impacts the return on assets.

H1b: Intellectual capital positively impacts Tobin's Q.

Research Question 2: How does intellectual capital impact earnings quality?

According to Sarea and Alansari (2016), a substantial correlation exists between intellectual capital and the quality of earnings. However, certain researchers have posited that earnings quality acts as an essential intermediary factor, linking the precision of financial reporting to the overall performance of the firm (Ma & Ma, 2017). Thus, the hypothesis was developed as follows:

Hypothesis 2: Intellectual capital positively impacts earnings quality.

Research Question 3: How does earnings quality impact performance?

According to Handoko and Ahmar (2016), the utilization of accrual-based earnings management impacts the market growth of manufacturing companies listed on the Indonesia Stock Exchange, as assessed by Tobin's Q. Thus, the hypotheses were developed as follows:

Hypothesis 3: Earnings quality positively impacts firm performance.

H3a: Discretionary accruals (DA) negatively impact return on assets.

H3b: Discretionary accruals (DA) negatively impact Tobin's Q.

Research Question 4: How does intellectual capital affect firm performance through earnings quality?

According to Antonio et al. (2019), indirect corporate governance greatly impacts firm performance mediated by earnings quality.

Hypothesis 4: Intellectual capital impacts firm performance through earnings quality.

H4a: Discretionary accruals (DA), as a mediating variable, indirectly impacts intellectual capital (MVAIC) toward ROA.

H4b: Discretionary accruals (DA), as a mediating variable, indirectly impacts intellectual capital (MVAIC) toward Tobin's Q.

3. RESEARCH METHODS

3.1. Methodology

This study employed data from 2019 and 2020. Path analysis statistics and structural equation modeling (SEM) were utilized to estimate and analyze the relationships among the variables.

3.2. Sample Selection and Data Collection

A sample of 114 firm-year observations from the service industry listed on the Stock Exchange of Thailand in 2019 and 2020 were chosen; a sample size of 100 to 200 was recommended by Hoyle (1995). In this study, the outlier was eliminated using the boxplot technique for 64 firm-year observations. The data exhibited a normal distribution, rendering it suitable for statistical analysis. The utilization of structural equation modeling analysis employing the maximum likelihood estimation method was introduced by Bentler and Lee (1978).

Table 5. Samples in financial statement research in 2019-2020.

Description	Number of firms
Companies in the service industry listed on the Stock Exchange of Thailand (2019–2020)	229
Excluding:	
Companies in rehabilitation	2
Companies with unavailable information	49
Outliers by boxplot technique	64
Final sample	114

Source: SETSMART (2021).

Table 5 presents the population of listed companies between 2019 and 2020. All sectors under the service industry were included in the research; however, companies in the process of rehabilitation and those with unavailable or incomplete information were excluded from this research. Therefore, the research sample for this study comprised only 114 firms. The data were collected from SETSMART and Form 56-1 reported to the Stock Exchange of Thailand.

3.3. Data Analysis

This study employed descriptive and inferential statistics. Descriptive statistics were employed to showcase the values of the independent and dependent variables, specifically intellectual capital, in the forms of minimum, maximum, mean, and standard deviation. In addition, discretionary accruals was employed as the mediating variable. Control variables of firm size, firm age, and levels of debt and assets were also taken into account.

Various techniques were employed for inferential statistics. Normality tests were conducted to assess the distribution of the data. To explore the connections between variables, a correlation matrix was constructed. Path analysis statistics and structural equation modeling (SEM) were utilized to analyze the connections among the variables and evaluate the proposed theoretical model.

3.4. Structural Equation Modeling (SEM)

AMOS, a statistical software program used for conducting structural equation modeling (SEM), was employed to evaluate the consistency and appropriateness of the model and empirical data. This analysis involved assessing the agreement between the model and the observed data, and it also helped to reduce the sample covariance and the covariance matrix of the observed variables. The goodness-of-fit was evaluated based on the following conditions: Chi-square/df acceptable level value < 3; p-value of Chi-square > 0.05; root mean square residual < 0.05; goodness of fit index > 0.90; adjust goodness of fit index > 0.90; comparative fit index > 0.90; norm fit index > 0.90; root mean square error of approximation < 0.05 (Diamantopoulos & Siguaw, 2000; Hair, Ringle, & Sarstedt, 2011; Hu & Bentler, 1999).

The SEM and path analysis have set criteria for determining whether the tested model is consistent with the empirical data (Kline, 2018). At least four tests are recommended: X^2, GFI, NFI or CFI, and Standardized Root Mean Square Residual (SRMR). According to Baron and Kenny (1986), testing the mediating variables can be divided into

three categories which are directly or indirectly caused by independent variables (X) to dependent variables (Y) as presented below.

1. Total effect (c) = c' + ab
2. Direct effect (c') = c – ab
3. Indirect effect (ab) = c – c'

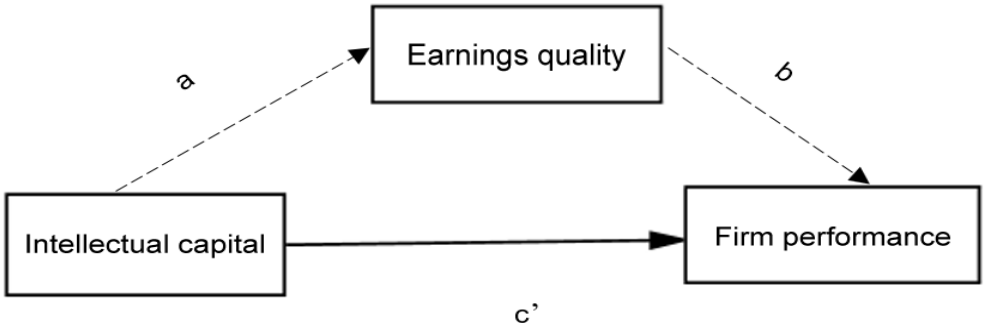

Figure 2. Mediation test.

Note: Baron and Kenny (1986).

Figure 2 depicts the examination of the mediation effect of earnings quality on intellectual capital and firm performance. Three main types of simple mediation were considered: 1. Full mediation, 2. Partial mediation, and 3. Direct effect.

Table 6. Summary of variable.

Variable type		Abbreviation	Hypotheses	Reference
Independent variable				
	Intellectual capital	MVAIC	H1a,H1b, H2,H3a, H3b,H4a, H4b	Ulum et al. (2014) and Ulum et al. (2017)
Mediating variable				
	Discretionary accruals	DA	H3a,H3b, H4a,H4b	Mojtahedi (2013) and Sarea and Alansari (2016)
Dependent variables				
	Return on assets	ROA	H1a, H4a	
	Tobin's Q	TBQ	H1b, H4b	Antonio et al. (2019)
Control variables				
	Firm size	LnSize	H1a,H1b, H2,H3a, H3b,H4a, H4b	Brown and Caylor (2009)
	Firm age	AGE	H1a,H1b, H2,H3a, H3b,H4a, H4b	Nimtrakoon (2015)
	Leverage	LEV	H1a,H1b, H2,H3a, H3b,H4a, H4b	Ariff et al. (2016)

Table 6 shows the indicators of this variable obtained from the literature review, including the intellectual capital (MVAIC) model, discretionary accruals (DA), return on assets (ROA), Tobin's Q (TBQ), firm size (LnSize), firm age (AGE), and leverage (LEV).

In accordance with the mediation test proposed by Baron and Kenny (1986), the presence and nature of mediating effects can be determined. If the independent variable impacts the dependent variable significantly without the involvement of the mediating variable, it suggests the absence or lack of a direct effect. Conversely, when the independent variable significantly impacts the dependent variable through the mediating variable, it suggests partial mediation. Full mediation, on the other hand, transpires when the independent variable does not have a direct impact on the dependent variable, but rather exerts an impact solely through the mediating variable.

4. RESULTS

4.1. Descriptive Statistics

Fundamental statistical measures, such as minimum, maximum, mean, and standard deviation were utilized for analyzing general data. The study examined the correlation between intellectual capital as the independent variable, earnings quality as the mediating variable, and return on assets (ROA) and Tobin's Q as the dependent variables. Controlling variables of firm size, firm age, and leverage were also considered. The analysis outcomes are presented in Table 7.

Table 7. Descriptive statistics of variables (n = 114).

Variable	Min.	Max.	Mean	Std. deviation	Skew.	Kurt.
MVAIC	0.15	11.37	4.97	2.72	0.63	-0.49
DA	0.01	1.43	0.48	0.29	0.39	-0.32
ROA	-10.79	28.06	6.67	7.01	0.44	0.52
TBQ	0.29	4.66	1.80	1.07	1.00	-0.23
LnSize	13.19	20.08	15.61	1.55	0.76	0.19
AGE	1.00	65.00	30.28	14.24	-0.04	-0.17
LEV	0.03	0.80	0.40	0.19	0.08	-0.96

Note: MVAIC = Intellectual capital, DA = Discretionary accruals, ROA = Return on assets, TBQ = Tobin's Q, LnSize = Logarithm of total assets of the firm, AGE = The number of years the firm has been listed on the SET, LEV = Leverage.

The independent variable, intellectual capital (MVAIC), showed an average value of 4.97, the minimum and maximum values were 0.15 and 11.37, respectively, and the standard deviation was 2.72.

The mediating variable, earnings quality, was assessed based on discretionary accruals (DA). The mean was found to be 0.48, with a range between 0.01 and 1.43. The standard deviation of DA was determined to be 0.30.

For the dependent variables, ROA showed an average value of 6.67, the minimum and maximum values were -10.79 and 28.06, respectively, and the standard deviation was 7.01. Tobin's Q (TBQ) showed an average value of 1.80, the minimum and maximum values were 0.29 and 4.66, respectively, and the standard deviation was 1.07.

The controlling variables of firm size, age, and leverage are summarized as follows. Firstly, the mean natural logarithm of firm size (LnSize) showed an average value of 15.61, with a minimum of 13.19, a maximum of 20.08, a standard deviation of 1.55, a skewness value of 0.76 and a kurtosis value of 0.19. Secondly, firm age (AGE) showed an average value of 30.28, a minimum of 1.00, a maximum of 65.00, a standard deviation of 14.24, skewness of -0.04, and kurtosis of -0.17. Finally, leverage (LEV) showed an average value of 0.40, minimum and maximum values of 0.03 and 0.80, respectively, and a standard deviation of 0.19.

4.2. Normality Testing

To assess the normality of the data, two commonly used indicators are skewness and kurtosis. According to Curran, West, and Finch (1996), skewness is considered a more significant indicator. A kurtosis value exceeding 10 indicates a departure from normal distribution, and values exceeding 20 suggest a more pronounced deviation. In this study, the range of skewness values was from 0.91 to -0.28, while the range of kurtosis values was from 0.92 to -0.96, as presented in Table 7.

Table 8. Correlation matrix.

Variable	MVAIC	DA	ROA	TBQ	LnSize	AGE	LEV
MVAIC	1						
DA	-0.322**	1					
ROA	0.276**	0.209*	1				
TBQ	0.062	0.238*	0.602**	1			
LnSize	0.114	-0.066	-0.015	0.129	1		
AGE	-0.026	-0.117	0.045	-0.110	0.026	1	
LEV	0.015	0.035	-0.267**	-0.145	0.564**	-0.103	1

Note: ** and * indicate statistical significance at the 0.01 and the 0.05 levels, respectively.

These findings indicate normality in the data. Furthermore, Vanichbuncha (2013) recommended that skewness values should fall within the range of -1 to +1 for a normal distribution. After conducting these evaluations, it was determined that the data followed a normal distribution, and a structural equation model was employed for the analysis.

Table 8 displays the correlation coefficients, which provide insights into the magnitude and direction of the relationships between pairs of variables (Devore & Peck, 1993). The following observations can be made based on the correlation coefficient magnitudes. When two variables exhibit a strong correlation, the correlation values will be below -0.80 or above 0.80. In the case of moderate correlation, the values will fall within the range of -0.50 to -0.80 or 0.50 to 0.80. Conversely, if two variables have a weak correlation, the values will range between -0.50 and 0.50. Upon examination of the correlation coefficient findings, it became apparent that the variables exhibited a range of weak to moderate interrelationships, as evidenced by correlation coefficients ranging from -0.322 to 0.602. This implies that the associations between the variables are not consistently strong, suggesting varying degrees of impact and dependency. Thus, the nature of the relationships among the variables can be clarified as follows.

1. Discretionary accruals (DA) had a relationship in the opposite direction with intellectual capital (MVAIC), with a correlation value of -0.322**, indicating that the relationship between DA and MVAIC was low but statistically significant at the level of 0.01.

2. Discretionary accruals (DA) had a relationship in the same direction as Tobin's Q (TBQ), with a correlation value of 0.238*, indicating that the relationship between DA and TBQ was low but statistically significant at the level of 0.05.

3. Discretionary accruals (DA) had a relationship in the same direction as return on assets (ROA), with a correlation value of 0.209*, indicating that the relationship between DA and ROA was low but statistically significant at the level of 0.05.

4. Tobin's Q (TBQ) had a relationship in the same direction as return on assets (ROA), with a correlation value of 0.602**, indicating that the relationship between TBQ and ROA was moderately and statistically significant at the level of 0.01.

Upon examining the correlation matrix, it was observed that the variables employed in this study displayed a low level of interrelationship, indicating that they can be subjected to further examination through inferential statistics. This suggests that there is potential for exploring the relationships and dependencies among the variables in more detail.

4.3. Structural Equation Model

Since this study primarily aimed to explore how intellectual capital impacts performance through earnings quality, the model tests conducted are as follows:

Model 1: Hypothesis test of the impact of intellectual capital (MVAIC) on return on assets (ROA) through discretionary accruals (DA).

Figure 3 presents the model fit for assessing how intellectual capital (MVAIC) impacts ROA through discretionary accruals (DA). The findings demonstrate a successful integration of the models with the empirical data. Notably, the evaluation metrics support this conclusion: a CMIN/df ratio of 0.890, a p-value of 0.486 for the Chi-square test, a GFI value of 0.987, an AGFI value of 0.947, a CFI value of 1.000, a NFI value of 0.953, and an RMSEA value of 0.000. Consequently, the model exhibits a favorable fit for testing the hypotheses, as presented in Table 9.

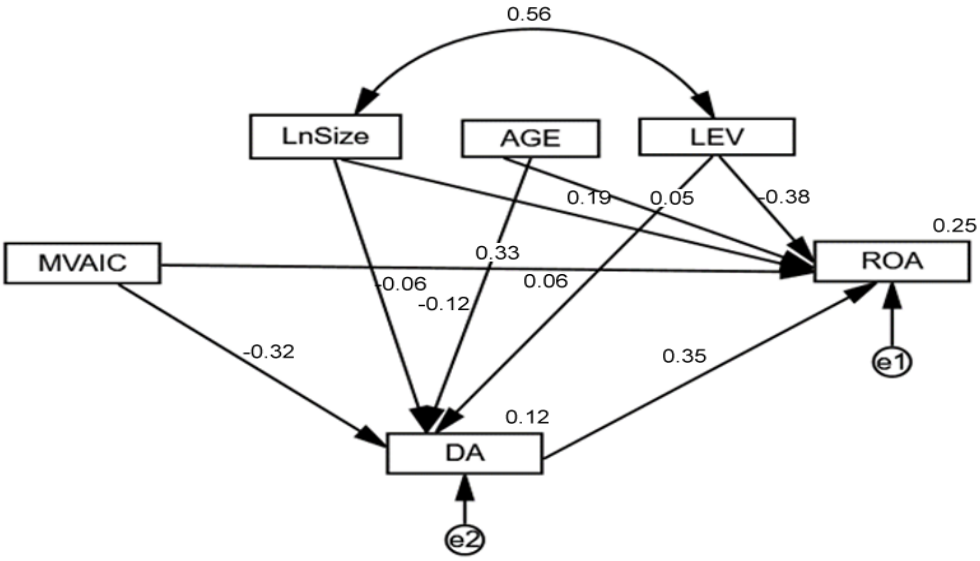

Figure 3. Structural model of inspection: The impact of intellectual capital (MVAIC) on ROA through discretionary accruals (DA).

Table 9. Parameter estimation and the significance test for the influence of intellectual capital (MVAIC) on ROA through discretionary accruals (DA).

Path	Regression weight		CR	P-value	Decision	Conclusion
	Estimate	SE				
ROA<--- MVAIC	0.334	0.221	3.878	0.000*	H1a: Supported	Significant
DA <--- MVAIC	-0.320	0.010	-3.626	0.000*	H2, H4a: Supported	Significant
ROA <--- DA	0.348	2.029	4.024	0.000*	H3a: Supported	Significant
DA <--- LEV	0.062	0.166	0.668	0.504		Insignificant
DA <--- LnSize	-0.061	0.021	-0.575	0.565		Insignificant
DA <--- AGE	-0.118	0.002	-1.333	0.182		Insignificant
ROA <--- AGE	0.050	0.040	0.610	0.542		Insignificant
ROA <--- LEV	-0.385	3.581	-3.885	0.000*		Significant
ROA <--- LnSize	0.185	0.446	1.873	0.061		Insignificant

Note: * = p-value < 0.05.

Table 9 presents the parameter estimation and significance test regarding the impact of MVAIC on ROA through DA. The outcome demonstrates that the proposed model aligns with the empirical data, as indicated by the significant parameters associated with each variable. This underscores the importance of examining the critical ratio (CR) and standard error (SE) values. Model 1 provides a comprehensive presentation of the findings as follows:

(1) A positive association between DA and ROA indicates that an increase in the absolute value of DA is positively related to ROA. These findings support the inference that earnings quality negatively affects ROA, as indicated by a CR of 4.005 and a p-value of 0.000 < 0.05. Thus, DA show statistical significance at the 0.05 level.

(2) MVAIC had a favorable impact on ROA, supported by a CR of 3.869 and a p-value of 0.000, which is lower than the significance level of 0.05. This suggests that intellectual capital holds significant statistical importance at the 0.05 level.

(3) A negative association between MVAIC and DA indicates that an increase in intellectual capital is linked to a decreasing absolute value of DA. Therefore, it can be inferred that intellectual capital positively impacts the quality of earnings, supported by a CR of -3.626 and a p-value of 0.000, which is less than the significant level of 0.05. These outcomes provide statistical proof of the significant impact of intellectual capital at the 0.05 level.

Model 2: Hypothesis test of the impact of intellectual capital (MVAIC) on Tobin's Q (TBQ) through discretionary accruals (DA).

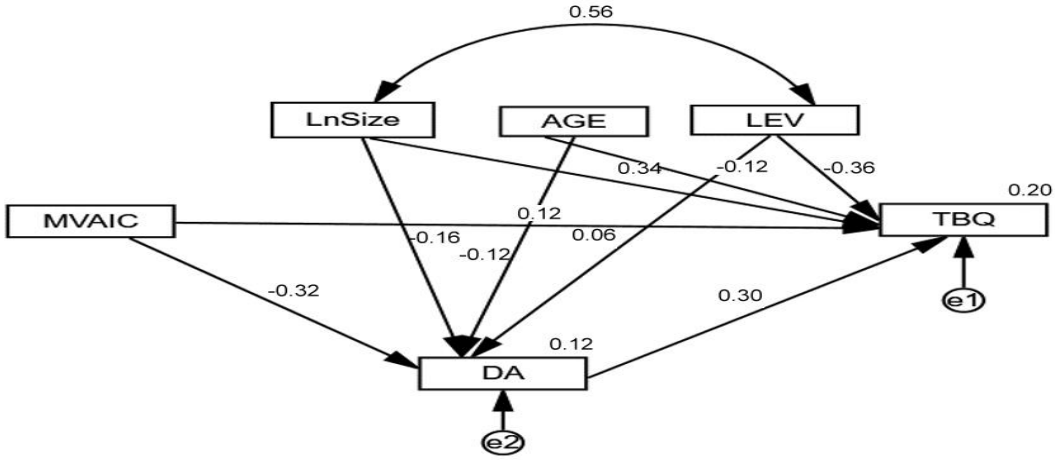

Figure 4. Structural model of inspection: The impact of intellectual capital (MVAIC) on Tobin's Q (TBQ) through discretionary accruals (DA).

In Figure 4, the model of modification was adjusted based on modification model indices by adding a link between variables of LnSize and LEV. Figure 4 shows the impact of intellectual capital (MVAIC) on Tobin's Q (TBQ) through discretionary accruals (DA). The CMIN/df was 0.890, the p-value of Chi-square was 0.486, GFI was 0.987, AGFI was 0.947, CFI was 1.000, NFI was 0.948, and RMSEA was 0.000. Thus, the model was deemed appropriate to test the hypotheses. However, it was also necessary to find other values, including the t-test value, the p-value, and the critical ratio (see Table 10).

Table 10. Parameter estimation and the significant test for the impact of intellectual capital (MVAIC) on Tobin's Q (TBQ) through discretionary accruals (DA).

Path	Regression weight				Decision	Conclusion
	Std. beta	SE	CR	P-value		
TBQ <--- MVAIC	0.120	0.035	1.354	0.176	H1b: Not supported	Insignificant
DA <--- MVAIC	-0.320	0.010	-3.626	0.000*	H2, H4b: Supported	Significant
TBQ <--- DA	0.296	0.324	3.299	0.000*	H3b: Supported	Significant
DA <--- LEV	0.062	0.166	0.583	0.560		Insignificant
DA <--- LnSize	-0.061	0.021	-0.575	0.565		Insignificant
DA <--- AGE	-0.118	0.002	-1.333	0.182		Insignificant
TBQ <--- AGE	-0.118	0.006	-1.386	0.166		Insignificant
TBQ <--- LEV	0.361	0.572	-3.534	0.000*		Significant
TBQ <--- LnSize	0.341	0.071	3.338	0.000*		Significant

Note: * = p-value < 0.05.

Table 10 shows the parameter estimation and the significance test for the impact of intellectual capital on Tobin's Q through discretionary accruals. The results show that the proposed model aligns with the empirical data and demonstrates the significant parameters for each variable. This suggests the need to assess the CR and SE values to further evaluate the impact. The results shown in the model are as follows:

(1) Discretionary accruals (DA) positively impacted Tobin's Q, with a critical ratio (CR) of 3.299 and a p-value of 0.000 < 0.05. It can be implied that the absolute value of discretionary accruals positively impacted Tobin's Q, and earnings quality negatively impacted Tobin's Q. In conclusion, the discretionary accruals were statistically significant at 0.05.

(2) Intellectual capital negatively impacted discretionary accruals, with a critical ratio of -3.626 and a p-value of 0.000 < 0.05. It can be implied that an inverse relationship exists between intellectual capital and the absolute value

of discretionary accruals. In conclusion, intellectual capital positively impacted earnings quality, and intellectual capital was statistically significant at 0.05.

Table 11. Standardized direct, indirect, and total effects of intellectual capital (MVAIC) on firm performance through discretionary accruals (DA).

Variable	Discretionary accruals (DA)			Return on assets (ROA)			Tobin's Q (TBQ)		
	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect
MVAIC	-0.320	-	-0.320	-	-	-	0.120	0.095	0.026
DA	-	-	-	-	-	-	0.296	-	0.296
R^2	-	12.00%	-	-	-	-	-	19.80%	-
MVAIC	-0.320	-	-0.320	0.334	-0.111	0.222	-	-	-
DA	-	-	-	0.348	-	0.348	-	-	-
R^2	-	12.00%	-	-	24.80%	-	-	-	-

In Table 11, the determinant coefficient (R^2) indicates that MVAIC impacted ROA with an accuracy of 24.80%, while DA impacted ROA with an accuracy of 12%. MVAIC was found to have a direct positive effect on ROA, indicated by a coefficient of 0.334. Conversely, MVAIC had a negative indirect effect on ROA, measured at -0.111, resulting in an overall positive effect.

In addition, the coefficient of the determinant (R^2) shows that MVAIC impacted Tobin's Q with an accuracy of 19.80%, and DA impacted Tobin's Q with an accuracy of 12.00%. Intellectual capital was found to have a positive direct effect on Tobin's Q at 0.120 and had a positive total effect on Tobin's Q at 0.026. However, it had a positive indirect effect on Tobin's Q at 0.095.

Table 12. Identifying the mediation effect using Baron and Kenny (1986) rules.

Model	Relationship			Direct effect (c' path)		Mediation result
	Independent variable	Mediating variable	Dependent variable	Beta	P-value	
Model 1	MVAIC	DA	ROA	-0.11	0.000*	Partial mediation
Model 2	MVAIC	DA	Tobin's Q	-0.09	0.176	Full mediation

Note: * = p-value < 0.05.

Model 1 in Table 12 displays the impact of intellectual capital on ROA through discretionary accruals ($\beta = 0.334$, $p = 0.000 < 0.05$). The mediation test using the Baron and Kenny method indicates that discretionary accruals acted as a partial mediator. Furthermore, Model 2 demonstrates no impact of intellectual capital on Tobin's Q through discretionary accruals ($\beta = 0.120$, $p = 0.176 > 0.05$). The mediation test using the Baron and Kenny method revealed that discretionary accruals served as a full mediator.

5. CONCLUSION AND DISCUSSION

5.1. Conclusion

According to descriptive statistical analysis, the mean of MVAIC was 4.97, and the standard deviation was 2.72. The average value of ROA was 6.67, and the standard deviation was 7.01. The average value of discretionary accruals was 0.48, and the standard deviation was 0.29. The mean of Tobin's Q was 1.80, and the standard deviation was 1.07. The mean of firm size was 15.61, and the standard deviation was 1.55. The mean of firm age was 30.28, and the standard deviation was 14.24. The mean of leverage was 0.40, and the standard deviation was 0.19.

Research Question 1: How does intellectual capital impact firm performance?

Hypothesis 1a: Intellectual capital positively impacts return on assets.

The study demonstrated a positive impact of intellectual capital on return on assets, leading to the acceptance of Hypothesis 1a. This finding aligns with the study by Soetanto and Liem (2019), which focused on publicly listed firms in Indonesia.

Hypothesis 1b: Intellectual capital positively impacts Tobin's Q.

Contrary to the hypothesis, the study found no positive impact of intellectual capital on firm performance, resulting in the rejection of Hypothesis 1b. This observation is consistent with the study by Xu and Liu (2020), which revealed that the component of intellectual capital does not affect Tobin's Q in South Korea Industrial Group.

Research Question 2: How does intellectual capital impact earnings quality?

Hypothesis 2: Intellectual capital positively impacts earnings quality.

The study indicated a positive impact of intellectual capital on earnings quality, leading to the acceptance of hypothesis H4. This discovery aligns with the studies carried out by Jaya, Agustia, and Nasution (2021) and Sarea and Alansari (2016), which showed that intellectual capital significantly affects earnings quality, measured using variables such as discretionary accruals. It also highlighted that intellectual capital represents a crucial intangible asset in financial reporting quality, supported by the Financial Accounting Standards Board (FASB).

Research Question 3: How does earnings quality impact firm performance?

Hypothesis 3a: Earnings quality positively impacts return on assets (ROA).

The study revealed a positive correlation between the absolute value of discretionary accruals and ROA, suggesting that earnings quality negatively impacts ROA. Therefore, hypothesis H3a was accepted. This finding aligns with the study by Saleh, Afifa, and Alsufy (2020), which observed a positive relationship between earnings quality and ROA in Jordanian public shareholding companies.

Hypothesis 3b: Earnings quality positively impacts Tobin's Q.

The study found that earnings quality had a positive impact on Tobin's Q at a significance level of 0.05, leading to the acceptance of Hypothesis 3. This finding aligns with the studies by Handoko and Ahmar (2016), Dang et al. (2020), and Fassas, Nerantzidis, Tsakalos, and Asimakopoulos (2023), all of which supported the positive link between earnings quality and firm value in various contexts.

Research Question 4: How does intellectual capital affect firm performance through earnings quality?

Hypothesis 4a: Discretionary accruals (DA) indirectly mediate the impact of intellectual capital (MVAIC) on ROA.

The study's findings indicate that earnings quality indirectly mediated the relationship between intellectual capital and ROA at a significance level of 0.05, leading to the acceptance of Hypothesis 4a. Moreover, the mediation analysis, following the Baron and Kenny (1986) method, indicated that earnings quality acted as a partial mediator. This conclusion aligns with Afifa, Saleh, and Haniah (2021), who demonstrated that the relationship between audit quality proxies and company performance (ROA) is completely mediated by discretionary accruals.

Hypothesis 4b: Discretionary accruals (DA) indirectly mediate the impact of intellectual capital (MVAIC) on Tobin's Q.

The study revealed that earnings quality had an indirect impact on the relationship between Tobin's Q and intellectual capital at a significance level of 0.05, leading to the acceptance of Hypothesis 4. Additionally, the mediation analysis, using the Baron and Kenny (1986) method, indicated that earnings quality acted as a full mediator. This finding aligns with Antonio et al. (2019), who showed that corporate governance had no significant effect on market response, but earnings quality emerged as a full mediating variable between corporate governance and market value in the Indonesian stock market.

Within the scope of this study gap, the MVAIC model has introduced a novel framework to measure intellectual capital. This updated model is designed to align with the dynamic digital business environment. Notably, Mutuc (2021) observed an impact of intellectual capital on the quality of profitability in the Asian region. Similarly, Saleh et al. (2020) identified a positive correlation between high earnings quality and improved performance among industrial companies in Jordan. Furthermore, additional investigations were conducted to explore the mediating effects of earnings quality on the association between intellectual capital and firm performance.

The findings revealed that earnings quality acts as a full mediating variable, specifically through discretionary accruals, influencing market value, as indicated by Tobin's Q. An important supplementary discovery from this study is that managerial discretion, independent of accounting policies and intellectual capital investment strategies, contributes to enhanced profitability resulting from genuine operational earnings, rather than accounting-based earnings impacted by managerial discretion. Consequently, this positive impact on profitability has a ripple effect on market value due to the critical role of financial reporting credibility in investors' decision-making processes, which involve forecasting future profits and considering factors such as the COVID-19 pandemic, market volatility, and the digital era's transformative business landscape, characterized by online systems. These findings align with agency theory, which elucidates the business relationship between organizational managers and shareholders, underscoring the favorable impact of proficient managerial performance on high-quality profitability, thereby reflecting an increase in market value. Shareholders seek augmented profits and prosperity for the business, while managers receive additional benefits, such as appropriate and justified remuneration.

5.2. Discussion

The study relied on an established foundation of academic literature to establish its theoretical and empirical frameworks. Intellectual capital theory was identified as the underlying theoretical basis for intellectual capital, while agency theory served as the driving force behind the conceptualization of earnings quality.

The findings of this study support the earlier investigations conducted by Boonchukham et al. (2023), which indicated a positive impact of intellectual capital on firm performance, specifically measured by ROA. This study has revealed an indirect association between earnings quality and intellectual capital, ultimately affecting firm performance. The statistical significance of this relationship was determined to be 0.05.

Furthermore, in Model 1, the mediating variable of earnings quality was found to exhibit partial mediation. The coefficient of determination (R^2) indicated that intellectual capital (MVAIC) impacted ROA through earnings quality with an accuracy of 24.80%. Additionally, in Model 2, earnings quality acted as an intermediary variable with full mediation. The coefficient of determination (R^2) demonstrated that MVAIC impacted Tobin's Q through earnings quality with an accuracy of 19.80%. There may be other factors that impacted operational performance during the COVID-19 crisis, such as global economic slowdown and uncertainty. Organizations have placed greater importance on cash reserves to ensure survival and make appropriate investments in favorable opportunities.

This research further investigated the indirect effects of mediating variables on the operational performance by considering the impacts of the COVID-19 pandemic and the adoption of accounting standards related to revenue recognition, including the intellectual capital using the MVAIC model. For regulatory and supervisory agencies, promoting and supporting intellectual capital investments, as well as serving as knowledge-based organizations and providing guidance on the implementation of various intellectual capital measurement methods, can contribute to the production of high-quality financial reports that reflect a company's good market value. This, in turn, aids in decision-making for stakeholders, such as investors and shareholders, who seek increased profitability and prosperity for the company. Additionally, professional accounting organizations can enhance training on accounting practices and the adoption of accounting standards for financial reporting by registered companies in Thailand to reflect their good operational performance. This data is valuable for decision-making by investors and other stakeholders.

6. STUDY LIMITATIONS

1. The sample used in this study consisted of only 114 small-sized companies in the service industry listed on the Thai stock market. This limitation leaves opportunities for subsequent studies with an expanded sample size in the future.

2. The Modified Jones model by Dechow et al. (1995) was employed to analyze earnings quality. It is recommended that future studies should employ other methods to compare their analysis results with the findings from this research.

7. SUGGESTIONS

This study solely targeted companies within the service industry, indicating the need for future studies to encompass a broader range of business sectors. Additionally, there is a call to investigate the direct impact of intellectual capital on earnings quality specifically within emerging economies' service industries. Furthermore, the exploration of diverse methodologies is recommended to measure profitability quality.

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