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Intellectual Capital and Firm Performance: Evidence from Technology Sector in Malaysia

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Abstract

The aim of the paper is to examine the impact of intellectual capital on firm performance of technology firms listed on the main market of Bursa Malaysia. The study covers a period of seven years from 2013 to 2019 and usable data was drawn from 32 firms, providing 224 observations for the analysis. Intellectual capital is proxy by Modified Value Added Intellectual Coefficient (MVAIC), human capital efficiency (HCE), structural capital efficiency (SCE), relational capital efficiency (RCE) and capital employed efficiency (CEE), while performance is proxy by return on asset (ROA). The empirical findings reveal a positive and significant association between MVAIC and ROA but a mixed relationships between the efficiency of MVAIC components and ROA. Two components, HCE and CEE, are positive and significantly associated with ROA. SCE is significant but negatively associated with ROA. While, RCE is insignificantly associated with ROA. There are some limitations associated with the study. The research outcome is specific to technology sector; therefore, the findings cannot be generalised to other industries. Further, the analysis uses MVAIC model and the model does not cover innovation capital and process capital, thus it may omit other aspects of intellectual capital. Some practical implications from the findings are to achieve higher future profitability, technology firms should not only manage physical capital effectively but also improve employee, internal processes and networking efficiently.

Keywords: Intellectual Capital, Technology Sector, MVAIC Model, ROA.

Introduction

Global transition to knowledge-based economy during the third industrial revolution in 1990s has created a new economic model that account 'knowledge' as factor input in the firm production process in addition to capital and labour (Harris, 2011). Accordingly, the knowledge-based economy has raise the importance of intellectual capital or knowledge assets as the firm's key resources in gaining and sustaining competitive advantage (Martin-de-Castro, Delgado-Verde, Lopez-Saez and Navas-Lopez, 2011) through various value creations that requires human intellects (Lerro, Linzalone, and Schiuma, 2014). The critical role of intellectual capital for the firm in balancing the innovation and exploitation activities is further emphasised in the present fourth industrial revolution era (Mahmood and Mubarik, 2020). Going forward, intellectual capital is the key assets for the firm survival.

Intellectual capital is a broad concept which is often divided into various components and the widely accepted components are human, structural and relational capital (Ting, Ren, Chen and Kweh, 2020). Human capital is described as the abilities, knowledge and experience that when employees leave, they take with them. At the same time, the knowledge that stays within the organisation is known as structural capital. Relational capital is characterised as all resources linked to the company's external relationships (Starovic and Marr, 2003). Intellectual capital is perceived as an intangible, reusable and manageable asset that can be used to build sustainable resources, accessible at the micro-level comprising individuals and organisations and the macro-level including cities, regions, and countries (Matos, Vairinhos, Selig and Edvinsson, 2019). For both society and organisations, intellectual capital is critical. In the context of an organization, it could be a source of competitive business advantage and stimulating innovation that leads to the generation of wealth. In an atmosphere of constant change, the ability to react effectively to unexpected events and consistently generate value is precisely the aim and province, the function and rationale of intellectual capital. Intellectual capital's unique focus is to assist build businesses that are prepared for strategic surprises and change (Rastogi, 2003).

The literature of intellectual capital has revealed the significance of intellectual capital on firm performance, and it has captured significant attention from scholars over the last three decades. Past studies have covered a wide range of industries and scholars often classify them into the knowledge-intensive sector (e.g. banks, finance, and technology) and capital-intensive sector (e.g. oil and gas, textile). Of the firms in the knowledge-intensive sector, the widely investigated are financial institutions involving banks and finance, but very few studies concentrated on technology firms (Vishnu and Gupta, 2014; Dženopoljac, Janoševic and Bontis, 2016). Generally, prior studies reported consistent empirical findings on the impact of intellectual capital on firm performance involving financial institutions, suggesting the positive association enhances firm performance. However, concerning technology firms, the results were inconclusive.

Based on the literature review undertaken, it is discovered that minimal empirical studies have endeavoured to clarify on intellectual capital and its association with firm performance of technology firms in Malaysia using Modified Value-Added Intellectual Coefficient model (Nimtrakoon, 2015). Thus, the findings of this paper aim to fill that void. The primary objective of the study is to examine the impact of intellectual capital on firm performance of technology firms in Malaysia. The specific objectives are to examine the impact of intellectual capital on firm performance using MVAIC model and to investigate the separate effect of human capital efficiency (HCE), structural capital efficiency (SCE), relational capital efficiency (RCE) and capital employed efficiency (CEE) on firm performance.

The paper is structured as follows. Section 2 provides literature review and research hypotheses. Section 3 presents methodology of the study. Section 4 provides analysis and discussion on the findings. Section 5 presents conclusion of the study.

Literature Review and Hypotheses

In the accounting and finance literature, research has been devoted to intellectual capital disclosure, measurement, and impacts to firm performance (Ashton, 2005; Kamath, 2008; Maditinos et al., 2011; Dumay, Guthrie and Rooney, 2020). This research specifically focuses on intellectual capital impacts to firm performance.

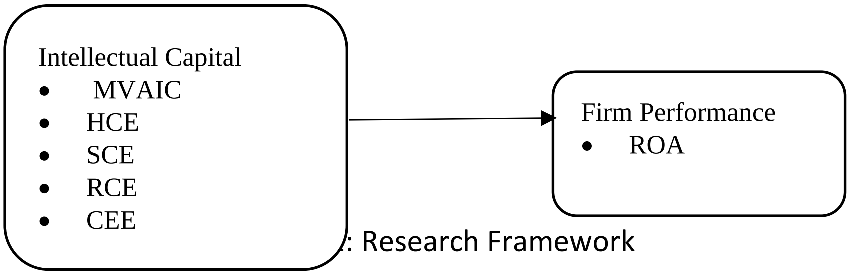
Past studies have covered a wide range of industries and scholars often classify them into the knowledge-intensive sector (e.g. banks, finance, and technology) and capital-intensive sector (e.g. oil and gas, textile). Further, the knowledge-intensive sector tends to invest more in intellectual capital than capital-intensive sector to gain competitive advantage (Vishnu et al., 2014; Nimtrakoon, 2015; Dzenopoljac et al., 2016; Xu and Li, 2019). Of the firms in the knowledge-intensive sector, the widely investigated are financial institutions involving banks and finance, but very few studies concentrated on technology firms (Vishnu et al., 2014; Dženopoljac et al., 2016). Generally, prior studies reported consistent empirical findings on the impact of intellectual capital on firm performance involving financial institutions, suggesting the positive association enhances firm performance. Al-Musali and Ismail (2016) studied the relationship between intellectual capital investment and firm performance of listed commercial banks in Gulf countries, and their study identified a positive association. Irsyahma and Nikmah (2017), drawing from the Indonesian banking sector, reported a positive association between intellectual capital and firm performance, implying banks with a higher degree of intellectual capital efficiency would demonstrate higher performance. Research by Tiwari and Vidyarthi (2018) exhibited a positive correlation between intellectual capital and firm performance in Indian public and private banks, suggesting banks with better intellectual capital efficiency usually have a better performance. A study by Tran and Vo (2018) on Thailand listed banks, Ousama, Hammami and Abdulkarim (2019) on Islamic banks of Gulf countries and Soewarno and Tjahjadi (2020) on Indonesian banks reported similar results, a positive and significant association between intellectual capital and firm performance.

However, concerning technology firms, there is little evidence and the results were inconclusive. Nimtrakoon (2015) conducted an empirical analysis of intellectual capital and firm performance of technology firms across five ASEAN countries and discovered a positive impact of intellectual capital on firm performance. The study suggested that intellectual capital may be an indicator of future firm performance. In contrast to the positive association, Dženopoljac et al. (2016) found no significant links between intellectual capital and firm performance in the technology sector of Serbia. Ting et al. (2020) revealed similar results in an analysis involving the relationship between intellectual capital and firm performance of technology firms in Taiwan. The empirical findings reported by Dženopoljac et al. (2016) and Ting et al. (2020) provide insights that stakeholders still perceive tangible assets as superior to intellectual capital in generating wealth for the firms. Closely related to this research is the study of intellectual capital impacts on technology-intensive firms in Malaysia which documented that many firms still depend on psychical capital efficiency compared to other intellectual capital components (Gan and Saleh, 2008). Based on the literature review undertaken, it is discovered that minimal empirical studies have endeavoured to clarify on intellectual capital and its association with firm performance of technology firms in Malaysian using MVAIC model.

In reference to the empirical evidence, the research framework and the corresponding hypotheses are drawn below.

H1 There is a positive and significant association between MVAIC and Profitability.
H2 There is a positive association between MVAIC components and Profitability.

a. There is a positive and significant association between HCE and higher Profitability.
b. There is a positive and significant association between SCE and higher Profitability.
c. There is a positive and significant association between RCE and higher Profitability
d. There is a positive and significant association between CEE and higher Profitability.



: Research Framework

Data and Methodology

The secondary data used in this empirical study were collected from the published annual reports of technology firms listed in the main board of Bursa Malaysia over the seven-year period from 2013 to 2019. As of 31 August 2020, a total of 40 firms were listed, however usable data was drawn from 32 firms, providing 224 observations for the analysis. MVAIC model was employed to measure intellectual capital efficiency. The following table provides the description of the model.

Table 1
Measurement of Intellectual capital using MVAIC model.

Model Components	Definition	Formula	Explanation of Terms
Value Added (VA)	The value created by the firm as operating profit before interest and tax (EBIT), adding back non-cash expenses like depreciation, amortisation and employee costs.	VA = P + E + D + A	P = Operating Profit E = Employee costs D = Depreciation A = Amortisation
Human Capital (HC)	The expenses related to employee compensation and development.	HC = Total wages and salary cost	HC = E
HCE	The contribution made by every unit of money invested in HC to the VA.	HCE = VA / HC	HCE = Human Capital Efficiency VA = Value Added HC = Human capital
Structural Capital (SC)	The supportive infrastructure that enables HC to function.	SC = VA - HC	VA = Value Added SC = Structural Capital
SCE	The contribution made by every unit of money invested in SC to the VA.	SCE = SC / VA	SCE = Structural Capital Efficiency VA = Value Added SC = Structural capital
Relational Capital (RC)	The expenses related to selling and distribution cost or marketing expenses.	RC = Total selling and distribution cost	
RCE	The contribution made by every unit of money invested in RC to the VA.	RCE = RC / VA	SCE = Relational Capital Efficiency VA = Value Added RC = Relational capital
Capital Employed	Representing capital expenditure of the company.	CE = TA - IA	TA = Total assets IA = Intangible assets
CEE	The contribution made by every unit of money invested in physical capital to the VA.	CEE = VA / CE	CEE = Capital Employed Efficiency VA = Value Added CE = Capital Employed

Source: Adapted from Chowdhury, Rana and Azim (2019)

The dependent variable, firm performance is viewed from profitability perspective which is proxy by return on asset (ROA). ROA is computed as net income over total assets. It indicates the ability of a firm in utilizing total assets and shows the profitability of a firm. To test the hypotheses of the study the following regression models (1) and (2) have been formulated. In addition to the key human capital variables, the regressors included the $\beta_n Z_{it}$ which is a set of firm controlled variables documented in empirical evidence including size (SIZE) and leverage (LEV). Firm size is measured as the natural logarithm of total assets and leverage is measured by total debt to total assets. While ε_{it} is the standard regression error terms.

Model 1: $ROA_{it} = \beta_0 + \beta_1 MVAIC_{it} + \beta_n Z_{it} + \varepsilon_{it}$ (1)

Model 2: $ROA_{it} = \beta_0 + \beta_1 HCE_{it} + \beta_2 SCE_{it} + \beta_3 RCE_{it} + \beta_4 CEE_{it} + \beta_n Z_{it} + \varepsilon_{it}$ (2)

Findings and Analysis

a. Descriptive Analysis

The descriptive analysis of technology firms is provided in table 2. The mean value of profitability of technology sector as indicated by ROA which stood at 0.0427 is sound, suggesting that the sample firms were able to generate profit. The value of standard deviation for each of the four components of intellectual capital as presented in Table 2 indicated small deviation from mean value (e.g. mean of HCE 2.6930, Std dev 3.5604). The value of standard deviation tests the consistency of the data. It indicates how far the data from each other is similar or different. As a rule of thumb, the lower the standard deviation value, the higher the consistency is. Meanwhile, the value of standard deviation as presented in Table 2 for CEE across technology sector recorded small deviation from their mean values. It shows a high consistency of the treatment in physical capital across firms in the technology sector.

Most variables are highly skewed (less than -1 or greater than +1) as indicated in the table 2 (Bulmer, 1979). Despite the skewness values, these variables are not transformed into a natural logarithm function (a method chosen to mitigate normality problem) due to the data being in percentage. The kurtosis values as presented in table 2 indicated all variables, HCE, SCE, RCE, CEE, MVAIC, ROA, SIZE, except leverage have kurtosis problem where the kurtosis values more than three indicating a leptokurtic distribution characterized by higher and sharper central peak with tails longer and fatter due to the kurtosis problem (Akinlawon, Asiribo and Adebanji, 2010). For leverage, the kurtosis value is three indicating normal distribution. The kurtosis problem in the data may not create an obstacle to produce quality and reliable statistics as this is expected in a research with financial time series. Akinlawon et al. (2010) argued that studies with financial time series often exhibited leptokurtosis value greater than 3. A leptokurtic situation may happen in both, the unconditional distribution and conditional distribution of daily asset returns (Akinlawon et al., 2010). In addition, when the sample size is large that is the number of observation is greater than 30, a variable with statistically significant skewness and kurtosis can be considered as a variable with normal distribution (Tabachnik and Fidell, 2007; Hair, Black, Babin and Anderson, 2010). Since the sample size is large (n=224) normal distribution of data can be considered in this study.

Table 2
Descriptive Analysis for Technology Sector

Sector	Variables	Mean	Min	Max	Std.Dev.	Skewness	Kurtosis
Technology	HCE	2.6930	-3.50938	27.8748	3.5604	4.0984	23.8975
	SCE	0.4622	-7.1952	5.8058	0.7995	-2.3949	48.3016
	RCE	0.0626	-0.73443	1.4853	0.1918	2.5938	19.9029
	CEE	0.2601	-0.49849	0.5563	0.1564	-0.9504	5.6893
	MVAIC	3.4778	-6.07903	29.0658	3.7650	3.6129	20.9367
	ROA	0.0427	-0.7519	0.3580	0.1416	-1.7366	9.8911
	SIZE	5.3100	0	6.2660	0.7841	-4.1327	28.7487
	LEV	0.3013	0	0.6792	0.1440	0.4873	2.8570

Notes: Number of observation is 224.

A comparison of MVAIC components as depicted in table 3 below suggest that all the firms in technology sector are generally more efficient in generating value from their human capital rather than structural capital, relational capital and capital employed. HCE is an indicator of value added by the human resources employed by the business, a HCE of 2.693 means for every RM1 invested, the firms create RM2.693 from its human capital. Following, SCE of 0.4622 indicated that for every RM1 invested, the firms create value of RM0.4622 from its structural capital. In terms of RCE, for every RM1 invested, the firms create RM0.0626 from its relational capital. Next, CEE of 0.2601 indicating that for every RM1 worth of investment, the value created from physical capital is RM0.2601. CEE is an indicator of efficiency in generating value from physical capital. It shows that technology firms are efficient in managing both, intellectual capital and physical capital, in creating values.

The percentage (%) next to the components of intellectual capital indicate the contribution towards MVAIC in technology sector. Of the four components of intellectual capital, HCE stood at 77.43%, followed by SCE at 13.29% then CEE at 7.48% and lastly RCE at 1.8%. RCE's contribution towards MVAIC in technology sector is very minimum in comparison to the other three components. It shows as presented in Table 3, HCE has a significant contribution towards MVAIC in the technology sector. As a conclusion, HCE is the main component of MVAIC as it makes a major contribution towards the value of MVAIC. HCE largely determines intellectual capital efficiency in technology sector. These findings supported the findings of Nawaz and Haniffa (2017); Ozkan, Cakan and Kayacan (2017); Tran et al. (2018). With regard to MVAIC, the greater the value of MVAIC indicates a higher efficiency level of the company.

The mean of the four components are presented below in order to evaluate the intellectual capital performance of technology firms using the MVAIC model:

Table.3
Mean of Intellectual Capital Performance (Sector) using MVAIC

Sector	HCE (a)	%	SCE (b)	%	RCE (c)	%	CEE (d)	%	MVAIC (a+b+c+d)	%
Technology	2.6930	77.43	0.4622	13.29	0.0626	1.8	0.2601	7.48	3.4778	100

b. Pearson Correlation Analysis

The Pearson correlation analysis of the technology sector is provided in the following table. Table 4 shows that the correlation value indicated significant positive associations between only several pairs of variables. As expected, MVAIC has significant positive correlation with firm's financial performance, ROA. It implies that firms with greater intellectual capital efficiency have higher financial performance. Specifically, MVAIC is significantly and positively related to ROA (r=0.4031, p<0.0001), indicating strong relationship between value efficiency and financial performance. Regarding the components of MVAIC, HCE, SCE and CEE exhibited significant positive correlations with ROA, except RCE. CEE (r=0.6811, p<0.0001) have the strongest correlation with ROA. HCE (r=0.3878, p<0.0001) and SCE (r=0.0393, p<0.0001) also implies significant positive correlations, but weakly correlated with ROA. Meanwhile, RCE have no correlation with ROA. It is noted that MVAIC has significant positive relationships with the components of intellectual capital except RCE. MVAIC has the strongest association with HCE (r=0.9826, p<0.0001), followed by its relationship with SCE (r=0.3353, p<0.0001) but weakly correlated with physical capital (r=0.1236, p<0.0001). One of the control variables, size, demonstrated weak correlation with profitability, ROA at correlation values of 0.2079 (p<0.0001). Size and leverage recorded significant positive correlation among themselves, but it is a weak association (r=0.2903, p<0.0001). The pairwise correlation between MVAIC and HCE is very strong suggesting multicollinearity problem (Gujarati, Porter and Gunasekar, 2017). Therefore, to mitigate the problem the two explanatory variables are separated into model 1 and model 2 in the study.

Table 4
Pearson Correlation Matrix of Study Variables for Technology Sector

Sector	Variables	HCE	SCE	RCE	CEE	MVAIC	ROA	SIZE	LEV
Technology	HCE	1.0000							
	SCE	0.1629**	1.0000						
	RCE	-0.0502	-0.5147***	1.0000					
	CEE	0.1176*	-0.1188*	-0.0766	1.0000				
	MVAIC	0.9826***	0.3353***	-0.1091	0.1236*	1.0000			
	ROA	0.3878***	0.0393	-0.0050	0.6811***	0.4031***	1.0000		
	SIZE	0.2344***	0.1121*	0.0285	0.2509***	0.2573***	0.2079**	1.0000	
	LEV	-0.1505**	-0.0972	0.1179*	-0.1423**	-0.1629**	-0.2469***	0.2903***	1.0000

Notes: Number of observation is 224. The sign ***, **, * denotes the correlation significant level at 0.01, 0.05 and 0.1 respectively.

c. Regression Analysis

Table 5 presents the results of the two regression models in this study, applying the control variables of firm size and leverage. In model 1, the value of R^2 of 0.2107 indicated that 21.07 percent of possible variations in ROA is explained by MVAIC and the reliability is examined through its F-value of 68.61 ($p<0.0000$) which is found to be statistically significant. MVAIC is positively and significantly associated with ROA with the coefficients of 0.0170. The result implies that as MVAIC increases by RM1, ROA increases by RM0.017. The findings support H1, confirming that firms with greater MVAIC tend to have higher ROA. For model 2, the MVAIC components explain 54 per cent of the variations in ROA with an adjusted R^2 of 0.5441 having control variables of firm size and leverage in the analysis. The model with F-value of 69.89 ($p<0.0000$) is statistically significant for prediction. The study reveals a mixed relationship between the efficiency of MVAIC components and ROA of technology firms for the seven-year study period, 2013-2019. Two components of MVAIC, HCE and CEE, are found to be positively and significantly associated with ROA with the coefficients of 0.0086 and 0.6284 respectively. The findings imply that as HCE and CEE increases by RM1, ROA increases by RM0.009 and RM0.63 respectively. Other components of MVAIC, SCE, is significant but negatively associated with ROA. On the other hand, RCE is insignificantly associated with ROA. Of the four components of MVAIC, the efficiency level of CEE (0.63) indicated a decisive role in ensuring higher profitability and reaffirming the premature stage of intellectual capital utilisation in technology sector of a developing country. The findings support H2 (a) and (d), confirming that firms with greater HCE and CEE, but not with SCE and RCE, tend to have higher ROA.

The two control variables in the study, firm size and leverage, document different results. Firm size in both models are insignificantly associated with ROA indicating that firm size, big or small, does not influence profitability. For leverage, both models exhibit similar pattern of relationship that is it affects ROA negatively. The higher the profit level, the lower the level of leverage indicating pattern of financing in line with pecking-order theory and empirical evidence.

These results are broadly in line with prior research findings (e.g. Nimtrakoon, 2015; Al-Musali et al., 2016; Ozkan et al., 2017; Ousama et al., 2019; Xu et al., 2019), confirming firms with greater level of intellectual capital will exhibit higher profitability. Regarding the four components of MVAIC, CEE and HCE, are the most influential value drivers according to their association with ROA. The findings suggest that physical capital (proxy by CEE) is still relevant in generating firms' profitability and has long been associated with value creation process (Nimtrakoon, 2015). In addition, the findings also imply that human capital, has been acknowledged as an effective source of wealth creation. It could be attributed to the fact that human capital is vested in employees rather than the firm (Edvinsson, 1997; Nimtrakoon, 2015). Among MVAIC components, SCE and RCE seem to be the least influential value drivers.

Table 5
Regression Results for Model 1 and 2

Model	1	2
Variables	ROA	ROA
Cons t-value	-0.0313 (-0.58)	-0.0474 (-1.35)
MVAIC t-value	**0.0170***** **(6.96)**	NA
HCE t-value		**0.0086***** **(4.31)**
SCE t-value		-0.0099*** (4.31)
RCE t-value		-0.0179 (-0.46)
CEE t-value		**0.6284***** **(15.07)**
Size t-value	0.0131 (1.20)	-0.0073 (-0.98)
Lev t-value	-0.1815** (-2.56)	-0.1721*** (-3.34)
R-Sq F-stat Sig F-stat Wald Chi-Sq	0.2107 N/A N/A 68.61***	0.5441 69.89*** (0.0000) N/A

p-value	(0.0000)	N/A

Notes: Notes: Number of observation is 224. The sign ***, **, * denotes the correlation significant level at 0.01, 0.05 and 0.1 respectively. The figures in the parentheses are the t-statistics.

Conclusion

This study is one of few studies focusing on intellectual capital utilisation in Malaysia technology sector. The empirical findings reveal a positive and significant association between MVAIC and profitability, suggesting that intellectual capital affects profitability of technology firms. However, a mixed relationships between the efficiency of MVAIC components and profitability are noted. A separate analysis into the components of MVAIC revealed that two components, HCE and CEE, are found to be positive and significantly associated with ROA. SCE is significant but negatively associated with ROA. While, RCE is insignificantly associated with ROA. Even though, both HCE and CEE are positive and significantly correlated with ROA, but CEE recorded higher efficiency level. As Malaysia is still a developing country and the technology sector is still developing, the findings of the study suggest that profitability is primarily driven by CEE which is in line with the study of Chowdhury, Rana, Akter and Hoque (2018); Ozkan et al. (2017). Therefore, the conclusion that can be drawn from the findings of the study is that both, physical capital and intellectual capital affect profitability, but physical capital is the primary determinant of profitability and the utilisation of intellectual capital is still at a low level.

The findings of the current study may offer several practical contributions. First, managers of technology firms should increase their firms' recognition of intellectual capital utilization in enhancing their profitability through gaining a better understanding of intellectual capital and put greater effort on its management. This is especially so as Malaysia is currently operating in knowledge-based economy, where firms' reliance on intellectual capital as a source of competitive advantage is greatly enhanced. Second, regarding the low-HCE, firms may revise their employees' financial and non-financial rewards schemes and employee-related programs such as training to enhance employee capability, attitude and satisfaction. Third, to enhance structural capital, the firm may consider re-designing and creating a conducive organizational culture, management control system and a strong information technology system to support internal processes and operations. Fourth, to strengthen relational capital, the firms may establish networking with valuable partners such as suppliers and customers.

There are some limitations associated with the study. The current research is limited to listed technology firms in the main board of Bursa Malaysia, therefore, the findings cannot be generalised to other industries. Further, the analysis uses MVAIC models and the model does not cover innovation capital and process capital, thus it may omit other aspects of intellectual capital. Therefore, future research may consider investigating the impact of intellectual capital on profitability using other sector as a research setting. To examine other aspect of intellectual capital by adopting different measurement model such as Integrated Intellectual Capital Model.

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