The impact of intellectual capital on firm performance: A study of Vietnamese firms listed on Vietnam Stock Exchange

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Abstract

Firms have considered intellectual capital (IC) as a key factor improving their competitiveness and performance. They can optimize their performance by maximizing resource utilization through examining the IC and physical capital. Therefore, in order to improve their competitiveness, this paper examines the impact of IC and its components on Vietnamese listed firm performance with a comparison among industry types over the period 2008-2021. The value added intellectual coefficient (VAIC) model is employed to measure IC. The system generalized method of moments (SGMM) and structural equation model (SEM) are used to identify the factors affecting firm performance. Our findings are that IC and its components play an important role in firm performance. VAIC, human capital efficiency (HCE), and capital employed efficiency (CEE) contribute to firm performance. Structural capital efficiency (SCE) positively influences firm performance for all combined firms and manufacturing companies, while it has a negative effect on firm performance in the service sector. The financial crisis played an important role, but the COVID-19 pandemic eroded firm performance. The financial crisis had a moderating effect on IC. This research expands the understanding of IC by analyzing the impact of IC and its components on firm performance with consideration of global crises and industry comparison.

1. INTRODUCTION

The knowledge-based economy has played a fundamental role in the global economy. This has led to the increasingly important role of intellectual capital (IC) in the world economy (Smriti and Das, 2018). Increasing the firm value is the key strategic goal of every firm (Machova and Vochozka, 2019), and thus improving characteristics such as skills and knowledge is important to enhance firm competitiveness and performance. Xu and Liu (2020) provide evidence that IC can promote firm wealth generation, but it is not reported in the balance sheet such as tangible assets. Intangible assets, including databases, employee skills, research and development, and system, can produce competitive advantages. IC plays a main role in developing knowledge and skills in order to generate firm value in the long run (Alvino et al., 2021). IC, actually, is the sum of all employee skills and competencies that can improve firm performance (Shahwan and Habib, 2020). IC includes three types of capital: human, relational, and structural (Aljuboori et al., 2022). IC is considered as a strategic resource providing a competitive edge, and it is necessary for companies to understand and employ IC effectively to obtain their competitive advantage (Xu and Liu, 2020).

Researchers and companies worldwide have recognized the importance of IC. The importance of IC has increased, especially when the knowledge economy has become an emerging norm in the current society. Firms have paid much attention to IC and used it to improve their

performance. IC has been the focus of much scholarly research. Researchers have divided IC into three components: HC (human capital) includes commitments, loyalty, motivation, and competencies; SC (structural capital) includes configurations, procedures, and infrastructures; RC (relational capital) represents relationships. Anifowose et al. (2018) indicate that firm efficiency is strongly affected by HC. Gupta et al. (2020) report that employees can use their knowledge and skills to obtain a competitive advantage if firms have a strong SC. Oppong et al. (2019) point out that RC can increase external links, which might help improve firm efficiency. Most previous researchers, such as Xu and Li (2019), Buallay et al. (2020), and Soetanto and Liem (2019), confirm the positive role of IC on firm performance and a non-linear relationship between IC and firm performance. However, researchers see an ambiguous relationship (Zhang et al., 2021). Others, like Momani and Nour (2019), point out that IC has a negative influence on firm performance.

The different points of views coming from the previous researchers have created research gaps for other researchers (Zhang et al, 2021). Many people have expressed the need to study IC in developing countries, like Vietnam, on both macro and micro levels. Most previous studies have focused on the firm level in a specific country context; few papers have made industry comparisons. The lagged impact of IC components has not been much examined (Xu and Liu, 2020). The research on the role of IC and its components in Vietnam is limited (Zhang et al., 2021). In addition, there have been no studies on the role of IC on firm performance during crises such as the financial crisis and the COVID-19 pandemic. In fact, the moderating role of crises are not analyzed in the existing literature. Thus, it is beneficial to examine the role of IC in the case of Vietnam, and through crises.

This paper makes the following contributions. First, it enriches the literature by analyzing the impact of IC and its components on firm performance. Second, it compares the effect of IC and its components on firm performance between firms in the manufacturing sector and the service sector. Third, it employs lagged IC components to analyze the impact. Fourth, it analyzes the impact of IC and its components in consideration of the 2008-2009 financial crisis, and the COVID-19 pandemic of 2020-2021. Fifth, it analyzes the moderating effects of the financial crisis and COVID-19 pandemic. Finally, it provides managers a guideline for improving firm profitability. This also helps government policy makers understand deeply the impact of IC and its components inconsideration of the financial crisis and COVID-19 pandemic. Consequently, policy makers can issue appropriate policies that can promote firm efficiency and lift the financial burdens for firms during such crises.

This paper examines the effect of IC and its components on the performance of Vietnamese listed firms from 2008 to 2021, so as to better understand companies within the Association of Southeast Asian Nations (ASEAN). Explicitly, this paper answers the following questions: (1) How do IC and its components affect firm performance? (2) Do global crises affect firm performance? (3) Do global crises have a moderating effect? (4) Does the effect of IC and its components on firm performance differ between the manufacturing industry and service industry? To answer these questions, the role of IC and its components are investigated, including the resource-based view theory and the empirical role in creating firm value and firm performance. The key points of the theory and empirical evidence are that IC can help firms generate new ideas and transform these new ideas into products and services, leading to an improvement of firm performance. Firms can benefit from knowledge collecting, sharing and application, thereby increasing productivity. This paper states that IC and its components contribute to an increase in competitiveness, innovation and firm performance. The paper employs the VAIC model with its components, HCE, SCE and CEE, to answer the research

questions. A good result of this paper can provide useful solutions and implications for other ASEAN countries to achieve better economic growth. In addition, this paper also examines the individual components of IC on firm performance. This paper, thus, can provide individuals among ASEAN countries guidelines to determine whether or not investing more in human capital leads to better business and better performance.

This paper also compares the effect of IC and its components on business performance between manufacturing and service sectors in Vietnam. This is because different industries may have different characteristics. Manufacturing firms have features different from those of service firms. The company influence on profit explanation is important in manufacturing, while the industry influence on profit explanation is important in services (Fernandez et al., 2022). Manufacturing firms are a part of knowledge-intensive firms which incorporate sophisticated scientific processes to add significant value to their products. Therefore, any firm that depends largely on its producing skills is a capital intensive firm. The manufacturing sector is knowledge and capital intensive in nature, and hence it is good to carry out a comparative analysis of IC and its components (Smriti and Das, 2018). The results can be different because service firms require an intensity of knowledge and creativity from their employees (Dinu et al., 2023). The Vietnamese government has paid much more attention to the manufacturing industry than to other industries like services. Manufacturing and service industries may be high knowledge intensity sectors, thus offering a reliable dataset for our research. Therefore, the research results can be better when making a comparison between the two industries.

The rest of this paper is structured as follows. The theoretical background is presented in section 2. Data and research methodology is shown in section 3. Section 4 presents the research results and discussion. Section 5 is the conclusion.

2. THEORETICAL BACKGROUND

2.1 Resource-Based View Theory
Most studies have used the resource-based view theory to examine the impact of intellectual capital on firm performance. This theory gives a theoretical framework to analyze firm performance and competitive advantage. This theory indicates that firms have tangible and intangible assets that can be connected with opportunities from outside markets to increase their efficiency (Tran et al., 2022). Firm wealth can be improved if firms exploit and accumulate efficiently intangible assets, which with intellectual capital can generate competitive advantages for firms (Anik and Sulistyo, 2021). Firms can use these assets to improve service quality, decrease economic costs, create human resources, and improve human capital, leading to higher firm performance (Vasudevan, 2021). Firms have intellectual capital resources to improve long run performance. Each firm can have intellectual capital such as specific skills, knowledge and know-how, which can be used to increase its productivity and performance (Ali et al., 2022). Therefore, it is appropriate to employ this theory to study the impact of intellectual capital on firm performance.

2.2 Intellectual capital measurement
Researchers define IC as an intangible asset that employees can obtain from experience, skills, and customer relationships (Smriti and Das, 2018). As calculated by Smriti and Das (2018), Xu and Liu (2020), and Tran et al. (2022), IC has three main components: human capital efficiency (HCE), structural capital efficiency (SCE) and capital employed efficiency (CEE). However, the IC measurement in terms of money is not easy, since the IC concept is new in developing countries like Vietnam. Therefore, researchers have developed a new measurement, the value-

added intellectual coefficient (VAIC), which is employed to assess intellectual capital performance. The VAIC is correlated to firm performance (Smriti and Das, 2018). Yet, the VAIC has a drawback. It does not reflect the relational capital. Previous researchers have modified the VAIC into the MVAIC (modified VAIC) by including relational capital. They have used spending on marketing, selling, promotion and donations to measure this relational capital (Ali et al., 2022). This MVAIC model is now widely used by researchers and practitioners when calculating IC and its components. It is also easy to calculate the efficiency of IC and allow researchers to carry out a comparative analysis across different industries and countries (Smriti and Das, 2018). Our dataset includes relational capital and so the MVAIC is used in our research.

2.3 Intellectual capital and firm performance

Previous researchers have made different conclusions about the relationship between IC and firm performance, but most of them confirm that IC plays an important role in firm performance. This is because IC can help firms generate new ideas. Firms with their innovation capability can identify novel ideas and transform these ideas into products and services, hence improving firm efficiency. They then can have a high level of competitive advantages due to employee skills and expertise, business training and valuable information. Better products/services can be generated by these new ideas. The new ideas can improve renovation capability, and thus firms can overcome challenges, leading to better firm performance (Nasar, 2020). Firms can benefit from better knowledge gathering, sharing, application, helping them know how to do the right thing in the proper way. This might lead to better quality, lower costs, and thus better firm performance (Aljuboori et al., 2022). Intellectual capital can help firms collect information that can be employed to improve their management skills and revenues, attract more customers, provide new products/services, and hence improving firm performance (Limijaya et al., 2021). Nasar. (2020) indicate that IC has a positive effect on innovation and competitiveness. Marzo and Bonnini (2023) analyze the impact of IC on financial performance in Italy to show a non-linear relationship between IC and financial performance. Xu and Li (2019) examine China and conclude that IC is positively correlated to financial performance. Buallay et al. (2020) empirically examine the role of IC on bank efficiency in Persian Gulf countries and indicate that there is a positive relationship between IC and bank efficiency. Soetanto and Liem (2019) study the effect of intellectual capital on firm performance in Indonesia and conclude that IC is positively related to firm performance. Poh et al. (2018) study Malaysia banks to show that IC and bank performance have a significant relationship. Some researchers such as Zhang et al. (2021) consider IC as the knowledge to improve wealth and profit, and a main source of value generation.

Previous studies have employed different models to measure IC like the VAIC (Poh et al., 2018; Smriti and Das, 2018) and MVAIC (Ali et al., 2022; Tran et al., 2022). Various econometric techniques such as OLS, random and fixed effect, GMM and data envelope analysis are used to estimate the effect of IC on business performance. Most previous researchers confirmed the positive role of IC on firm performance and the non-linear relationship between IC and firm performance. However, some found an ambiguous relationship (Zhang et al., 2021). Others such as Momani and Nour (2019) and Ali et al. (2022) point out that IC has a negative influence on firm performance.

In summary, although researchers have different ideas, most researchers argue for a positive role of IC on firm performance. The different ideas, however, provide research gaps for other researchers (Zhang et al, 2021). Many scholars have expressed a need for studying IC in developing countries like Vietnam in terms of macro and micro levels. Most previous studies

have focused on the firm level in a specific country context; few papers have studied industry comparisons. The research on the role of IC in Vietnam is limited (Zhang et al., 2021). In addition, there have been no studies on the role of IC on firm performance during crises such as the 2008-2009 financial crisis and Covid-19 pandemic. The moderating role of crises are not analyzed in the existing literature. Therefore, it is necessary to analyze the importance of IC and its components in the case of Vietnam to clarify the impact on business performance.

2.4 Hypothesis development

IC, an intangible asset, is employee specific skills, knowledge and know-how that firms can employ to increase their productivity and performance (Ali et al., 2022). IC is a driver of firm productivity (Xu and Wang, 2019), and it can be used to increase firm efficiency for all firm sizes (Smriti and Das, 2018). Many studies show that IC has a positive effect on company performance. For instance, Smriti and Das (2018) study the case of Indian listed firms and conclude that IC helps firms increase productivity, sales growth and market value. Xu and Wang (2019) indicate that IC is positively correlated with firm profitability, growth and performance. Zhang et al. (2021) examine the impact of IC on pharmaceutical firms in Vietnam and confirm a positive correlation. On the other hand, VAIC is used to measure IC (Smriti and Das, 2018). Vietnam is a rapidly developing economy with a huge need of human capital. An increase in IC will lead to a big improvement in performance. Therefore, an increase in IC can improve firm efficiency and vice versa. This leads to the following hypothesis:

H1: Intellectual capital performance positively affects firm performance.

IC cannot work well without physical capital. Therefore, by using financial and physical resources, the value added intellectual coefficient generates IC effectiveness. The customer capital reflects relational capital because this capital includes all relations (Ramírez et al., 2019). Capital employed efficiency is used to measure for IC in terms of customer or physical financial resources. Many studies indicate that capital employed efficiency has a positive effect on firm performance. Smriti and Das (2018) state that capital employed efficiency positively influences company performance. Xu and Li (2019), in the case of China, confirm the positive effect of capital employed efficiency. Xu and Wang (2019) provide evidence that capital employed efficiency has a positive influence on the earnings quality. Haris et al. (2019) report on capital employed efficiency's significantly positive effect. Alturiqi and Halioui (2020) and Tran et al. (2022) argue that capital employed efficiency positively affects firm performance. Ali et al. (2022) examine the case of Pakistan and India and find the positive impact of capital employed efficiency on firm performance for both cases. This leads to the following hypothesis:

H2: Capital employed efficiency positively influences firm performance.

Firm system, structure, and processes form structural capital (Smriti and Das, 2018). Factors such as management processes, firm plans, and know-how can support employee and firm performance (Zhang et al., 2021). Structural capital efficiency is used to measure the value-added efficiency of structural capital (Rezende and Silva, 2021; Acuna-Opazo and Oscar, 2021). Xu and Wang (2019) provided evidence that structural capital efficiency has a positive influence on Chinese agricultural listed firms' performance. Smriti and Das (2018) and Xu and Liu (2020) reported that structural capital is positively correlated with firm performance. Structural capital efficiency is positively related to business performance in China. Ali et al. (2022) conclude that structural capital efficiency plays a positive role in financial performance in Pakistani and Indian companies. However, Zhang et al. (2021) find that structural capital efficiency has a negative effect on pharmaceutical firms. This aside, based on most findings, we offer the following hypothesis:

H3: Structural capital efficiency positively influences firm performance.

Employee skills, experiences and competencies create human capital, which is a key factor of IC (Onumah and Duho, 2019). Human capital reflects employee knowledge, expertise, resources, data, which can be applied to business issues, thus improving firm wealth. Xu and Wang (2019) report that human capital efficiency has a positive influence on Chinese agricultural listed firms' performances. Alturiqi and Halioui (2020) contend that human capital efficiency plays a positive role in firm performance. Tran et al. (2022) show that human capital efficiency is positively correlated with return on asset, while it is negatively related to return on equity. Zhang et al. (2021) provide evidence that human capital efficiency has a positive impact on firm performance. Alamanda and Springer (2019) point out that human capital is important for improving firm efficiency. Ali et al. (2022) report that human capital efficiency plays a positive role in Pakistan and Indian business performance. Based on these arguments, we offer the following hypothesis:

H4: Human capital efficiency positively influences firm performance.

A large number of studies have been done about the effect on firm performance of the 2008-2009 financial crisis and the COVID-19, most of which confirm a strongly negative effect. Oseifuah and Gyekye (2018) use 75 non-financial firms listed on the Johannesburg Securities Exchange to study the influence of the financial crisis and conclude that the relationship between the crisis and firm performance is negative. Jabeur et al. (2020) investigate the effect of the financial crisis on 805 French companies and conclude that the crisis influenced firm performance. Akgün et al. (2021) found a negative impact of the financial crisis on firm performance in the EU-28. And, Ahmad et al. (2023) witnessed a negative effect on 351 English firms. However, Madaleno and Bărbuță-Mișu (2019) employed a sample of non-financial companies from European nations for the period 2006-2015 and concluded that profits were higher during the financial crisis.

Companies worldwide incurred large losses due to the COVID-19 pandemic (Aifuwa et al., 2020). Shen et al. (2020) study the effect of the pandemic on firm performance in Chinese listed firms and indicate that the pandemic worsened firm performance. Zhang and Zheng (2022) show that the pandemic weakened sale-related profitability in Chinese listed firms. Xu and Jin (2022) explore the impact of the COVID-19 pandemic on the financial performance of China agri-food firms, concluding that the pandemic had no effect on firm performance in general. They also find that the impact was positive for state-owned firms and low-risk areas but negative for private-owned firms and firms in middle and high-risk areas. Bui et al. (2022) use 131 Vietnamese listed firms to examine the effect of the COVID-19 pandemic on firm performance, finding a negative impact. However, Cahyaningati et al. (2022) examine the impact of the pandemic in Indonesian firms and conclude that the pandemic positively affected firm performance. In addition, the financial crisis and COVID-19 pandemic generated environmental turbulence. Zambon et al. (2020) indicate that, in such turbulence, the relationship between IC and firm performance could be moderated. Ramadhan and Prijadi (2022) report that COVID-19 had a moderating effect on business performance through promoting research and development in developing countries. Based on these findings, we put forth the following hypotheses:

H5A: CRISIS negatively influences firm performance.
H5B: COVID-19 negatively influences firm performance.
H5C: Crises have a moderating effect on firm performance.

Different industries have different characteristics, e.g., manufacturing firms have features different from those of service firms. The company influence on profit explanation is further important in manufacturing, while the industry influence on profit explanation is further important in services (Fernandez et al., 2022). Manufacturing firms are a part of knowledge-intensive firms and employ the sophisticated scientific highly added value in their goods. Therefore, any firm which depends largely on its producing skills is called a capital intensive firm. The manufacturing sector is knowledge and capital intensive in nature, and hence it is good to carry out a comparative analysis of IC and its components (Smriti and Das, 2018). The results can be different because service firms require an intensity of knowledge and creativity from their employees (Dinu et al., 2023). Therefore, this paper posits the following hypothesis:

H6: The impact of intellectual capital and its components on firm performance is different between manufacturing and service companies.

3. DATA AND METHODOLOGY

3.1 Data collection

A dataset was manually collected from 82 firms listed on the Vietnamese exchange during the period 2008-2021. We collected annual financial reports of these firms listed on the HOSE (46 firms), HNX (26 firms) and UPCOM (10 firms) from the websites Vietstock and CafeF. We then collected yearly data and calculated variables as described in table 1. All appropriate variables are available on these websites.

Our research sample includes 39 manufacturing firms and 43 service firms. The companies were chosen based on their financial reports audited by the big 4 auditing companies. These firms have to disclose the financial statements audited for 14 consecutive years (2008-2021). After excluding observations with negative value-added (VA) scores, 1,106 observations from 82 companies operating in the two industries are used in the analysis. The observations with a negative VA, which means that the firm is using more input resources than its outputs, were excluded due to the inability of the VAIC model to handle negative VA values. Therefore, the dataset is the unbalanced panel data.

3.2 Model and variable measurement

Based on the estimation models of Smriti and Das (2018) and Tran et al. (2022), we add financial crisis (CRISIS) and Covid-19 pandemic (COVID-19) to create the following models:

Model 1:
$$ROA_{it} = \beta_0 + \beta_1 ROA_{it-1} + \beta_2 HCE_{it} + \beta_3 SCE_{it} + \beta_4 CEE_{it} + \beta_5 HCE_{it-1} + \beta_6 SCE_{it-1} + \beta_7 CEE_{it-1} + \beta_8 SIZE_{it} + \beta_9 LEV_{it} + \beta_{10} CRISIS_t + \beta_{11} COVID\text{-}19_t + \varepsilon_{it}$$

Model 2:
$$ROA_{it} = \beta_0 + \beta_1 ROA_{it-1} + \beta_2 VAIC_{it} + \beta_3 SIZE_{it} + \beta_4 LEV_{it} + \beta_5 CRISIS_t + \beta_6 COVID\text{-}19_t + \varepsilon_{i,t}$$

Model 3:
$$ROE_{it} = \beta_0 + \beta_1 ROE_{it-1} + \beta_2 HCE_{it} + \beta_3 SCE_{it} + \beta_4 CEE_{it} + \beta_5 HCE_{it-1} + \beta_6 SCE_{it-1} + \beta_7 CEE_{it-1} + \beta_8 SIZE_{it} + \beta_9 LEV_{it} + \beta_{10} CRISIS_t + \beta_{11} COVID\text{-}19_t + \varepsilon_{it}$$

Model 4:
$$ROE_{it} = \beta_0 + \beta_1 ROE_{it-1} + \beta_2 VAIC_{it} + \beta_3 SIZE_{it} + \beta_4 LEV_{it} + \beta_5 CRISIS_t + \beta_6 COVID\text{-}19_t + \varepsilon_{it}$$

Where the dependent variables are ROA_{it} and ROE_{it} in the current year. Following, the independent variables of firm performance indicators of the previous year are: ROA_{it-1}, ROE_{it-1}, HCE_{it-1}, SCE_{it-1}, CEE_{it-1} and $VAIC_{it}$, HCE_{it}, SCE_{it}, CEE_{it}, $SIZE_{it}$, LEV_{it}, $CRISIS_t$, and $COVID\text{-}19_t$ of the current year. ε_{it} are error term is i, at current time period t.

The IC's components are one year lagged since it is supposed that Vietnamese firms can create revenues from previously investing in research and development and innovation along with physical capability. The logarithm of total asset is employed to reduce data variation, thus providing a lower standard deviation and robust results.

The dependent variables and independent variables are defined and measured as shown in table 1.

Table 1: Definition of variables used and their measurement

Variable	Definition	Measurement
Dependent variables		
ROA	Return on asset	Net income/total asset
ROE	Return on equity	Net income/total equity
Independent variables		
VAIC	Value-added intellectual capital efficiency	HCE+SCE+CEE
HCE		Value added/human capital
SCE	Human capital efficiency	Structural capital/Value added
CEE	Structural capital efficiency	
SIZE	Capital employed efficiency	Value added/capital employed
LEV	Firm size	Logarithm of total asset
CRISIS	Financial leverage	Total debt/total asset
COVID-19	Financial crisis between 2008 and 2009	1 for financial crisis and 0 otherwise
	Covid-19 pandemic between 2020 and 2021	1 for Covid-19 pandemic and 0 otherwise

Note: Structural capital = value added – human capital. Intellectual capital efficiency = HCE + SCE. Intellectual capital (VAIC) = HCE + SCE + CEE.

3.3 Estimation methods

The standard regression techniques of panel data, the SGMM and the SEM are employed to run the regression model. The dynamic model is employed to supply robust results. The GMM is preferred to the fixed effect model, since the fixed effect model may contain the error term in the regression equation, which includes the unobserved firm-specific effects and the observation-specific errors. The pooled ordinary least-square, random-effect and fixed effect model might provide a biased estimation due to the lagged variable (Dahir et al., 2018). Furthermore, these models cannot solve the problem of heteroskedasticity, multicollinearity and endogeneity (Smriti and Das, 2018; Nguyen, 2022). The GMM technique proposed by Arellano and Bond (1991) is used to estimate the regressions. The usage of the SGMM can increase efficiency, and the SGMM estimators are better than the GMM regressors (Blundell and Bond, 1998). The SGMM estimation provides efficient and consistent estimates even if explaining variables are not strictly independent and there are problems of heteroskedasticity and autocorrelation (Dahir et al., 2018). The difference GMM (DGMM) is better when dealing with a dataset with a small number of groups, but our dataset has a large number of groups. Our estimated results show that the number of groups is larger than the number of instruments. In addition, the SGMM estimator is more effective than DGMM because the SGMM employs a system that combines estimations of levels and first differences (Dahir et al., 2018). Therefore, the SGMM is employed to estimate and explain the impact of IC and its components on firm performance.

We also employ the SEM to analyze the interaction between crises and the IC variable, and the moderating role of crises on firm performance. The SEM is employed to test the relationship

between latent variables and manifest variables (Yim, 2019). We use the financial crisis and COVID-19 pandemic variables as latent variables affecting IC and manifest variables influencing firm performance. VAIC, SIZE, and LEV are used as manifest variables. Stata 15 is used to estimate our regressions.

4. RESULTS AND DISCUSSION

4.1 Descriptive statistics

Table 2 shows the mean, standard deviation, minimum and maximum value of variables for 1,106 observations. The mean of ROA is 6.9% with its standard deviation of 7.8%. The maximum value is 72.19%, and the minimum value is -13.1%. For ROE, the mean value is 14.97% with its standard deviation of 13.66%. The biggest loss is 107.43%, and the largest profit is 160.75%. The extremely small and large values of ROE do not affect our regression results since we have deleted these values, run regressions again and achieved similar results. For IC, the mean value varies from 0.182 to 3.194, and the standard deviation fluctuates from 0.176 to 2.412. The minimum value varies from -12.66 to -0.1, and the maximum value fluctuates from 1.08 to 33.49.

Table 2: Descriptive statistics

Variable	Observations	Mean	SD	Minimum	Maximum
ROA	1,106	6.900	7.805	-13.100	72.190
ROE	1,106	14.972	13.664	-107.430	160.750
ROE	1,092	14.793	10.608	-15.420	67.770
VAIC	1,106	3.194	2.412	-12.580	33.490
HCE	1,106	2.539	2.207	-8.200	32.370
SCE	1,106	0.474	0.540	-12.660	3.510
CEE	1,106	0.182	0.176	-0.100	1.080
SIZE	1,106	7.778	2.710	2.500	14.380
LEV	1,106	0.551	0.256	0.0200	0.960
CRISIS	1,106	0.143	0.350	0.000	1.000
COVID-19	1,106	0.143	0.350	0.000	1.000

Source: own calculations

Table 3 presents the results of the correlation analysis of Vietnamese listed firms. The dependent variables and IC independent are positively correlated to each other. Correlation among most independent variables is below 0.5, except SIZE and LEV, LEV and CEE, SIZE and CEE. This result might rarely signal the problem of multicollinearity. However, the VIF results in table 4 show that the mean VIF is smaller than 5, meaning that there is no problem of multicollinearity. Therefore, the dataset is reliable and robust.

Table 3: Correlation matrix

	ROA ROA(-1) ROE ROE(-1) VAIC HCE SCE CEE SIZE LEV CRISIS COVID-19						
ROA	1						
ROA(-1)	0.76	1					
ROE	0.78	0.49	1				
ROE(-1)	0.51	0.78	0.46	1			
VAIC	0.35	0.18	0.45	0.23	1		
HCE	0.28	0.12	0.39	0.19	0.97	1	
SCE	0.15	0.08	0.24	0.12	0.48	0.28	1

CEE	0.80	0.66	0.54	0.39	0.01	-0.05	-0.05	1			
SIZE	-0.35	-0.33	-0.07	-0.05	0.16	0.13	0.15	-0.52	1		
LEV	-0.51	-0.48	-0.09	-0.10	-0.05	-0.02	0.03	-0.56	0.67	1	
CRISIS	0.09	-0.01	0.12	0.002	0.15	0.14	0.10	-0.03	-0.13	-0.01	1
COVID-19	-0.07	-0.05	-0.06	-0.03	0.03	0.03	0.01	-0.03	0.10	-0.002	-0.17 1

Source: own calculations

4.2 Diagnostic tests, robustness check and validity of the estimated results

We use the variance inflation factor (VIF) to test the multicollinearity problem. The result shows that mean VIF fluctuates between 1.53 and 1.69, which does not exceed 5, revealing that there is no problem of multicollinearity (Neter et al., 1990). In addition, we also employ the Breusch-Pagan test to test the problem of heteroscedasticity. Our result shows that there is a problem of heteroscedasticity because of the p-value of 0.000 in all tests.

We employ the SGMM to solve these problems and the problem of endogeneity by using lagged dependent variables as instrumental variables. The SGMM estimators are better than the GMM regressors (Blundell and Bond, 1998). The SGMM can improve the efficiency of regressed results with a smaller period of time and larger number of companies (Smriti and Das, 2018). Our results show that Hansen's J test p-values vary from 0.150 to 0.935, and AR (2) test p-values fluctuate between 0.123 and 0.950 as presented in tables 4, 5, and 6. These reveal consistent and robust results, because all instruments are valid, and there is no problem of autocorrelation. In addition, the fixed effect estimation may ignore the dynamic relationships between dependent and independent variables while the SGMM takes it into account (Roodman, 2006; Smriti and Das, 2018). Therefore, the SGMM results are used to explain the impact.

4.3 Impact of IC on firm performance

The dynamic SGMM regression methods are used to run all models to gain the effect of IC on business performance as presented in tables 4, 5, and 6. Table 4 shows four estimation results for all firms. The estimation results from model 1 show that ROA_{it-1}, HCE, SCE, CEE, SCE_{it-1} and CRISIS are significant and positively related to firm performance. In contrast, HCE_{it-1}, CEE_{it-1}, SIZE, LEV, and COVID-19 are significant and negatively correlated with firm performance. The estimation results of model 2 indicate that ROA of the previous year and VAIC are significant and positively related to firm performance. Model 2 shows similar results to model 1. These results show that when employees gain more commitments, loyalty, motivations, and competences, firms gain more customers or physical and financial resources, management processes, better firm plans, and know-how, and firm performance will be improved. This reveals that IC would be a good instrument for generating firm wealth, and enhancing competitiveness and performance.

Table 4: Empirical result – All firms

Variable	ROA (1)	ROA (2)	ROE (3)	ROE (4)	ROE (5)	ROE (6)
ROA_{t-1}	0.375*** (0.000)	0.502*** (0.000)				
ROE_{t-1}			0.537*** (0.000)	0.420*** (0.000)	0.092** (0.037)	0.483*** (0.000)
VAIC		0.785*** (0.000)			2.036*** (0.000)	0.198 (0.632)

Variable	(1)	(2)	(3)	(4)	(5)	(6)
HCE	0.550*** (0.000)		0.556*** (0.000)	0.846** (0.013)		
SCE	3.462*** (0.000)		2.539*** (0.000)	4.516** (0.033)		
CEE	3.040*** (0.000)		3.047*** (0.000)	44.125*** (0.000)		
HCE$_{t-1}$	-0.316*** (0.000)		-0.737*** (0.000)	-0.964*** (0.000)		
SCE$_{t-1}$	0.899*** (0.000)		1.330*** (0.010)	1.631*** (0.006)		
CEE$_{t-1}$	-1.345*** (0.000)		-1.974*** (0.000)	-19.268*** (0.000)		
SIZE	-0.281*** (0.001)	-0.175 (0.343)	-0.376*** (0.000)	0.246 (0.302)	-0.804 (0.120)	0.169 (0.765)
LEV	-0.348*** (0.592)	-1.327 (0.590)	1.063 (0.286)	6.310* (0.080)	2.138*** (0.000)	-1.387 (0.863)
CRISIS	0.587*** (0.005)	1.095** (0.011)	0.485* (0.064)	2.740*** (0.000)	2.366** (0.021)	3.179*** (0.000)
COVID-19	-0.292*** (0.000)	-0.613*** (0.000)	-0.178*** (0.010)	-0.638*** (0.008)	-0.936** (0.012)	-1.191*** (0.004)
Constant	0.772 (0.389)	3.225** (0.042)	1.919** (0.024)	-4.485* (0.073)	2.184 (0.618)	6.103** (0.013)
Number of observations	1,027	1,027	1,027	1,005	1,027	1,005
AR(2) test	0.945	0.127	0.547	0.342	0.269	0.611
Hansen test of overid	0.103	0.108	0.112	0.182	0.139	0.331
Number of instruments	52	31	49	42	31	25
Number of groups	79	79	79	79	79	79
Mean VIF	3.45	1.50	3.07	3.85	1.40	1.41

Note: * significant at 0.10, ** significant at 0.05, *** significant at 0.01. p-value is in bracket.

For the manufacturing industry, the results of table 5 confirm that IC has a positive effect on firm performance. Firm size and financial crisis also have positive impacts on firm performance. Financial leverage is negatively related to return on asset but positively correlated with return on equity. By contrast, the previous period of HCE and CEE, and COVID-19, have a converse relationship with firm performance, whereas SCE$_{it-1}$ is not significant.

Table 5: Empirical result – Manufacturing industry

Variable	ROA (1)	ROA (2)	ROE (3)	ROE (4)
ROA$_{t-1}$	0.527*** (0.000)	0.368* (0.088)		
ROE$_{t-1}$			0.689*** (0.000)	1.548*** (0.000)
VAIC		0.802** (0.016)		1.570*** (0.000)
HCE	0.348*** (0.000)		1.837*** (0.000)	
SCE	3.845***		7.098***	

	(0.000)		(0.000)	
CEE	5.185***		4.446***	
	(0.000)		(0.000)	
HCE$_{t-1}$	-0.414***		-2.467***	
	(0.001)		(0.000)	
SCE$_{t-1}$	-0.561		0.711	
	(0.237)		(0.290)	
CEE$_{t-1}$	-3.571***		-2.960***	
	(0.000)		(0.000)	
SIZE	0.495***	-0.630	0.530***	-0.946
	(0.000)	(0.215)	(0.000)	(0.209)
LEV	-0.278	-7.939*	7.759***	9.682**
	(0.728)	(0.063)	(0.000)	(0.019)
CRISIS	1.656***	1.398**	2.549***	5.040***
	(0.000)	(0.042)	(0.000)	(0.006)
COVID-19	0.058	-0.872**	-0.999***	0.516
	(0.648)	(0.011)	(0.000)	(0.586)
Constant	-4.549***	10.546*	-8.118***	-13.130**
	(0.000)	(0.069)	(0.000)	(0.043)
Number of observations	507	507	507	507
AR(2) test	0.240	0.200	0.403	0.950
Hansen test of overid.	0.529	0.253	0.711	0.935
Number of instruments	37	31	37	25
Number of groups	39	39	39	39

Note: * significant at 0.10, ** significant at 0.05, *** significant at 0.01. p-value is in brackets.

For the service industry, the results of table 6 show relatively similar results to the manufacturing industry. However, SCE and SCE$_{it-1}$ are significant and negatively related to firm performance. These findings reveal that IC is also a good tool for increasing firm wealth and performance. For the service sector, structural capital is not a tool that can be used to improve firm wealth and performance.

Table 6: Empirical result – Service industry

Variable	ROA (1)	ROA (2)	ROE (3)	ROE (4)
ROA$_{t-1}$	0.461***	0.229***		
	(0.000)	(0.000)		
ROE$_{t-1}$			0.480***	0.369***
			(0.000)	(0.000)
VAIC		0.914***		2.257***
		(0.000)		(0.000)
HCE	1.075***		2.663***	
	(0.000)		(0.000)	
SCE	-0.359***		-0.403***	
	(0.000)		(0.006)	
CEE	2.350***		5.172***	
	(0.000)		(0.000)	
HCE$_{t-1}$	-0.698***		-2.075***	
	(0.001)		(0.000)	
SCE$_{t-1}$	-0.500***		-0.658***	
	(0.000)		(0.001)	
CEE$_{t-1}$	-1.509***		-4.025***	

	(0.000)		(0.000)	
SIZE	-0.055***	-0.287***	0.466***	0.744*
	(0.000)	(0.000)	(0.000)	(0.062)
LEV	-1.659***	-5.086***	0.180	-5.994
	(0.000)	(0.000)	(0.830)	(0.143)
CRISIS	0.197***	0.613*	1.293*	1.930**
	(0.008)	(0.061)	(0.058)	(0.011)
COVID-19	-0.438***	-0.366***	-0.868***	-0.854**
	(0.00)	(0.001)	(0.000)	(0.029)
Constant	2.269***	6.278***	-0.103	-1.286
	(0.000)	(0.000)	(0.930)	(0.440)
Number of observations	559	559	559	559
AR(2) test	0.330	0.184	0.342	0.279
Hansen test of overid.	0.280	0.592	0.244	0.150
Number of instruments	42	31	42	25
Number of groups	43	43	43	43

Note: * significant at 0.10, ** significant at 0.05, *** significant at 0.01. p-value is in brackets.

The results in table 7 show that CRISIS is positively significant with VAIC in all regressions. This means that a financial crisis has a positive influence on IC. In contrast, COVID-19 is positively insignificant with VAIC in all regressions. Overall, these findings indicate that a financial crisis has a moderating effect on IC and then affects financial performance in the case of Vietnam.

Table 7: SEM results

Relationships	ROA	ROE	ROA	ROE	ROA	ROE
	All firms		Manufacturing sector		Service sector	
Financial crisis → Intellectual capital	1.061***	1.061***	0.954**	0.954**	1.251***	1.251***
	(0.000)	(0.000)	(0.015)	(0.015)	(0.000)	(0.000)
COVID-19 pandemic → Intellectual capital	0.377	0.377	0.176	0.176	0.510	0.510
	(0.175)	(0.175)	(0.639)	(0.639)	(0.185)	(0.185)
Intellectual capital → Firm performance	1.094***	2.626***	1.061***	2.564***	1.205***	2.815***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.003)	(0.003)
Firm size → Firm performance	-0.274***	-0.649***	-0.848***	-2.099***	-0.431***	-0.125
	(0.010)	(0.004)	(0.001)	(0.000)	(0.001)	(0.743)
Leverage → Firm performance	-1.299***	1.172	-1.816***	-2.125	-6.463***	1.375
	(0.000)	(0.615)	(0.000)	(0.357)	(0.000)	(0.764)
Financial crisis → Firm performance	0.281	1.139	-0.383	-0.202	0.204	1.549
	(0.697)	(0.397)	(0.631)	(0.882)	(0.860)	(0.513)
COVID-19 pandemic → Firm performance	-1.529***	-2.031**	-1.646**	-2.077	-0.842	-1.124
	(0.000)	(0.033)	(0.040)	(0.149)	(0.112)	(0.286)

Note: * significant at 0.10, ** significant at 0.05, *** significant at 0.01. p-value is in brackets with robust standard error.

4.4 Discussion

The regression results in tables 4, 5 and 6 show that VAIC is positively significant in all regressions. These findings indicate that IC plays an important role in firm efficiency, creating growth and wealth for Vietnam (Smriti and Das, 2018). IC can help firms improve their innovation capacity, competitiveness and then performance. These findings show that VAIC has a positive influence, meaning that IC plays an important role in generating firm wealth and profit. Therefore, IC should be promoted to gain competitive advantages (Ali et al., 2022). These results confirm the positive role of innovation capability in creating higher competitive

advantages and better performance (Aljuboori et al., 2022). These results support hypothesis H1 and are consistent with findings of previous researchers such as Aljuboori et al. (2022) in the case of Malaysia, and Zhang et al. (2021) and Ali et al. (2022) in the case of India. This result is also in line with Xu and Liu (2020) in the case of Korea, Ali et al. (2022) in the case of India and Pakistan, and Najar et al. (2020) in the case of Tunisia. These results confirm the resource-based theory in the Vietnamese situation.

For the components of VAIC, HCE, SCE and CEE are positively significant for all Vietnamese listed firms and the manufacturing industry. Meanwhile, SCE is negatively significant for the service industry and not significant for the manufacturing sector. For models 1 and 2, the findings show obviously that HCE, SCE, and CEE have a positive effect on firm performance and support H2, H3, and H4. These results reveal that IC components, HCE, SCE, and CEE, together influence firm performance in Vietnam. The service and manufacturing sectors also show the positive significant effect of WAIC on firm performance, but for the service sector, SCE and SCE_{it-1} have a negatively significant impact, thus rejecting H3. These results are consistent with Xu and Wang (2019) in the case of China, Xu and Liu (2020) in the case of Korea, and Ali et al. (2022) in the case of India and Pakistan.

Hypothesis H2 is supported by all of the regression equations, which show the significantly positive influence of HCE on financial performance in Vietnamese listed firms. These results reveal that Vietnamese listed firms are good at promoting and increasing their employees' loyalty, commitments, motivations, and competences. This reflects the fact that Vietnamese listed firms learn how to encourage their employees' motivations and recruit skilled staff. This suggests that expenditure on employees should be considered as an investment, and a firm can use these human resources to generate additional wealth (Xu and Liu, 2020). Firms pay more attention to employee training and education, and skills, and consequently improve competitiveness and performance (Ali et al., 2022). This is consistent with the study of Li and Zhao (2018) in the case of China, Smriti and Das (2018) in the case of India, Alturiqi and Halioui (2020) in the case of Saudi Arabia, and Ali et al. (2022) in the case of India and Pakistan.

The findings from models 1 and 3 indicate that SCE has a positive relationship with firm profit in Vietnam for all manufacturing firms, supporting H3. These results reflect the fact that Vietnamese listed firms are proficient in using their internal resources in increasing their employee knowledge and, in turn, improving configuration, renovation, procedures, and infrastructure. It should be effectively managed to achieve potential benefits, since frameworks, policies, information, and networking play an important role in firm profitability (Ali et al., 2022). SCE is a driving factor for firm performance. Firms with good infrastructure, processes and databases can help their employees work well and hence enhance their performance, as during the COVID-19 pandemic (Sears, 2021). These results support the organizational learning theory and are consistent with Smriti and Das (2018) in the case of India, Xu and Wang (2019) in the case of China, and Xu and Liu (2020) in the case of Korea.

However, these findings show the opposite impact in the service sector, supporting H6. This reveals that the service firms are not good at employing their internal resources for profit. This is because employees in the service sector may change their jobs quickly, and thus firms cannot use their internal resources well. This result is in the line with Smriti and Das (2018) in the case of India.

All equations giving the positively significant coefficients of CEE support H4. These results imply that capital employed is a key determinant of profitability in Vietnamese listed firms. The significant results of CEE indicate that tangible assets play an important role in firm performance (Smriti and Das, 2018). Higher capital employed efficiency is associated with higher firm performance (Sears, 2021). Researchers propose that CEE is the key contributor to firm value and financial performance (Smriti and Das, 2018). Companies, which are successful in managing IC, could maximize their competitiveness, performance and productivity (Costa, 2012). These results are in line with the case of India (Smriti and Das, 2018), Italy (Costa, 2012), and Australia (Nadeem et al., 2017).

The financial crisis had a moderating effect on firm performance. The coefficient of the COVID-19 pandemic is not significant but has a positive sign. These results imply that Vietnamese listed firms are encouraged to increase IC and its components when crises happen. These firms train their employees to deal with crises. They employ technology such as IT technology to communicate with customers and work from home. They invest more in research and development. Therefore, they can enhance their performance. Ramadhan and Prijadi (2022) show that the COVID-19 pandemic had a moderating effect on business performance through promoting research and development in developing countries. The financial crisis of 2008-2009 had a positive effect on firm performance because the Vietnamese government expanded monetary policy, reduced and deferred taxes for firms, supported firms, increased public investments, promoted consumption, provided the interest rate support of 4% for bank loans, and increased consumer confidence. The positive impact was the result of special policies issued and carried out by the government to stabilize the economy (Nam, 2020). This result is inconsistent with the case of South Africa (Oseifuah and Gyekye, 2018), France (Jabeur et al., 2020), and England (Ahmad et al., 2023). In contrast, the COVID-19 pandemic had a negative impact on firm performance even though the government had a similar policy. This is because the negative impacts of the COVID-19 pandemic were extremely strong, with cancelled flights, closed borders, and closed businesses. Firms then operated online and allowed their employees to work from home. However, firms met the difficulties stemming from weak demand and high inflation, and consequently the Vietnamese government started a monetary tightening policy. These results are in the line with Shen et al. (2020), Zhang and Zheng (2022) in the case of China, Cahyaningati et al. (2022) in the case of Indonesia, and Bui et al. (2022) in the case of Vietnam.

5. Conclusion

Previous scholars have confirmed that IC is the key factor generating competitive advantage and value of firms in the knowledge-based economy (Xu and Wang, 2019). To enhance the competitiveness and performance of companies, this paper examines the impact of IC and its components on firm performance of Vietnamese listed firms, with a comparison between the whole sample and service firms and manufacturing firms. Our findings show that IC and its components play an important role in firms' competitiveness and performance. Vietnamese listed firms have used human resources quite well, thus contributing to their competitiveness and performance. Our findings contribute to the IC literature in the Vietnamese context through analyzing the impact of IC and its components on financial performance with an industry comparison, analyzing the effect of crises combined with IC and its components, thus affecting firms' competitiveness and performance. Furthermore, VAIC, HCE, and CEE contribute to firm performance. SCE positively influences performance for the whole sample and manufacturing companies, while it has a negative effect on performance in the service sector. The lagged IC's components influence firm performance. The financial crisis of 2008-2009 played an important

role, but the COVID-19 pandemic eroded firm performance. The Vietnamese government provided supporting policies, but the significantly negative impact of the COVID-19 pandemic outweighed their effect. The financial crisis had a moderating effect on IC, affecting firms' competitiveness and performance. These findings might help managers understand deeply the role of IC and its components, and then develop a good strategy for improving firms' competitiveness and performance (Zhang et al., 2021). Therefore, our findings meet our research goals.

This research can be beneficial for managers in reviewing the use of IC in improving firms' competitiveness and performance. Firms should pay attention to both financial and physical capital (Xu and Liu, 2020). Our findings show that managers should participate in continuous learning and training to improve HCE. Companies should have a good knowledge strategy, information system, database and infrastructure to develop SCE. Technological innovation networks and social network relationships should be paid attention to in order to build firm image and technological innovation capabilities, thereby improving firms' competitiveness and performance. Although IC and its components are important to a knowledge-intensive and skill-based industries like banks, IT companies, and investment funds, there is little research on this issue in Vietnam (Zhang et al., 2021). This study, therefore, provides benefits to managers who want to improve their firms' competitiveness and performance. IC can be employed as a tool to assess the firm performance and help managers know the role of training creative employees. These findings can help managers gain more evidence for investment in research and development to improve their firm innovation capabilities and competitiveness. In addition, crises such as the financial crisis of 2008-2009 and the COVID-19 pandemic can promote IC, and thus managers can use these crises as a strategy for software firms to enhance their performance during them.

This research has some limitations. First, this study focuses only on Vietnamese listed firms; the results might not reflect all firms in Vietnam. Further study should include unlisted firms in the research sample. Second, this study analyzes the case of a single country, and the results might not be generalized for all countries. Further research might include regions like South East Asia or developing countries. Further study results should be compared with findings of other countries or regions like ASEAN (Xu and Liu, 2020). This paper does not include other factors affecting firm performance such as firm risk, GDP, and inflation. Future research might include these factors in the research model.

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