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Firm Financial Performance and Intellectual Capital in R&D and Consultancy Services in Lower-Medium-Income Countries: The Case of Vietnam

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Abstract:
This research evaluates the impact of intellectual capital (IC) on firm financial performance in research, development, and consultancy services in a lower-medium-income country like Vietnam. Applying the value-added intellectual coefficient with the random and effect models for the period of 2005-2014, empirical results imply that IC contributes significantly to the firm financial performance. In which structural capital efficiency (SCE) has the highest impact and Capital Employed Efficiency (CEE) has the second one on firm performance. Impact of IC and its components depend on firm sizes. SCE has the strongest effect on firm financial performance for large-sized firms and CEE has the strongest effect for micro-sized firms. This research has some contributions as follows: i) the first examines impacts of IC and its components on ROA for firms in R&D and consultancy services with comparison among different firm sizes; ii) it shortens the research gap of IC impact for lower-medium-income countries; iii) data represents for whole economy and the studied time experienced significant reform in development of knowledge and service sector while limitations of most other research is single ownership and short study time; iv) it is associated with policy and management objectives because its results will give evidence to reform policies to reach national goals of increasing national income; v) it figures out which IC element has the strongest effect on these firms' financial performance, resulting the corresponding recommendations to Vietnamese government and firm managers. The findings suggest Vietnamese government and firm managers which component of intellectual capital they should focus on investing corresponding to various firm sizes.

Keywords: *Knowledge, Intellectual capital, VAIC, R&D, consultancy, services, firm performance, random effect, fixed effect, lower-medium-income countries.*

JEL Classification*: D83, M29, L25.*

1. Introduction

Recently the world has witnessed the transition from traditional economy to knowledge-based economy, which is driven by knowledge resources, including intellectual capital (IC) (Canibano et al., 2000). IC is a powerful capital which could accelerate efficiencies of other inputs, creating high added value, enhancing innovation, creation, scientific and technological achievements, resulting the improvement in national income for country in general and financial performance for enterprises in particular (Choo et al., 2010).

Due to the crucial role of IC, numerous research interested in IC and tried to measure it. The literature of IC witnessed a continuous development of its definition and components. Besides three common components of IC, human capital, structural capital, and capital employed (Public, 1998), researchers introduce more new components, including social capital, rational capital, continuously developed by other researchers, including (Bayraktaroglu et al., 2019; Soewarno and Tjahjadi, 2020; and Muhammad, 2022).

R&D activities in enterprises have the following basic roles: Strengthening technological capacity; increase market position ; and increase export activities. Market leaders always have the highest rate of investment in R&D. However, R&D is a risky investment and is more difficult to control effectively than normal business and production activities. Therefore, R&D and consultancy services are required to increase efficiency of these activities (Dat, 2022).

Vietnam is a typical lower-medium-income country which has continuously afforded in increasing its national income. Vietnam spent twenty years to upgrading from low-income to lower-medium-income country (World Bank, 2022). Vietnam has developed from one planning economy to one of the most dynamic emerging economies among East Asia – Pacific countries (World Bank, 2022). Vietnam has recently targeted to rely on knowledge, including intellectual capital to shorten time to move to high-income country by 2045.

Most research employ ROA and ROE to represent for firm financial performance (Mohammed, 2014; Li and Zhao, 2018; Xu and Wang, 2019). If firms take on leverage, ROA takes effect of financial leverage into account while ROE does not. There is no research focusing on evaluating IC impact on ROA for firms in R&D and consultancy services for a lower-medium-income like Vietnam. Therefore, this research aims at investigating impacts of IC and its components on ROA for R&D and consultancy services in Vietnam, with comparison among different firm sizes. This study uses fixed and random effects models to control the individual and time effects. It contributes to the literature of IC impact in terms of following points: i) the first examines impacts of IC and its components on ROA for firms in R&D and consultancy services with comparison among different firm sizes; ii) it shortens the research gap of IC impact for lower-medium-income countries; iii) data represents for whole economy and the studied time experienced significant reform in development of knowledge and service sector while limitations of most other research is single ownership and short study time; iv) it is associated with policy and management objectives because its results will give evidence to reform policies to reach national goals of increasing national income; v) it figures out which IC element has the strongest effect on these firms' financial performance, resulting the corresponding recommendations to Vietnamese government and firm managers.

The study concentrates in following research questions:

- How IC affects ROA of firms in R&D and consultancy services in Vietnam?
- How IC components affect ROA of firms in R&D and consultancy services in Vietnam?
- How different effects of IC on ROA of firms in R&D and consultancy services among different firm sizes in Vietnam?

After the introduction, this paper reviews literature on effects of IC on firm financial performance. Next part focuses on research methodology, employed variables and data. The fourth section discusses empirical results, paving the way for the last part of conclusion, implication, and limitation.

2. Literature review

Numerous research agree that IC has positive and significant on firm financial performance (Canibano et al., 2000; Wangwe et al., 2016; and Pendo, 2020). There remains inconsistency in definition, components, and measurement of IC. In 1969, John Kenneth Galbraith introduced the first concept of "Intellectual Capital", which encompasses both intangible and ideological processes. Inheriting this definition, several researchers such as Edvinsson and Sullivan, 1996; Bontis, 1998; and Huang and Jim, 2010. Rastogi defines intellectual capital as crucial abilities of a company to combine and deploy its knowledge resources to create value to achieve its future objectives. The IC' definition has been continuously modified, nowadays, there is no agreement of definition of "intellectual capital" (Zambon, 2004). Nevertheless, many researchers believe that intellectual capital consists of three main elements: human capital, structural capital, and social capital (Bontis, 1998; Sharabati, Jawad and Bontis, 2010; Phusavat et al., 2011; Aramburu and Saenz, 2011).

In 1998, Pulic firstly introduced a method, namely the value-added intellectual coefficient, or VAIC to measure IC effectiveness, which was subsequently developed by other scholars such as Bayraktaroglu et al. (2019), Soewarno and Tjahjadi (2020) and Muhammad (2022). Recently, numerous researchers have employed VAIC which is based on three factors: CEE—capital efficiency, SCE—structural capital efficiency, and HCE—human capital efficiency. Generally, most of researchers agree that IC has positive and significant impact on firm performance (Canibano et al., 2000; Wangwe et al., 2016; and Pendo, 2020). There is no study focusing on research, development and consultancy service sub-sector which is a key sector for the national economic growth, particularly for the case of emerging economies. This research fills this gap with the case of Vietnam, particularly during the period 2005-2014 with significant institutional reform for knowledge development, therefore, the first hypothesis is as following:

H1. *IC* contributes to *firm financial performance of R&D, consultancy services sub-sector*.

Human Capital

Human capital is represented by the awareness, certifications, and expertise of employees in the firm and is often illustrated in terms of wages and salaries (Vergauwen et al., 2007). Nonaka and Von Krogh (2009), Gilbert, Von, and Broome (2017) believed that human capital is expressed through employees' ability and enthusiasm in using the company's physical resources to solve problems creatively, improving knowledge and expanding new business opportunities. Nonaka and Von Krogh (2009), Cao and Wang (2015), Von and Broome (2017) and Hoang and Nguyen (2017) argued that human resource (HC) is one of the most crucial intangible resources, which is reflected in employee characters, skills, attitudes, ability, the level of education and work experience. The positive impact of HCE on firm performance is evident in several emerging countries including Tanzania (Wangwe, et al., 2016) and India (Oppong and Pattanayak, 2019; Smriti and Das, 2018). Therefore, this paper tests the following hypothesis for an emerging country in Southeast Asia, the case of Vietnam:

H2. *Human capital efficiency (HCE) is beneficial for the firm's performance.*

Structural Capital

Structural capital (SC) supports companies for developing a productive working environment as well as firm's research and development activities (Pulic, 1998; and Petty and Guthrie, 2000). Pulic (1998) argued that SC includes internal policies and controls, such as corporate strategies, patents, organizational networks, and brand names. Bontis et al., (2015) indicated a positive effect of structural capital efficiency (SCE) on financial performance of the company in Serbia, while Isanzu (2015) shown a negative impact in Tanzania and Romania. From these results and findings, the following hypothesis is tested:

H3. *Structural capital efficiency (SCE) improves a firm's financial performance.*

2.4. Capital Employed

The third component of the IC is capital employed (CE), that promotes internal and external relationships with staffs and customers, suppliers, creditors, and governments, resulting in the improvement of company performance (Chowdhury et al., 2019). There are mixed results regarding the impact of CE on corporate performance.

Several scholars have found positive effects of CE (Chu et al., 2011; Ousama and Fatima, 2015; and Smriti and Das, 2018). For the case of emerging countries, some witnessed the positive impact of CE on firm performance, such as China and India (Nadeem et al., 2017), whereas other countries do not (Bayraktaroglu et al., 2019 and Chowdhury et al., 2019). Asare et al. (2017) found that the effect of CE was extremely powerful compared with other IC components, however not as strong as that of HCE. Thus, this paper considers the following hypotheses:

H4. *Capital employed efficiency (CEE) expresses a positive impact on a company's financial performance.*

H5. *Human capital performance (HCE) has a strongest impact on a company's financial performance in comparison with other IC components.*

2.5. Firm Performance

Numerous indicators such as return on assets (ROA), return on equity (ROE), return on assets (ATO) and sales growth (SG) demontrate a firm's financial performance (Soewarno and Tjahjadi, 2020). The usage these same common indicators will facilitate the comparison of results between studies (Firer and Williams, 2003; Chen et al., 2005; Chan, 2009; Ting and Lean, 2009; Chowdhury et al., 2019). Regarding control variables, research focusing on IC impact usually analysed leverage and firm size as control variables. In addition, firm features that can affect a company's performance through the method of its operation and manages its activities including ownership, capital deepening, experience and gender issue (Nguyen, 2023). Ownership influences firm's financial performance (Firer and Williamson, 2005; Ahmed et al., 2022). Therefore, the following hypotheses are established:

H6. *The impacts of IC efficiencies on a firm's performance differ among different cohorts of firm size.*

The common limitations of recent research are small sample, single industry/field, short study time, same control variables, etc. There are gaps for further research, IC impact can be investigated with different ownerships, firm sizes, industries, different countries and over longer time periods, with more dependent variables, more various IC components, more comprehensive control variables.

3. Methodology

3.1. Variables

All variables are theoretically driven (Table 1). This paper uses ROA as the dependent variable to examine impact of IC on financial performance of a company. According to the resource-based theory, the financial performance of a company is also expressed in return on assets (ROA) because it can be converted into "value" in the market (Wernerfelt, 1984). Additionally, numerous studies used this indicator, thus facilitating for comparison with other research findings (Chen et al., 2005; and Chowdhury et al., 2019).

Regarding the interested explaining variables in this research are IC and its components. As mentioned above, this paper employs the most common model - value-added intellectual coefficient model (VAIC), which was firstly introduced by Pulic (1998). Similar to numerous studies, VAIC is composed of three efficiencies: human capital efficiency (HCE), capital employed efficiency (CEE), and structural capital efficiency (SCE) (Muhammad, 2022).

In terms of control variables, similar to various, research, this study employs leverage and firm size. Additionally, other firm features affecting a firm's performance are controlled, including ownership, capital deepening, experience, and gender issue (Ahmed et al., 2022 and Nguyen, 2023). Ownerships include state-owned, non-state-owned (excluding FDI firms) and FDI enterprises. According to Vietnam regulations, firm sizes are based on employee number, in which large-sized firms have more than 100 employees, medium-sized ones have maximum of 100 and more than 50 employees, small-sized ones have maximum of 50 and more than 10 employees, and micro-sized ones have as not more than 10 employees.

The year dummies are controlled for dynamic changes in the business environment. Financial variables are de-flated by the annual consumer price index (CPI) of Vietnam to facilitate comparison among years. The variable investigated in logarithmic form is capital deepening.

Table 1. Variables.

Independent vars.	Measurement
Dependent variable	Return on assets (ROA), representing firm financial performance
Independent variables	
IC Efficiencies	
VAIC	Value-added intellectual coefficient
HCE	Value added per total employees' earning
SCE	Ratio of value added minus total employees' earning divided by value added
CEE	Ratio of value added divided by total tangible assets
Control variables	
Capital deepening	Fixed asset per employee
Leverage	Total liabilities divided by total assets (the book value)
Gender issue	Ratio of female employees
Experience	Years since the founding year
State-owned enterprises	Dummy var. 1: State-owned enterprises; 0: Otherwise
Non-state-owned enterprises	Dummy var. 1: non-state-owned enterprises; 0: Otherwise

Source: Own analysis

3.2. Empirical model

Following public (1998), this paper applies VAIC model as follows:

VAIC= HCE+ SCE+ CEE (1)

In which: CEE = VA/CE ; HCE = VA/HC; SCE = SC/VA; SC = VA – HC.

CE is measured by total tangible assets; HC is calculated by total employees' earning.

VA is value added and measured based on the 'value-added' approach (Riahi-Belkaoui, 2003):

VA = NI + T + DP + I + W (2)

Where: NI is net income after tax; T reflects taxes; DP represents depreciation; I implies interest expense; and W is estimated by total employee wages and salaries.

Similar to Chowdhury et al., 2019 and Muhammad (2022), this paper examines the IC impact on firm financial performance in research, development and consultancy basing on the model as follows:

$$ROA_{it} = a_0 + \beta_v VAIC_{it} + \beta_x X_{it} + e_{it} \quad (3)$$

$$ROA_{it} = a_0 + \beta_h HCE_{it} + \beta_s SCE_{it} + \beta_c CEE_{it} + \beta_x X_{it} + e_{it} \quad (4)$$

e_{it} denotes a random disturbance and it is assumed to be normal, independent and identically distributed (IID) with $E(e_{it}) = 0$ and$var(\varepsilon_{it}) = \sigma_\varepsilon^2 > 0$.

Fixed and random effects models are employed for Model (3) which is conducted for whole sample to evaluate the impact of whole IC efficiency on firm financial performance; and for model (4) which is examined IC components' impact for different firm sizes. X_{it} expresses internal factors.

3.3 Data

This paper employs data extracted from the annually national enterprise Census of Vietnam. This census is the most comprehensive one for firm information. It is the most suitable to measure VAIC for many years at firm level representing for whole country. The study focuses on firms in research and development (R&D) and consultancy services in Vietnam (sub-sectors in details in Appendix 1). In order to compare among years, the paper sets up balanced panel data with the same firms for whole period, however after deleting missing observations, the used data is unbalanced panel with 15,966 firm-year observations, including 7840, 6272, 1141 and 713 of micro, small, medium, and large-sized firms, respectively (Table 2). This paper applies STATA 16.0. software to run the empirical estimations.

Table 2: Descriptive Statistics of Private Firms

Variable	Mean	Std. Dev.	Min	Max
ROA	0.03	0.07	-0.12	0.41
VAIC	2.47	1.16	1.00	16.37
HCE	1.71	0.94	1.00	15.18
SCE	0.33	0.18	0.00	0.93
CEE	0.43	0.39	0.00	2.25
Capital deepening	72.39	212.19	0.00	3641.75
Leverage	0.41	0.28	0.00	1.05
Experience	8.89	6.20	1.00	67.00
Female employee rate	0.39	0.19	0.00	1.00
State owned enterprises	0.01	0.10	0.00	1.00
Private enterprises	0.92	0.26	0.00	1.00

Note: Author's calculation. The number of observations: 15,966

4. Results

This part presents the empirical results of impact of IC and its components on firm financial performance of research, development, and consultancy services. The model runs for whole sample, then runs separately for different firm sizes for comparison purpose. Relying on the Hausman tests, the measurement is chosen for fixed or random effects models .

4.1. General impact of IC on agricultural firm performance

This part investigates the impact of whole IC (model 1) and of IC efficiency's components on firm financial performance (model 2). With positive and significant coefficients, the outcomes confirm the hypotheses 1, 2, 3, 4, that IC, HCE, SCE, CEE have positive and significant impacts on firm financial performance of research, development, and consultancy services in Vietnam. However, the strength of HCE does not satisfy the hypothesis 5 because its coefficient is smaller than CEE's one (Table 3).

The results from model 1 confirms the hypothesis 1 that generally IC contributes to firm performance. This result is similar to other lower - medium - income countries, including Czech (Muhammad, 2022) and Nigeria and Ghana (Pendo, 2020).

The impacts of HCE, SCE, CEE are significant and positive , accepting the hypotheses 2, 3, and 4. SCE has the strongest impact (coefficient of 0.1497) instead of HCE (coefficient of 0.0054) as respected, therefore the hypothesis 5 is rejected. The outcome is consistent with Farrukh and Joiya (2018) and Vitalis (2018) who found that SCE contributes significantly to financial performance. The significant and strongest impact of SCE on firm financial performance in this study is in contrast to Wang (2011), and Chowdhury et al. (2019). This result suggests firm managers concentrating on increasing structural capital. The positive coefficient of CEE confirms its beneficial impact on firm performance. It is contrast with findings of Pendo (2020) and Forte et al. (2019) that CEE negatively correlated with firm financial performance.

Regarding internal factors, capital deepening is a significant and negative control variable. It implies firm should pay attention to improve efficiency of capital usage. Leverage seems to be burden to firms; the higher leverage causes the lower firm financial performance. These results of capital deepening and leverage suggest that firm should restructure capital, focusing on investment fields with higher value-added. In addition, research and development (R&D) investment is venture investment typically, thus for service firms mostly with low capacity and competitiveness in Vietnam, the leverage becomes seriously risky. Higher female employee rate results lower firm financial performance. It suggests the low working condition for female workers in Vietnam.

Table 3: Intellectual Capital efficiency for R&D and consultancy Service enterprises in Vietnam (Fixed effect model)

	IC	IC components
	(1)	(2)
Total IC efficiency		
Total Intellectual capital	0.0299***	
	(0.000)	
IC components' efficiency		
Human capital efficiency		0.0054***
		(0.001)
Structural capital efficiency		0.1497***
		(0.004)
Capital Employed Efficiency		0.0824***
		(0.001)
Internal factors		

Capital deepening	-0.0008***	-0.0004***
	(0.000)	(0.000)
Leverage	-0.0165***	-0.0184***
	(0.002)	(0.002)
Experience	0.0001	0.0002
	(0.000)	(0.000)
Gender issue	-0.0094***	-0.0105***
	(0.004)	(0.003)
State ownership	-0.0092	-0.0093*
	(0.006)	(0.005)
Private ownership	-0.0079	-0.0110**
	(0.005)	(0.005)
Constant	-0.0333***	-0.0537***
	(0.005)	(0.005)
R^2	0.284	0.395
Observations	15966	15966

Note: The table provides the results of the Random effect model. An asterisk (*),(**),(***)denotes statistical significance at least at the 10%, 5%, 1% levels, respectively. Standard errors are in parentheses. Model 1 expresses the impact of IC on firm financil performance in sub-sector of research and development and consultancy services. Model 2 presents the impact of IC components on firm financil performance in sub-sector of research and development and consultancy services. All models are regressed with time dummy variables. We do not report these variables here. The results estimated by fixed/redom effect methods and hausman tests shall be provided upon request.

3.2. IC effects on firm financial performance by different firm sizes

This section analyses and compares impact of IC and its components on firm financial performance among different firm sizes. The empirical outcomes express that IC is beneficial for firm performance of R&D and consultancy services, once again confirming the hypothesis 1. However, the effects of IC components among various firm sizes change compared with the case of whole sample. Hypotheses 3, 4 are accepted while hypotheses 2, 5 are rejected. The effects of IC components depend on firm sizes, accepting the hypothesis 6 (Table 4).

That means, IC contributes to firms at all firm size. SCE and CEE both have positive and significant impacts on firm performance. Our outcomes are similar to Chen et al. (2005), who presented evidence of positive effects of CEE and SCE on the Taiwanese firms profitability, confirming the findings that CE becomes important in creating high value returns (Ting and Lean, 2009). SCE has the strongest effect compared with other IC components. SCE is strongest for large firms while CEE has the strongest effect on micro-sized firms.

While HCE is not all significant at all firm sizes and is the weakest effects rather than the strongest effects compared with effects of other IC components. Similar to Chu et al. (2011), the strongest effects belong to SCE,

implying the most significant role of SC for firms in R&D and consultancy services. It is suitable because the internal policies, strategies strongly affect efficiency of R&D investment. While HCE is only positive and significant for micro and small-sized firms. The insignificant effect of HCE is consistent with Mohammed (2014) who found there is not relationship between HCE and firm performance. It implies that at small sizes, firm should increase HC, at medium and large sizes firm should improve efficiency of this capital.

Regarding internal factors, the effects changes corresponding various firm sizes. For factors of capital deepening, leverage, gender issue and private ownership, negative effects are mitigated when firms increase their sizes based on employee numbers. Micro-sized firms face the most strongly negative effect of capital deepening and gender issues, implying the inefficiency in capital usage and insufficient working conditions for female employees in these firms. Medium and large firms which is state owned should improve organization procedures to improve financial performance.

Table 4: Intellectual Capital efficiency for R&D and consultancy Service enterprises in Vietnam (Fixed and Random effect models)

	IC				IC components			
	Micro firms	**Small firms**	**Medium firms**	**Large firms**	**Micro firms**	**Small firms**	**Medium firms**	**Large firms**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Total IC efficiency								
Total Intellectual capital	0.0275***	0.0305***	0.0384***	0.0254***				
	(0.001)	(0.001)	(0.002)	(0.002)				
IC components' efficiency								
Human capital efficiency					0.0018*	0.0076***	0.0074	-0.0041
					(0.001)	(0.001)	(0.006)	(0.004)
Structural capital efficiency					0.1444***	0.1534***	0.1491***	0.1684***
					(0.006)	(0.007)	(0.027)	(0.024)
Capital Employed Efficiency					0.0953***	0.0783***	0.0701***	0.0817***
					(0.002)	(0.002)	(0.005)	(0.006)
Internal factors								
Capital deepening	-0.0012***	-0.0007**	-0.0003	-0.0006	-0.0007***	0.0001	0.0012	-0.0001
	(0.000)	(0.000)	(0.001)	(0.002)	(0.000)	(0.000)	(0.001)	(0.002)
Leverage	-0.0159***	-0.0169***	-0.0355***	-0.0171	-0.0190***	-0.0183***	-0.0265**	0.0091
	(0.003)	(0.004)	(0.011)	(0.015)	(0.003)	(0.003)	(0.011)	(0.013)
Experience	-0.0003	0.0001	-0.0001	0.0000	0.0002	0.0002	-0.0001	0.0001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)

Gender issue	-0.0088**	-0.0062	-0.0172	0.0208	-0.0089**	-0.0102	-0.0260	0.0155
	(0.004)	(0.007)	(0.021)	(0.022)	(0.004)	(0.006)	(0.020)	(0.020)
State ownership	-0.0428*	0.0107	-0.0332**	-0.0267***	-0.0080	-0.0004	-0.0321**	-0.0259***
	(0.025)	(0.014)	(0.013)	(0.007)	(0.049)	(0.013)	(0.013)	(0.006)
Private ownership	-0.0314***	-0.0038	0.0130	-0.0063	-0.0433	-0.0078	0.0075	-0.0074
	(0.006)	(0.010)	(0.009)	(0.007)	(0.036)	(0.009)	(0.009)	(0.006)
Constant	-0.0165**	-0.0306***	-0.0165	0.0107	-0.0275	-0.0578***	-0.0280**	-0.0432***
	(0.007)	(0.010)	(0.014)	(0.015)	(0.036)	(0.010)	(0.014)	(0.014)
R^2	0.3530	0.294	0.302	0.314	0.412	0.393	0.355	0.460
Observations	7840	6272	1141	713	7840	6272	1141	713

Note: The table provides the results of the Random and fixed effect model. An asterisk (*),(**),(***)denotes statistical significance at least at the 10%, 5%, 1% levels, respectively. Standard errors are in parentheses. Model 1 (random effect model), models 2, 3, 4, 5 (fixed effect models) investigate effects of IC on firm financil performance in sub-sector of research and development and consultancy services for micro, small, medium, large-sized firms, respectively. Models 5, 6, 7 (fixed effect models), model 8 (random effect model) expresses the impact of IC components on firm financil performance in sub-sector of research and development and consultancy servicesfor micro, small, medium, large-sized firms, respectively. All models are regressed with time dummy variables. We do not report these variables here. The results estimated by fixed/redom effect methods and hausman tests shall be provided upon request.

4. Conclusions

This research evaluates impact of IC and its components on firm financial performance of R&D and consultancy services in a lower-medium-income country like Vietnam. Applying VAIC model with fixed and random effects model, empirical results confirm the positive and significant effects of IC on firm financial performance of R&D and consultancy services in Vietnam. Interestingly, SCE is the most important IC component for Vietnamese firms in R&D and consultancy sub-sector. CEE is also beneficial for these firms. However, HCE is insignificant for medium and large firms. Hypotheses 1, 3, 4, 6 are accepted, while hypotheses 2, 5 are rejected. The results suggest solutions and policy implications for Vietnam for R&D and consultancy services. In order to achieve the target of accelerating innovation and creation by R&D and consultancy services, Vietnamese government should concentrate in supporting firms in this sub-sector with strengthening investment in IC. The government and firm managers should focus on increasing SCE and CEE, particularly SCE. They should investigate reasons why HCE has insignificant effect on firms at medium and large sizes. The management mechanism in recruiting and using labor force in these firms should be reformed in Vietnam. The government and firm managers should have solutions corresponding to various firm sizes. Focusing on increasing SCE for large firms drive highest efficiency for financial performance in R&D and consultancy services in Vietnam. In order to support micro-sized firms in this sub-sector, the government and firm leaders should pay attention in increasing CEE.

Additionally, the government and firm managers should improve efficiencies of capital usage (particularly for micro-sized firms) and leveraging (especially for medium-sized firms). Vietnamese government should supply more preferential loans or more flexible condition to access credit for firms, particularly for medium-sized firms. Micro-sized firms suffer most from gender issues, suggesting firms and government pay more attention in improving working conditions for female employees. State-owned firms at medium and large sizes should focus on improving financial performance.

This paper has some limitations. It only uses one financial performance indicator, ROA. Further research should employ others such as return to equity (ROE), sale growth, and assets turnover (ATO). This study only compares among firm sizes, other research could compare among different ownerships, and service activities. Regarding IC elements, innovation and social capitals are not evaluated in this research because of limitations of data.

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Appendix 1: R&D and consultancy sub-sectors - Economic activities in service sector in Vietnam

Code	Sub-code	- Economic activities
701	7010	Activities of the office headquarters
702	7020	Management consulting activities
711	7110	Architectural activities and related technical consultancy
712	7120	Testing and technical analysis
721		Scientific research and technological development in the field of natural sciences and engineering
	7211	Scientific research and technological development in the field of natural sciences
	7212	Scientific research and technological development in the field of technical science and technology
	7213	Scientific research and technological development in the field of medical and pharmaceutical sciences
	7214	Scientific research and technological development in the field of agricultural sciences
722		Scientific research and technological development in the field of humanities and social sciences
	7221	Scientific research and technological development in the field of social sciences
	7222	Scientific research and technological development in the field of humanities
731	7310	Advertise
732	7320	Market research and opinion polls
741	7410	Dedicated design activities
742	7420	Photographic activity
749	7490	Other professional, scientific and technological activities have not been classified anywhere