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Abstract
The aim of this study is to examine the impact of intellectual capital on financial performance of Malaysian construction firms using value-added intellectual coefficient (VAIC) model. The empirical data were drawn from a panel consisting of 41 construction firms listed in Bursa Malaysia and observed over a five-year period of 2011 to 2015. Two regression models were examined in order to test the hypotheses included in the research framework of the study. Intellectual capital is the independent variable in the study and measured by VAIC, HCE, SCE, CEE and the dependent variable, financial performance, is proxy by ROA. The results show that VAIC is positive and significantly associated with ROA. However, on the components of intellectual capital, only CEE is positive and significantly associated with ROA. The concentration on one industry and the relatively narrow five-year period for data collection were the main limitations of this study. The value of this study is the contribution towards intellectual capital literature by expanding into construction firms and such a research is limited.
Keywords: Intellectual Capital, Financial Performance, VAIC, Construction Firms.

Introduction
Firms employ resources to create sustainable competitive advantage and according to resource-based theory, a firm has a bundle of resources which are both tangible and intangible (Barney, 1991). These resources become a source of competitive advantage only if they exhibit the characteristics of valuable, rare, inimitable, and non-substitutable (Barney, 1991). Valuable is the ability of firms' resources to create sustainable value and the resources are said to be rare when the resources are heterogeneously distributed across firms, not easily accessible to competitors and possessed by very few firms. As for inimitable resources, they are the resources that the firm is able to protect from being copied by competitors. Meanwhile, non-substitutable resources are

resources with no equivalent strategic resources or capabilities (Barney, 1991). However, some scholars argued that intangible resources are the only source of firms' competitive advantage due to two unique characteristics which are inimitable and non-substitutable, unlike tangible resources that are generic in nature and can be traded openly in the market (Youndt, Subramaniam and Snell, 2004; Reed, Lubatkin, and Srinivasan, 2006). Additionally, in Knowledge economy, economic growth is no longer determined by the employment of tangible resources but rather by the employment of knowledge-based resources which is intangible in nature and collectively they are referred to as intellectual capital.

In the meantime, construction industry acted as engine of economic growth specifically in developing economies such as Malaysia. The activities in construction industry are closely linked to the various phases of economic development, thus generating higher multiplier effect in the economy of a country (Park, 1989; Lean, 2001; Rameezdeena and Ramachandra, 2008; Raza, Mohd and Zulkipli, 2013). In relation to Malaysia's economy, construction industry is contributing positively towards the country GDP. The industry contributed 3.2 percent to Malaysia GDP in 2011, increase to 3.5 percent in 2012 and increase further to 3.8 percent in 2013 (Department of Statistics Malaysia, 2014). The increase can be attributed to the strong growth and the implementation of major projects by the government. In regards to this, a study of intellectual capital in construction industry appear to be both timely and appropriate, *first,* because construction industry is heavily depended on intellectual capital notably in terms of human capital-related activities such as attracting human capital, developing human capital and retaining human capital. *Second,* the process of building designs, architecture work, electrical, plumbing and mechanical aspects are knowledge intensive, thus provides a fruitful setting for intellectual capital assessment. *Third,* to the best of the researchers' knowledge, this industry has not been widely researched in the past.

There are mixed findings on the issue of intellectual capital and financial performance. The evidence of intellectual capital incentives on firms' financial performance has been documented by Ting and Lean (2009), Nimtrakoon (2015) but Joshi, Cahill, Sidhu and Kansal (2013), Bontis, Janosevic and Dzenopoljac (2015) indicated no evidence between intellectual capital and firms' financial performance. In addition to this, most of the studies conducted are relevant to other industries for example banking sector, financial sector. None of the above studies has examined the impact of intellectual capital on firms' financial performance in construction industry setting. Thus, the motivation of this study is to extend the understanding of the impact of intellectual capital on firms' financial performance in Malaysian construction firms. In essence, the findings of the study may uncover the contribution of intellectual capital towards firms' financial performance and provide valuable guidance to firms' managers in designing business strategy. In addition, it will improve intellectual capital practices and moves in tandem with the economy. Accordingly, considering the importance of measuring intellectual capital for construction industry, this study has two main objectives. The first is to measure the impact of intellectual capital on financial performance and second is to examine the separate effects of human capital efficiency, structural capital efficiency and capital employed efficiency on financial performance.

The remainder of this paper is structured as follows. The next section, Section 2 provides the literature review. Section 3 provides the research framework of this study. This is followed

by Section 4 that outlines the data and methodology of the study. The results of the data analyses and discussions are shown in Section 5. The last section concludes the study.

Literature Review

The concept of intellectual capital has evolved from different academic disciplines and has increasingly become an interdisciplinary field; therefore there is no single definition or categorization of intellectual capital (Marr, 2007). However, this study adopts the definition of intellectual capital as the combination of human capital, structural capital and relational capital. Human capital is the individual employees and the group of employees in the organisation. The individual employee refers to the employee's personal attributes, technical competence and creativity. The group of employees refers to the team work, healthy working environment and corporate culture. As for structural capital, it encompasses all the knowledge kept in the organizational infrastructures such as databases, organizational procedures, patents and trademarks including other organizational capability that supports employees' productivity. Meanwhile, relational capital is the link that the organisation has with its external environment such as customers, suppliers, resource providers, banks and shareholders. Relational capital is the ability of an organisation to create relational value with its external stakeholders. Relational capital creates value to organizations in the form of customer and brand loyalty, customer satisfaction, market image and goodwill, power to negotiate, strategic alliances and coalitions (Bontis, 1996; Edvinsson and Malone, 1997; Stewart, 1997; Roos and Roos, 1997; Joshi et al., 2013).

The findings on the relationship between intellectual capital and financial performance had documented inconsistency. Some scholars argued positive relationship between intellectual capital and financial performance (Ting et al.,2009; Nik Maheran and Md Khairu, 2009; Khan, Yasser and Hussain, 2015; Nimtrakoon, 2015) and others documented negative relationship between intellectual capital and financial performance (Kamath, 2008; Joshi et al., 2013; Maditinos, Chatzoudes, Tsairidis, and Theriou, 2011; Mehralian, Rajabzadeh, Sadeh and Rasekh, 2012; Mosavi, Nekoueizadeh and Ghaedi, 2012; Bontis et al., 2015). For this reason, this research tends to investigate further the relationship between intellectual capital and financial performance in Malaysian construction industry.

The Research Framework

This paper adopts the research framework which is consistent with the study of Kamath (2008); Nik Maheran et al. (2009); Ting et al. (2009); Joshi et al. (2013); Ku Ismail and Abdul Karim (2011); Al-Musali and Ku Ismail (2014); Nawaz and Haniffa (2017), that is to examine the impact of intellectual capital on financial performance. However, this paper introduces a new research setting that is Malaysian construction industry.

Some studies concluded that firms' financial performance is influenced by the level of intellectual capital (Nik Maheran et al., 2009; Ting et al., 2009; Ku Ismail et al., 2011; Al-Musali et al., 2014, Nawaz et al., 2017), while other studies failed to confirm this relationship (Kamath, 2008). As a larger number of studies argued the existence of positive relationships, hence it is hypothesized that the greater the intellectual capital, the higher the financial performance.

H1   A higher value of VAIC leads to higher financial performance.

H2   Higher values of intellectual capital are associated with higher financial performance.

   H2a   Higher values of human capital efficiency are associated with higher financial performance.

   H2b   Higher values of structural capital efficiency are associated with higher financial performance.

   H2c   Higher values of capital employed efficiency are associated with higher financial performance.

Hypothesis 1 uses VAIC as an aggregate measure of intellectual capital and hypothesis 2 examine the separate effect of each component of intellectual capital on firms' financial performance. The separation of VAIC and its components would increase the explanatory power of the research framework and the regression models.
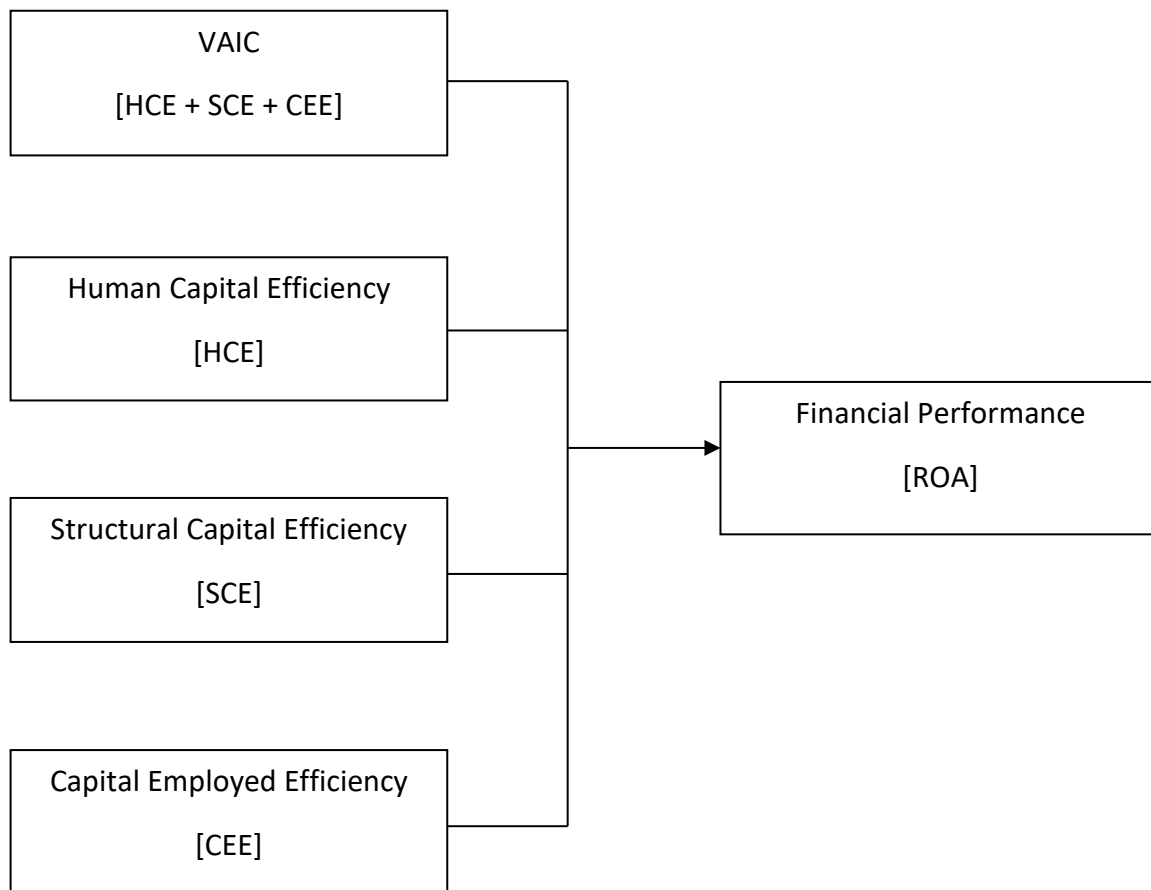

Figure 1
The Research Framework of the Study

Data and Methodology
The data used in this study were collected from the audited annual reports of 41 construction firms listed in the construction sector of Bursa Malaysia via their websites. There were 45 firms listed as at 31 December 2015, however four firms were dropped from the analysis. For the firms to be included in the analysis, three criteria would have to be fulfilled namely the sample firms should have been listed in Bursa Malaysia for the whole five-year period, none of the firms have been delisted during the period under investigation and all the five-year financial statements are available for the firms to be included in the study (Addae, Nyarko-Baasi and Hughes, 2013; Joshi et al., 2013; Abor, 2005). The number of observations for this analysis is 205 and the sample period was from 2011 to 2015.

To be consistent with prior studies (Ting et al., 2009; Maheran et al.,2009; Joshi et al., 2013; Al-Musali et al., 2014; Nimtrakoon, 2015; Nawaz et al., 2017), this study adopted ROA as financial performance indicator. ROA is calculated as operating profit divided by total assets. An advantage of using ROA lies in its ability to reflect the efficiency of utilizing available assets in generating profits (Al-Musali and Ku Ismail, 2014).

Intellectual capital and its components namely human capital, structural capital, capital employed is measured using value-added intellectual coefficient (VAIC) model (Pulic, 1997). VAIC is the sum of HCE, SCE and CEE. HCE is an indicator of human capital efficiency in creating value. It is computed by dividing value added (VA) by HC and HC is proxy by personnel costs. SCE is an indicator for structural capital efficiency measured by dividing SC by VA. SC is defined as the difference between VA and HC. Meanwhile, CEE is an indicator for capital employed efficiency. Capital employed represents the book value of total assets. CEE is defined by dividing the VA by CE. Total VA is computed using the formula of VA = OP + EC + D + A, where OP = Operating Profits; EC = Total Employee Expenses; and D = Depreciation and A = Amortization. VAIC model is used in this study due to several reasons. First, VAIC model has been used time and again in the literature of intellectual capital therefore it has been robustly tested (Goh, 2005; Joshi *et al*., 2013). In addition, VAIC offers simplicity, subjectivity, reliability and comparability in its measurement of intellectual capital which make it an ideal model to measure intellectual capital efficiency (Joshi *et al.*, 2013).

Empirical Results
Descriptive Analysis
Information on descriptive statistics includes the number of observations, minimum, maximum, mean, standard deviation of all the variables in the study and is provided in table 1.
Table 1: Descriptive Analysis

Variables	Mean	Standard Deviation	Min	Max
Hce	5.9257	15.5339	-12.0972	163.7715
Sce	0.7183	0.7629	-0.8137	9.9797
Cee	0.1323	0.3129	-0.1264	4.2774
Vaic	6.7764	15.8599	-11.0654	169.0428
Roa	7.7071	29.9237	-21.9002	425.0063

The mean value of VAIC as presented in table 1 is 6.7764, depicting the value creation capability of construction firms for every RM1 invested throughout 2011 to 2015. HCE is the most influential component in creating wealth with mean value of 5.9257, compared to SCE and CEE with the mean values of 0.7183 and 0.1323 respectively. Notably that HCE largely determines intellectual capital efficiency in the construction industry. This findings is consistent with the findings of Goh (2005); Kamath (2007); Joshi et al. (2013), Ku Ismail, 2011; Al-Musali et al. (2014); Nawaz and Haniffa, (2017). HCE and SCE depicts value creation from intangible resources hence their emphasis is on intellectual capital, meanwhile CEE is the value generated from one unit of physical and financial capital; thus, it is the tangible resources. The combined mean value of the HCE and SCE is 6.644, which is much higher than the mean value of CEE of 0.1323. The comparison suggests that firms create value more efficiently from intellectual capital rather than from physical capital. It is in line with prior literature that firms operating in the knowledge economy tend to create value from intellectual capital rather than physical capital (Nimtrakoon, 2015). In addition, the mean value of ROA is 7.7071, suggesting that the firms were able to generate profit during the period of analysis.

Correlation Analysis

Pearson correlation coefficients were computed in order to examine the strength and the direction of the relationship between all the variables in the study. The Pearson correlation coefficient values vary from -1.00 to +1.00 indicating a perfect positive correlation, a value of -1.00 represents a perfect negative correlation, and a value of 0.00 indicates no linear relationship between the two variables. The strength of the relationship can be divided into three categories (Cohen 1998; Tabachnick & Fidell, 2007; Pallant, 2007), weak relationship (0.10 to 0.29 and -0.10 to -0.29); moderate relationship (0.30 to 0.49 and -0.30 to -0.49) and strong relationship (0.5 to 1.0 or -0.5 to -1.0). Table 2 presents the Pearson correlation coefficients of the study.

Table 2: Correlation Analysis

Variables	HCE	SCE	CEE	VAIC	ROA
HCE	1.000				
SCE	0.5067	1.0000			
CEE	0.8444***	0.0004	1.0000		
VAIC	0.9988***	0.1037*	0.8468***	1.000	
ROA	0.7432***	0.0232	0.9509***	0.7478***	1.0000

Notes: ***, **, *, correlation is significant at 0.001, 0.05, and 0.1 level respectively

It is found that the correlation value indicated significant and positive associations between only several pairs of variables. VAIC is positive and significantly related to ROA (r=0.7478, p<0.0001), indicating strong relationship between value efficiency and financial performance. Regarding the components of VAIC, CEE (r=0.9509, p<0.0001) and HCE (r=0.7432, p<0.0001), have the strongest correlation with ROA. Meanwhile, SCE is insignificantly correlated to ROA. In addition, it is noted that VAIC has positive and significant relationships with its three components. Particularly, VAIC has the strongest association with HCE (r=0.9988, p<0.0001), followed by its relationship with CEE (r=0.8468, p<0.0001) but weakly correlated to SCE (r=0.1037, p<0.1).

Data Analysis

This study used secondary data extracted from the audited annual reports of the sample firms for the five-year period 2011 to 2015 which provided a panel of 205. In relation to this, panel data is suitable for longitudinal analysis because it provides both the time and cross-sections dimensions (Baltagi, Bratberg and Holmes, 2005). To determine the suitability of the panel data for statistical analysis, various tests were carried out on the data collected. The tests are panel unit root test, diagnostic tests (heteroscedasticity, serial correlation and multicollinearity) and poolability test (Breusch Pagan LM test and Hausman test).

The first test is to check for the presence of unit root in all variables, this study adopts two different panel unit root tests namely Levin, Lin and Chu (LLC) test and Fisher Type using Phillips Perron (PP) test. The results of the test are presented in table 3.

Table 3: Results of the LLC and Fisher Type-PP Panel Unit Root Test at Levels

Panel unit Root Test Variables	LLC	Fisher Type -PP
HCE	92.4954***	226.556***
SCE	30.1409***	194.490***
CEE	60.6889***	222.671***
ROA	99.1003***	190.105***

Notes: ***, **, * denote statistical significant at the 1, 5, and 10 percent levels respectively.

The results of panel unit root test above indicated that the null hypothesis of unit root (non-stationery) is rejected for all the variables. Therefore, this study concluded that the variables were stationery at levels which implied that these series were integrated at order zero, $I(0)$.

Heteroscedasticity and Serial Correlation tests were performed after obtaining an appropriate model through poolability test. The testing of heteroscedasticity and serial correlation is essential in panel data analysis due to the fact that the presence of heteroscedasticity and serial correlation problem would affect the reliability of the model regressions. In order to identify for the presence of heteroscedasticity in the data, this study adopts modified wald test for groupwise heteroscedasticity in fixed effect regression model. The assumption of the problem lies in the p-value, if the p-value is lesser than 0.01, 0.05 or 0.1 than the null hypothesis is rejected indicating the presence of heteroscedasticity problem in the regression models (variances are not constant). In addition, to detect if the data has serial correlation problem, wooldrigde test was performed. Similarly, the assumption of the problem lies in the p-value, if the p-value is lesser than 0.01, 0.05 or 0.1 than the null hypothesis is rejected and concluding that the data has first-order autocorrelation. The results are presented in table 4.

Table 4: Results of Heteroscedasticity and Serial Correlation tests

Tests	Heteroscedasticity		Serial Correlation	
Model	1	2	1	2
Statistics	2.6et09	3.4et0.6	1012.35	4074.12
P-value	0.0000	0.0000	0.0000	0.0000

The p-values of the above tests are lesser than 0.01, the results indicated the presence of heteroscedasticity problems and serial correlation problem in the data. The presence of

heteroscedasticity and serial correlation problems require treatment of data. This problem can be treated by producing standard robust error.

Multicollinearity test of the four independent variables (HCE, SCE, CEE, and VAIC) has been done. Using a cut-off value of VIF less than 5 (VIF for HCE = 3.52, SCE = 1.01, CEE = 3.51, VAIC = 1.00), no multicollinearity problems among variables is found.

Breusch Pagan LM tests were performed to identify either the model regression can be pooled using Pooled OLS or either by Random Effect or Fixed Effect. If the p-value is greater than 0.05 than Pooled OLS would be chosen and if the p-value is lesser than 0.05, therefore the result of Hausman test would determine either the model regression would be pooled using Random Effect (p-value > 0.05) or Fixed Effect (p-value < 0.05). The results of poolability test are presented in table 5.

Table 5: Results of Poolability test

	Model 1			Model 2		
	FE	RE	Pooled LS	FE	RE	Pooled LS
Cons						
β	-2.5765	-2.0985	-1.8536	-0.4231	-4.5599	-5.1536
t-value	-1.79	-1.18	-1.22	-5.85	-4.28	-5.93
p-value	(0.076)*	(0.240)	(0.222)	(0.001)***	(0.001)***	(0.001)***
HCE						
β				-0.4772	-0.4468	-0.4146
t-value	N/A	N/A	N/A	-6.75	-6.67	-5.67
p-value				(0.001)***	(0.001)***	(0.001)***
SCE						
β				-0.4922	0.1165	1.3721
t-value	N/A	N/A	N/A	-0.69	0.24	0.7973
p-value				(0.493)	(0.812)	(0.087)*
CEE						
β				114.043	111.814	108.315
t-value	N/A	N/A	N/A	33.17	33.84	29.90
p-value				(0.001)***	(0.001)***	(0.001)***
VAIC						
β	1.5176	1.4470	1.4109			
t-value	16.24	16.71	16005	N/A	N/A	N/A
p-value	(0.001)***	(0.001)***	(0.001)***			
R-Sq	0.6181	0.6181	0.5592	0.9503	0.9500	0.9179
F-stat	263.78	N/A	257.51	1026.85	N/A	748.81
Sig F-stat	(0.0001)**	N/A	(0.0001)**	(0.0001)**	N/A	(0.0001)**
Wald Chi-	*	279.23	*	*	3098.87	*
Sq	N/A	(0.0001)**	N/A	N/A	(0.0001)**	N/A
p-value	N/A	*	N/A	N/A	*	N/A

BP LM Test Chi-Sq p-value	5.99 (0.0144)**	19.08 (0.0001)***
Hausman Test Chi-Sq p-value	4.04 (0.0445)**	23.25 (0.0001)***

Notes: ***,**,* indicate statistical significance at the 1, 5 and 10 percent level respectively. The figures in the parentheses are the t-statistics. N/A is not applicable.

The p-value of BP LM test is lesser than 0.05 (p=0.0144), therefore pooled OLS would be rejected. Meanwhile, the p-value of Hausman test is lesser than 0.05 (p=0.0445) indicating that the fixed effect model would be used as the model estimator for model 1. Concerning model 2, the p-value of BP LM test is lesser than 0.05, similarly pooled OLS would be rejected. Likewise, the p-value of Hausman test is lesser than 0.05, the fixed effect model would be used as the model estimator.

Hypotheses Testing
There were two hypotheses developed for this study. The first hypothesis is to examine the impact of VAIC on financial performance. The second hypothesis is to assess the separate effect of VAIC components, HCE, SCE and CEE, on financial performance. To test these hypotheses, two regression models were formulated as follows:

Regression Model 1 $ROA_{it} = \alpha_{it} + \beta_0\,VAIC_{it} + \varepsilon_{it}$
Regression Model 2 $ROA_{it} = \alpha_{it} + \beta_0\,HCE_{it} + \beta_1\,SCE_{it} + \beta_2\,CEE + \varepsilon_{it}$

Table 6: Regression results

Dependant Variable : ROA		
Independent Variable	Model 1	Model 2
Intercept	-2.5765*	-0.4231***
	(-1.79)	(-5.85)
Hce	N/A	-0.4772***
		(-6.75)
sce	N/A	-0.4922
		(0.493)
cee	N/A	**114.043***
		(33.17)**
VAIC	**1.5176***	N/A
	(16.24)**	
R^2	0.6181	0.9503
F-value	263.78	1026.85
Sig F-value	0.0001***	0.0001***
N	205	205

Notes: ***,**,* indicate statistical significance at the 1, 5 and 10 percent level respectively. The figures in the parentheses are the t-statistics. N is number of observation. N/A is not applicable.

Table 6 illustrates the results of the regression analyses. The coefficient value of R^2 for model 1 is 62 per cent, suggesting that the regression model is able to explain approximately about 62 percent variation in the firms' ROA. The regression model is found to be statistically significant with an F-value of 263.78, suggesting that the amount of variation explained by the model is reliable for prediction. The coefficient value of VAIC is 1.5176 which implies that as VAIC increases by RM1, ROA increases by RM1.5176. The finding supports H1, confirming that firms with greater VAIC tend to have higher ROA. As for model 2, the coefficient value of R^2 shows that 95 percent variation of ROA is explained by the variance of HCE, SCE and CEE. The F-value is statistically significant at the 1 percent level implying that the regression model is reliable for prediction. One component VAIC that is CEE with coefficient value of 114.043 is found to be positive and significantly associated with ROA. The findings suggested that as CEE increases by RM1, ROA increases by RM114. It is noticed that the other two components of intellectual capital are negatively associated with ROA. The findings supported H2c but not H2a and H2b, confirming that firms with higher CEE but not HCE and SCE, tend to influence firms' financial performance.

Several conclusions can be drawn from the above findings. First, the result of regression model 1 recorded positive and significant association between VAIC and ROA, confirming that firms with a greater level of intellectual capital will exhibit higher profitability. These results are in line with prior research findings (Ting et al., 2009; Ku Ismail et al., 2011; Al-Musali et al., 2014; Nimtrakoon, 2015; Nawaz and Haniffa, 2017). Second, CEE is found to be the most significant value drivers of firms' profitability. It implies that physical capital is important in generating profitability. This result is consistent with the findings of Nimtrakoon (2015) for Asean technology firms. Third, the explanatory power as indicated by R^2 varies between the two models (the R^2 of model 1 = 62 percent, model 2 = 95 percent). The explanatory power of model 2 using the three

components of VAIC is relatively higher suggesting that managers may place different emphases on the three components of VAIC (Chen, Cheng and Hwang, 2005; Al-Musali et al., 2014).

Conclusion and Recommendation

This study provides empirical evidence by examining the relationship between intellectual capital and financial performance in construction industry in Malaysia. The findings of the study show a positive and significant relationship between intellectual capital and financial performance in construction firms and among the components of VAIC, physical capital is found to be the most influential value drivers in the industry.

Some practical implications of the research findings are identified in the context of Malaysian construction industry. The research findings suggest that construction firms should increase intellectual capital utilization in enhancing their financial performance. In relation to this, it provides management with an opportunity to critically analyze the contribution of intellectual capital to the firms and will aid the design of business strategies. In addition, the findings revealed that construction firms gain greater benefit from financial and physical capital in relation to human capital and structural capital, therefore increasing investment in physical capital may lead to even higher profit.

This research has several limitations which should be acknowledged. The first limitation is associated with the sample firms which are drawn from only one industry, construction, therefore, the research findings is restricted to this industries and limit the generalization of the findings to other industries. The second limitation is linked to the model VAIC used in this research. Some scholars have questioned the validity and appropriateness of the model (Stahle, Stahle and Aho, 2011). They claimed that the model is designed to measure the efficiency of the firms' human capital and capital investment rather than intellectual capital. Another limitation of the research is the relatively narrow five-year period for the data collection. Therefore, future research should extend the literature into other potential industries such as service industries or other knowledge-based industries and perhaps should consider extending the time period beyond five years. To address the limitation of VAIC model, future research should consider other models such as MVAIC model (Ulum, Ghozali and Purwanto, 2014) in order to arrive at a better measurement of intellectual capital and its efficiency.

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