**Intellectual Capital Efficiency and Firm Performance of Technology, Telecommunication and Media Companies in Malaysia**

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**ABSTRACT**

The main purpose of this paper is to study the association between intellectual capital efficiency (ICe) and firm performance of companies in the Technology and Telecommunications & Media (TT&M) sectors on the Malaysian main and ACE markets. Data were collected from 37 companies’ annual reports for the year 2018. Value added intellectual coefficient (VAIC) and its components were measured using Pulic’s model, whereas firm performance focuses on profitability, proxied by return on asset (ROA) and return on equity (ROE). VAIC, human capital efficiency (HCe) and Capital employed efficiency (CEe) are associated with significantly higher ROA and ROE. However, Structural capital efficiency (SCe) is not significant with either ROA or ROE. These findings have useful implications to the TT&M companies as their managers may improve on the efficient usage of the relevant capitals in order to gain better firm performance. Moreover, the findings of this study could also be beneficial to policy makers as the financial success of TT&M companies would be in line with national economic policies.

***Keywords****:* *Intellectual capital efficiency, VAIC, Value added, Firm Performance, ACE market, Technology and Telecommunications & Media.*

**INTRODUCTION**

Technology and Telecommunications & Media (TT&M) companies are considered to be high-technology and knowledge intensive firms. Thus logically, intangibles, particularly intellectual capital (IC) are deemed to play a critical role in these firms’ performance. As the business environment is dynamic, highly volatile and competitive, especially in the TT&M sectors, the companies in these sectors should be optimizing their IC efficiency. The efficient usage of IC could enhance performance of these TT&M companies and enable them to sustain their businesses.

However, as these sectors are volatile (Hunter, Kobelsky, Richardson, 2003) an investigation using recent TT&M companies’ data is needed to determine the extent of association between IC efficiency and firm performance of these companies. This is because, although there are a growing number of studies on IC efficiency in Malaysia, the studies tend to focus on companies on the main market of Bursa Malaysia. Hence, there are only a few studies that include the ACE market (Noradiva, Parastou & Azlina, 2016; Rahim, Atan & Kamaluddin, 2017) but their data is now relatively outdated. Furthermore, this study specifically tests the companies in the TT&M sectors.

Additionally, Malaysia launched its National Policy on Industry 4.0, i.e. Industry4WRD on 31 October 2018. This policy intends to promote digital transformation in the manufacturing and related service sectors (Ministry of International Trade Industry, 2020). Generally, the TT&M sectors are the support sectors for these other sectors; hence the policy developments in Malaysia could result in the changes in the dynamics between IC efficiency and performance of companies in the TT&M sectors.

Therefore, the purpose of this study is to investigate the effect of IC efficiency and its components on firm performance of companies in the TT&M sectors in Malaysia. IC efficiency is proxied by Pulic’s Value Added Intellectual Coefficient (VAIC) measure. The sample of this study comprises 37 companies in the TT&M sectors, which are listed on the main and ACE markets. The data were collected from the annual report for the year 2018 of these companies.

The findings of the study would be useful, firstly, to the TT&M companies as they would want to find out the extent IC efficiency can be used to generate firm performance, in this current volatile environment of their sectors. Moreover, the managers from these companies may benefit from the findings of which IC efficiency component is primary in stimulating firm performance in the TT&M sectors.

Moreover, as the government of Malaysia is promoting Industry4WRD, policy makers may be interested to know the performance of companies in the TT&M sectors, as these companies are capable of supporting Malaysia’s national policy. More importantly, the government may want to find out key factors that enhance performance of companies in the TT&M sectors, in order to ensure congruence with their policy.

This study should also be of interest to researchers, particularly in Malaysia as it extends the IC efficiency literature specifically in the TT&M sectors. As mentioned above, the study also includes companies in these sectors from the ACE market. Thus, the findings of this study can be used to deduce if there is any significant difference between the results of the TT&M companies on the main board and ACE market. Furthermore, the findings of this study can be compared against the findings of relevant prior Malaysian studies as well as used as a reference by future studies to enable a better understanding of IC efficiency, particularly in technology intensive sectors, in Malaysia.

The following sections of this study are organised as follows: The next section reviews prior literature. The third section explains the research method and data collection. The fourth section presents and analyses the findings of study. The last section concludes the study with a discussion on implications and limitations of this study, as well as suggestions for future research.

**LITERATURE REVIEW**

The term “intellectual capital” was originally coined by John Kenneth Galbraith in 1969 (Edvinsson and Sullivan 1996; Bontis 1998). In broad terms, IC is the gap between companies’ market and book values (Stewart, 1997), where the former is greater than the latter due to IC (Radjenovic & Krstic, 2017). Although there is no universally accepted definition of IC, nor the classification of its components (Ozkan, Cakan & Kayacan 2016; Soetanto & Liem 2019), there is general agreement that IC adds value to the firm (Sveiby, 1997; Vishnu & Gupta, 2014; Chiucchi & Dumay, 2015; Sangiorgi & Sibioni 2017).

Due to IC influencing firm value, numerous studies over the last two decades, have attempted to measure IC; even though it is complicated to measure (Kehelwalatenna, 2016; Forte, Tucker, Matonti & Nicolo, 2017; Ting, Ren, Chen & Kweh, 2020). Nevertheless, one of the common approaches to measuring IC is by considering its efficiency, by using Pulic’s (1998; 2000; 2004) value added intellectual coefficient (VAIC) (Ting, Ren, Chen & Kweh, 2020). A multitude of studies have used Pulic’s VAIC to measure IC efficiency, including in Malaysia (Goh, 2005; Gan and Saleh, 2008; Ting & Lean, 2009; Ousama and Fatima, 2015). Nevertheless, the following paragraphs will only review the most relevant prior literature in relation to the context of this study, i.e. IC efficiency and firm performance studies in Malaysia, specifically high-technology companies or ACE market (previously MESDAQ market).

Gan and Saleh (2008) investigated the association between VAIC and firm performance using 89 technology intensive companies on the MESDAQ market for the years 2004 and 2005. They found VAIC to be positively significantly associated with profitability and productivity, measured by return on asset (ROA) and asset turnover (ATO), respectively. However, VAIC was not significantly associated with firm market valuation. Further analysis indicated that human capital efficiency (HCe) and capital employed efficiency (CEe) had a significant positive association with the three dependent variables (DVs) but structural capital efficiency (SCe) did not.

Later, Nimtrakoon (2015) conducted a similar study to Gan and Saleh (2008), but using 220 technology firms listed on five Asian stock exchanges in the year 2011. The five Asian countries are Malaysia, Indonesia, Philippines, Thailand and Singapore. Another cross-country study was by Pratama, Innayah & Darmawan (2019) who also tested high-technology companies, but only from Malaysia and Indonesia (619 observations). Nimtrakoon’s (2015) tests of the Malaysian data (95 companies) were consistent with the results of Gan and Saleh (2008), where VAIC, HCe and CEe were significantly positively associated with the profitability measures (ROA; ROE) but SCe was not. As for Pratama et al.’s (2019) results of the Malaysian data, VAIC was found to be significantly positively associated with ROA, hence congruent with Gan and Saleh’s (2008) as well as Nimtrakoon’s (2015) findings.

Rahim, Atan & Kamaluddin (2017) also conducted a study on all technology firms listed on Bursa Malaysia’s main and ACE markets in the year 2009. However, Rahim et al. (2017) only focused on the effects of HCe on firm performance of these technology companies. Based on 19 and 36 companies on the main and ACE markets, respectively, HCe was found to be significantly positively correlated with ROA. Thus, Rahim et al.’s (2017) findings are also in line with Gan and Saleh’s (2008) results on HCe.

Noradiva, Parastou & Azlina (2016) used panel data analysis to study 46 companies listed on the ACE market of Bursa Malaysia for the years 2009 until 2012 (184 firm-years). However, unlike previous studies, the purpose of Noradiva et al.’s (2016) study was to examine the effect of managerial ownership on the relationship between intellectual capital performance and firm value. Similar to Gan and Saleh (2008), Noradiva et al. (2016) found a significant positive association between VAIC and firm performance, but there was a non-significant non-linear effect of managerial ownership on the association between these two variables.

In contrast to the studies above, Kweh, Chan and Ting (2013) used data envelopment analysis (DEA) to test the ability of 25 public-listed software companies to transform IC efficiency (ICe) into firm value. The VAIC components were the input variables, whereas Tobin’s Q and return on equity (ROE) were the output variables in the DEA. Data for the year 2010 were collected from these software companies, which were on the main and ACE markets of Bursa Malaysia. Kweh et al’s (2013) findings reveal that the majority (80%) of the software companies are inefficient in transforming IC into corporate values; however, the main market companies seem to be less efficient than the ACE market companies.

The review of the relevant Malaysian studies above reveals that the findings are generally consistent, where VAIC, HCe and CEe are determinants of firm performance, particularly ROA. It also indicates that there is limited literature on the ACE market. Moreover, the above studies conduct their research on firms listed on the ACE market or technology companies, in general. Therefore, prior literature in Malaysia has not studied the ICe and firm performance of companies in the TT&M sectors specifically.

## RESEARCH METHOD

Secondary data were collected from the total of 37 listed companies in the TT&M sectors. Specifically, 18 companies were listed on the main market of Bursa Malaysia, and 19 companies were listed on the ACE market. The TT&M sectors were selected as a focus of this study because they are technology-oriented sectors, hence they are the sectors of interest. This is because, as mentioned before, their performance could play an important role in carrying out Malaysia’s National policy of Industry4WRD. Moreover, high-technology companies have high IC (Sofian, Tayles & Pike, 2006; Bontis, Janosevic & Dzenopoljac, 2015; Scafarto, Ricci & Scafarto, 2016). The relevant data to measure VAIC, HCe, SCe, CEe, ROA, ROE, firm size and leverage were collected from the annual reports of these companies for the year 2018.

In this study, the independent variables are VAIC and its components, HCe, SCe and CEe. These independent variables are measured using Pulic’s method of calculating ICe. Numerous prior studies, including in Malaysia, have used Pulic’s VAIC model to measure ICe.

On the other hand, the dependent variables of this study are ROA and ROE, which are firm performance, specifically profitability measures. These dependent variables were selected because they are relevant to the context of this study. This is because ROA is an indicator of how a company uses assets to generate profit, and in the context of this study, IC is considered to be an essential asset. Whereas, ROE is an indicator of the profit generated by a company from the money invested by shareholders of the firm. As this study focuses on listed companies, these companies and their shareholders would be interested to know the returns generated from shareholders’ investments into the company, and whether IC is able to enhance these returns. In addition, these firm performance measures are commonly used in the literature (Yalama, 2013; Maji & Goseami, 2016; Soetanto & Liem 2019, Asiaei, Barani, Bontis & Arabahmadi, 2020), including studies on Malaysian data (Gan & Saleh, 2008; Nimtrakoon, 2015; Rahim et al., 2017; Pratama et al., 2019), as seen in the review of the literature above. Using similar measures would enable some meaningful comparison of the results of this study with its predecessors.

The control variables of this study are firm size, leverage and market. Firm size is controlled as in prior studies (Mondal & Ghosh, 2012; Bontis, Janosevic & Dzenopoljac, 2015; Ozkan, Cakan & Kayacan, 2016; Ting, Ren, Chen & Kweh, 2020). Similarly, consistent with prior studies (Bontis et al., 2015; Zhicheng, Zhuoer, Shing & Wah, 2016; Chiucchi, Giulian & Poli, 2018), leverage is controlled. As for market, a dummy variable of ‘1’ is assigned if the firm is on the main market, and ‘0’ if it is on the ACE market.

In order to determine the association between VAIC and financial performance, the following multivariate regression was run:

FP = x1 + x2VAIC + x3Size + x4Lev + x5Mkt -------------------------------------- (1)

Where: FP = financial performance (proxied by ROA or ROE)

VAIC = Pulic’s Value Added Intellectual Coefficient

Size = Firm size as measured by total revenue

Lev = Leverage as measured by total liabilities on shareholders’ equity

Mkt = Market, measured by 1 = Main market; 0 = ACE market

x1 = constant

x2 - x5 = coefficients

Then, the association between the components of ICe and firm performance was tested using the following multivariate regression:

FP = y1 + y2HCe + y3SCe + y4CEe + y5Size + y6Lev + y7Mkt ------------- (2)

Where: FP = financial performance (proxied by ROA or ROE)

HCe = Pulic’s Human Capital efficiency

SCe = Pulic’s Structural Capital efficiency

CEe = Pulic’s Capital Employed efficiency

Size = Firm size as measured by total revenue

Lev = Leverage as measured by total liabilities on shareholders’ equity

Mkt = Market, measured by 1 = Main market; 0 = ACE market

y1 = constant

y2 – y7 = coefficients

## EMPIRICAL RESULTS AND DISCUSSION

Table 1 presents the descriptive statistics of the variables used in this study. The firm performance variables indicate the average ROA of the companies in the TT&M sectors is approximately 0.05. This means that nearly 5 cents is generated for every RM 1 of asset employed. As for ROE, on average, there is about 14 cents of returns for every RM 1 invested by shareholders. Nevertheless, it has to be noted that ROE has a relatively wide range of minimum and maximum values and proportionately large standard deviation. Thus, ROE is not normally distributed.

In analysing VAIC and its components, the statistics show that there is also a considerably wide range between the minimum and maximum values for HCe and SCe, as well as their standard deviations are proportionately high. Therefore, these variables are also not normally distributed. In addition, based on the mean values of the ICe components, HCe is the highest compared to SCe and CEe.

The companies in the TT&M sectors have a huge variation in firm size with the minimum size being approximately RM 2.2 million in terms of total revenue, whereas the maximum firm size is about RM 23.9 billion. On average, these companies’ size is about RM 1.3 billion in total revenue. In terms of leverage, the companies have approximately 70% debt on their shareholders’ equity. Again, the range and standard deviation are large. Thus, all of the above variables, except for ROA and CEe, are not normally distributed. Van der Waerden normalization approach was used to normalise the variables that were skewed. All variables were normally distributed after normalisation.

**Table 1: Descriptive Statistics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variables | Minimum | Maximum | Mean | Std. Deviation |
| ROA | -0.397 | 0.353 | 0.048 | 0.138 |
| ROE | -0.529 | 3.251 | 0.143 | 0.556 |
| VAIC | -3.091 | 19.886 | 3.742 | 4.550 |
| HCe | -1.491 | 18.729 | 3.107 | 4.197 |
| SCe | -3.349 | 1.754 | 0.389 | 0.808 |
| CEe | -0.255 | 0.640 | 0.246 | 0.174 |
| Size | 2,154,569 | 23,885,781,000 | 1,265,868,027 | 4,230,917,437 |
| Lev | 0.024 | 8.219 | 0.696 | 1.364 |

Prior to running the regressions, correlation tests were performed on the variables of each of the regressions. Table 2 presents the results of the correlation tests for the variables in the first regression model on VAIC and FP.

**Table 2: Pearson Correlation Results for Regression 1 Variables**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Correlations** | | | | | |
|  | ROA | ROE | VAIC | SIZE | LEV |
| ROA | **1** |  |  |  |  |
| ROE | **0.933\*\*** | 1 |  |  |  |
| *0.000* |  |  |  |  |
| VAIC | 0.**794\*\*** | **0.807\*\*** | **1** |  |  |
| *0.000* | *0.000* |  |  |  |
| SIZE | **0.518\*\*** | **0.486\*\*** | **0.604\*\*** | 1 |  |
| *0.001* | *0.002* | *0.000* |  |  |
| LEV | **0.033** | **0.106** | **0.077** | **0.459\*\*** | 1 |
| *0.847* | *0.531* | *0.651* | *0.004* |  |

Notes: The values in bold are the correlation coefficients.

The values in italic are the significance levels.

The Pearson correlation results in Table 2 are initial indications of the relationships between the variables. VAIC is significantly positively correlated with both ROA and ROE (p value = 0.000). This means that the higher the VAIC, higher the firm performance. Firm size of the TT&M companies is also significantly positively correlated with ROA and ROE. Thus, bigger companies make more profit. However, leverage of these companies is not correlated with their firm performance. Further analysis shows that in the TT&M companies, ROA and ROE are also significantly correlated, by about 93%. On the other hand, as the correlation coefficients between the explanatory variables are less than 80%, there is no problem of multicollinearity.

Next, Table 3 presents the results of the Pearson correlation tests for the variables in Regression 2. The results in Table 3 show that HCe and CEe are significantly positively correlated with both ROA and ROE (p-value = 0.000). SCe is also significantly positively correlated with the two performance measures, but slightly less so, i.e. with ROA (p-value < 0.05) and with ROE (p-value < 0.01). Firm size remains significantly positively correlated with both firm performance measures, but leverage is still not significant. In addition, as the correlation coefficients of the explanatory variables are below 80%, there is no multicollinearity problem.

**Table 3: Pearson Correlation Results for Regression 2 Variables**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | ROA | ROE | HCe | SCe | CEe | Size | Lev |
| ROA | **1** |  |  |  |  |  |  |
| ROE | **0.933\*\*** | **1** |  |  |  |  |  |
| 0.*000* |  |  |  |  |  |  |
| HCe | **0.829\*\*** | **0.815\*\*** | **1** |  |  |  |  |
| *0.000* | *0.000* |  |  |  |  |  |
| SCe | **0.345\*** | **0.498\*\*** | **0.563\*\*** | **1** |  |  |  |
| *0.036* | *0.002* | *0.000* |  |  |  |  |
| CEe | **0.648\*\*** | **0.571\*\*** | **0.475\*\*** | **-0.013** | **1** |  |  |
| *0.000* | *0.000* | *0.003* | *0.937* |  |  |  |
| Size | **0.518\*\*** | **0.486\*\*** | **0.612\*\*** | **0.273** | **0.489\*\*** | **1** |  |
| *0.001* | *0.002* | *0.000* | *0.103* | *0.002* |  |  |
| Lev | **0.033** | **0.106** | **0.104** | **-0.070** | **0.291** | **0.459\*\*** | **1** |
| *0.847* | *0.531* | *0.539* | *0.679* | *0.081* | *0.004* |  |

Notes: The values in bold are the correlation coefficients.

The values in italic are the significance levels.

Table 4 presents the results of Regression 1, where VAIC is the independent variable and either ROA or ROE are the dependent variables. Based on the adjusted-R2 in Table 4, 59.8% of ROA is explained by the independent variables. Also, VAIC is significantly positively associated with ROA (p-value = 0.000). Specifically, for every unit increase of VAIC, ROA increases by 73.4%. Although firm size was significantly correlated with ROA in Table 2, when Size was included in a multivariate regression with VAIC, the association between VAIC and ROA seems to have dominated, hence Size is no longer significant.

**Table 4: Regression analysis result of VAIC with ROA and ROE**

|  |  |  |  |
| --- | --- | --- | --- |
| Variable | VAIC with ROA | VAIC with ROE | |
| VAIC | 0.734  *(0.000\*\*\*)* | 0.827  *(0.000\*\*\*)* | |
| Size | 0.043  *(0.810)* | -0.109  *(0.539)* | |
| Lev | -0.070  *(0.579)* | 0.066  *(0.589)* | |
| Mkt | 0.100  *(0.476)* | 0.101  *(0.459)* | |
| Adjusted R2 | 0.598  *(0.000\*\*\*)* | 0.617  *(0.000\*\*\*)* |
| R2 | 0.643 | 0.660 |

Notes: \*\*\*, \*\*, \* Significant at 1%, 5% &10% respectively.

Every variable, Beta coefficient is on the top line, Followed by the significant level in brackets & italics.

The adjusted-R2 of ROE as the dependent variable is even higher, where 61.7% of ROE is explained by the independent variables. In fact, in referring to the VAIC coefficient, for each unit increase in VAIC, ROE increases by 82.7%. Interestingly, for companies in the TT&M sectors, their profitability (both ROA and ROE) is not dependent on whether they are in the main or ACE markets, as the control variable for Mkt is not significant.

These findings of VAIC significantly influencing firm performance (ROA and ROE) is consistent with prior studies using Malaysian data (Gan & Saleh, 2008; Nimtrakoon, 2015; Pratama et al., 2019). Nevertheless, based on the findings of this study, it would be considerably worthwhile for companies in the TT&M sectors to optimise their IC efficiency as it could result in substantial increase in profitability (ROA and ROE) of these companies.

Next, the results of Regression 2 are presented in Table 5 below, where IC efficiency has been disaggregated into its components. The adjusted-R2 of both regressions have increased when compared to the results in Table 4, where the independent variables are able to explain 75.8% and 68.7% of ROA and ROE, respectively. These results suggest that VAIC’s components are better at explaining profitability than VAIC alone. HCe and CEe are significantly positively associated with both ROA and ROE. However, HCe has a higher significance level (p-value = 0.000) for both profitability measures, whereas CEe is slightly less significant with ROA (p-value < 0.01) and ROE (p-value < 0.05). Specifically, for every unit increase in HCe, ROA and ROE increase by 72.2% and 62.8%, respectively. Whereas, for every unit increase in CEe, ROA and ROE increase by 35% and 32.5%, respectively. On the other hand, SCe is not significant with either of the profitability measures, and neither are the control variables.

The findings of this study are consistent with the findings of prior studies on Malaysia (Gan & Saleh, 2008; Nimtrakoon, 2015) where HCe and CEe are significant with firm performance but SCe is not. These findings indicate that although the technology-intensive sectors are dynamic, the ICe’s effect on companies in these sectors remain consistent even after nearly a decade.

**Table 5: Regression analysis result of HCe, SCe & CEe with ROA and ROE**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variable | | HCe, SCe & CEe with ROA | | HCe, SCe & CEe with ROE |
| HCe | | 0.722  *(0.000\*\*\*)* | | 0.628  *(0.000\*\*\*)* |
| SCe | | -0.067  *(0.539)* | | 0.176  *(0.162)* |
| CEe | | 0.350  *(0.002\*\*\*)* | | 0.325  *(0.011\*\*)* |
| Size | | -0.078  *(0.582)* | | -0.171  *(0.294)* |
| Lev | | -0.140  *(0.158)* | | 0.013  *(0.908)* |
| Mkt | | 0.104  *(0.341)* | | 0.094  *(0.449)* |
| Adjusted R2 | 0.758  *(0.000\*\*\*)* | | 0.687  *(0.000\*\*\*)* | | |
| R2 | 0.798 | | 0.739 | | |

Notes: \*\*\*, \*\*, \* Significant at 1%, 5% &10% respectively.

Every variable, Beta coefficient is on the top line, Followed by the significant level in brackets & italics.

Furthermore, the companies in the TT&M sectors in both markets in Malaysia are impacted by HCe more than CEe. Telecommunications and media companies are generally capital intensive (Maverick, 2018), therefore, logically, efficient usage of this capital promotes higher company performance. However, as these companies are high-technology companies, less reliance on tangible capital and more influence of Structural Capital (SC) was expected. Unfortunately, SC did not significantly affect profitability of these companies. Perhaps it is because, in a developing country like Malaysia, these companies are still highly reliant on their tangible assets.

Additionally, the above findings suggest that, even in high-technology companies, human capital is valuable, and the efficient utilisation of this capital substantially enhances the profitability of these companies. These results are credible as even in technology intensive companies, it is still the human resource who generate the ideas, as well as are the innovative, creative and reflective force in these companies. In addition, innovation and wise decision-making by the management and employees are deemed even more critical in dynamic and volatile companies in the TT&M sectors. Thus, the efficient use of human capital produces great rewards for the company and its shareholders in the form of higher ROA and ROE, respectively.

**CONCLUSION**

This study examines the impact of VAIC and its components on firm performance of 37 Malaysian companies in the TT&M sectors on the main and ACE markets for the year 2018. The findings of this study that VAIC is a significant determinant of firm performance would be encouraging to companies in the TT&M sectors as their investment in IC and its efficient usage substantially enhances their profitability. Therefore, TT&M companies that want to improve their firm performance should also find ways to utilise their IC efficiently.

Similarly, the findings that HCe is an influential factor in augmenting firm performance should convince these companies on the importance of recruiting, developing and retaining experienced and skilled human capital. The companies in the TT&M sectors should consider motivating their employees to be innovative, creative and productive as HCe is a considerable determinant of both ROA and ROE. As the findings of this study are consistent with prior literature (Gan & Saleh, 2008; Nimtrakoon, 2015; Rahim et al., 2017), it should be even more persuasive to companies in the TT&M sectors on the value of HCe.

Moreover, as the results suggest that CEe is still a significant factor in enhancing firm performance, but SCe is not, further investigation should be carried out by future researchers with the cooperation from these high-technology companies. The research could focus on possible reasons and solutions to generate profitability from SC. This is important because, if possible, these companies should attempt to gain more from SC. The intangible elements in a company makes it unique and drives its competitiveness and survival in a volatile market.

Furthermore, as the variable Mkt does not have a significant effect on firm performance, this is an indication that companies in the ACE market are not significantly different from their counterpart in the main market, at least not in terms of profitability. Therefore, it is deduced that the IC efficiency measures taken by the TT&M companies in the main market should be as equally effective in the ACE market companies in increasing firm performance.

The implications of this study are not only useful to the companies in the TT&M sectors, as discussed above, the findings of this study could be beneficial to the government as the national policy maker. This is because, as mentioned earlier in this paper, the Industry4WRD is a national policy that affects the manufacturing and services sectors. The TT&M sectors support the manufacturing and related service sectors. Therefore, TT&M companies’ financial success and sustainability as well as factors that generate this financial success would be of interest to the policy maker. This is due to the fact that the financial health of companies in the TT&M sectors would be essential in supporting the digital transformation of the other sectors, which is in line with the objectives of Industry4WRD.

This study has focused specifically on companies in the TT&M sectors, has only used profitability ratios as an indication of firm performance, and has restricted the sample period to one year of study, i.e. 2018. Thus, future research could extend this study by using various other relevant sectors, include several firm performance measures, and lengthen the sample period into a longitudinal study. In addition, qualitative studies in the TT&M sector would add value to the findings of this study. Despite its limitations, it is hoped that the findings of this study would inspire continuity in the legacy of IC efficiency literature in Malaysia.

# references

Asiaei, K., Barani, O., Bontis, N., & Arabahmadi, M. (2020). Unpacking the black box: How intrapreneurship intervenes in the intellectual capital-performance relationship? *Journal of Intellectual Capital* (ahead of print) <https://doi.org/10.1108/JIC-06-2019-0147> (Downloaded: 6 May 2020)

Bontis, N. (1998). Intellectual capital: an exploratory study that develops measures and models. *Management decision,* *36*(2), 63-76.‏

Bontis, N., Janošević, S., & Dženopoljac, V. (2015). Intellectual capital in Serbia’s hotel industry. *International Journal of Contemporary Hospitality Management, 27*(6), 1365-1384.‏

Chiucchi, M. S., & Dumay, J. (2015). Unlocking intellectual capital. *Journal of Intellectual Capital, 16*(2), 305-330.‏

Chiucchi, M. S., Giuliani, M., & Poli, S. (2018). The Relationship Between Intellectual Capital Performance and Ownership Gender Diversity in Small-Sized Italian Companies. *In Gender Issues in Business and Economics* (pp. 67-79). Springer, Cham.

Edvinsson, L., & Sullivan, P. (1996). Developing a model for management intellectual capital. *European Management Journal, 14*(4), 187-199.

Erik Sveiby, K. A. R. L. (1997). The intangible assets monitor. *Journal of Human Resource Costing & Accounting, 2*(1), 73-97.‏

Forte, W., Tucker, J., Matonti, G., & Nicolò, G. (2017). Measuring the intellectual capital of Italian listed companies. *Journal of Intellectual Capital,* *18*(4), 710-732.

Gan, K., & Saleh, Z. (2008). Intellectual capital and corporate performance of technology-intensive companies: Malaysia evidence. *Asian journal of business and Accounting*, *1*(1), 113-130.

Goh, P. (2005). Intellectual capital performance of commercial banks in Malaysia. *Journal of intellectual capital, 6*(3), 385-396.‏

Hunter, S., Kobelsky, K., Richardson, V.J. (2003). Information Technology and the Volatility of Firm Performance*. MIT Sloan School of Management Working Paper.* <http://ssrn.com/> abstract=475641 (Downloaded: 9 May 2020).

Kehelwalatenna, S. (2016). Intellectual capital performance during financial crises. *Measuring Business Excellence*, *20*(3), 55-78.‏

Kweh, Q. L., Chan, Y. C., & Ting, I. W. K. (2013). Measuring intellectual capital efficiency in the Malaysian software sector. *Journal of Intellectual Capital, 14*(2), 310-324.

Maji, S. G., & Goswami, M. (2016). Intellectual capital and firm performance in emerging economies: the case of India. *Review of International Business and Strategy, 26*(3), 410-430.‏

Maverick, J.B. (2018). Which types of industries have the largest capital expenditures? <https://www.investopedia.com/ask/answers/020915/which-types-industries-have-largest-capital-expenditures.asp> (Downloaded: 11 May 2020).

Ministry of International Trade Industry (2020). Industry4WRD. *Ministry of International Trade Industry Official website.* [https://www.miti.gov.my/index.php/pages/view/ industry4WRD](https://www.miti.gov.my/index.php/pages/view/%20industry4WRD) (Downloaded: 9 May 2020).

Mondal, A., & Ghosh, S. K. (2012). Intellectual capital and financial performance of Indian banks. *Journal of Intellectual Capital, 13*(4), 515-530.‏

Nimtrakoon, S. (2015). The relationship between intellectual capital, firms’ market value and financial performance: Empirical evidence from the ASEAN. *Journal of Intellectual Capital*, *16*(3), 587-618.‏

Noradiva, H., Parastou, A., & Azlina, A. (2016). The effects of managerial ownership on the relationship between intellectual capital performance and firm value*. International Journal of Social Science and Humanity, 6*(7), 514-518.

Ousama, A. A., & Fatima, A. H. (2015). Intellectual capital and financial performance of Islamic banks. *International Journal of Learning and Intellectual Capital*, *12*(1), 1-15.

Ozkan, N., Cakan, S., & Kayacan, M. (2016). Intellectual capital and financial performance: A study of the Turkish Banking Sector. *Borsa Istanbul Review* *17*(3), 190-198.‏

Pratama, B. C., Innayah, M. N., & Darmawan, A. (2019). The Effect of Intellectual Capital towards Firm Financial Performance: Study in High-Tech Firms in Indonesia and Malaysia. *International Proceeding Asean Youth Conference 2018*, 685-691.

Pulic, A. (1998, January). Measuring the performance of intellectual potential in knowledge economy. In *2nd McMaster Word Congress on Measuring and Managing Intellectual Capital by the Austrian Team for Intellectual Potential*.‏

Pulic, A. (2000). VAIC™–an accounting tool for IC management. *International journal of technology management*, *20*(5-8), 702-714.‏

Pulic, A. (2004). Intellectual capital–does it create or destroy value?. *Measuring business excellence*, *8*(1), 62-68.‏

Radjenovic, T., & Krstic, B. (2017). Measuring Intellectual Capital of National Economies. *Ekonomika, 63*(2), 31-43.

Rahim, A., Atan, R., & Kamaluddin, A. (2017). Human capital efficiency and firm performance: An empirical study on Malaysian technology industry. *In SHS Web of Conferences* (Vol. 36, p. 00026). EDP Sciences.

Sangiorgi, D., Sangiorgi, D., Siboni, B., & Siboni, B. (2017). The disclosure of intellectual capital in Italian universities: What has been done and what should be done. *Journal of Intellectual Capital*, *18*(2), 354-372.

Scafarto, V., Ricci, F., & Scafarto, F. (2016). Intellectual capital and firm performance in the global agribusiness industry: The moderating role of human capital. *Journal of Intellectual Capital*, *17*(3), 530-552.

Stewart, T. A. (1997). *Intellectual capital: the new wealth of organizations.* New York, NY, USA: Doubleday *30*(6): 953.

Soetanto, T., & Liem, P. F. (2019). Intellectual Capital in Indonesia: Dynamic Panel Approach. *Journal of Asia Business Studies,* *vol. 13*, no. 2, pp. 240–262.

Sofian, S., Tayles, M., & Pike, R. (2006). The implications of intellectual capital on performance measurement and corporate performance. *Jurnal kemanusiaan, (8)*, 13-24.

Ting, I. W. K., & Lean, H. H. (2009). Intellectual capital performance of financial institutions in Malaysia. *Journal of Intellectual capital* *10*(4): 588-599.‏

Ting, I. W. K., Ren, C., Chen, F. C., & Kweh, Q. L. (2020). Interpreting the dynamic performance effect of intellectual capital through a value-added-based perspective. *Journal of Intellectual Capital* (ahead of print).  <https://doi.org/10.1108/JIC-05-2019-0098>  <https://doi.org/10.1108/JIC-05-2019-0098> (Downloaded: 2 May 2020)

Vishnu, S., & Kumar Gupta, V. (2014). Intellectual capital and performance of pharmaceutical firms in India. *Journal of Intellectual Capital, 15*(1), 83-99.‏

Yalama, A. (2013). The relationship between intellectual capital and banking performance in Turkey: evidence from panel data. *International Journal of Learning and Intellectual Capital, 10*(1), 71-87.‏

Zhicheng, L., Zhuoer, C., Shing, L. T. T., & Wah, C. S. K. (2016). The Impact of Intellectual Capital on Companies’ Performances: A Study Based on Make Award Winners and Non-Make Award Winner Companies. *Procedia Computer Science*, 99, 181-194.‏