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INTELLECTUAL CAPITAL EFFICIENCY: A COMPARATIVE STUDY BETWEEN MALAYSIAN AND SINGAPOREAN MANUFACTURERS

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ABSTRACT

Among the indicators of high business performance is Intellectual Capital (IC) efficiency. Looking at limited comparative studies on IC, this study aims to explore and compare IC efficiency and its four components among ASEAN manufacturing firms in emerging (Malaysia) and developed (Singapore) countries using a value added model. This would be a good benchmark for Malaysia since Singapore, as one of the most competitive economies in the world, can act as a role model in pursuing its innovativeness. Utilising data from annual reports of 56 manufacturing firms over three years (2012-2014), an independent sample t-test was performed. Overall, no significant difference was observed in the mean scores of Modified Value Added Intellectual Coefficient (MVAIC) and its three components (human, structural and physical capital) across both countries except for innovation capital. Thus, the current innovativeness of Malaysian manufacturers could be a basis to design and strategise appropriate mechanisms to improve IC management in becoming a developed nation as spelt in the Malaysian economic agenda. A more comprehensive measure of a firm's IC efficiency is established by incorporating innovation capital as a standalone measure.

1. Introduction

One of the main ingredients for business survivability in a knowledge-based economy is intellectual capital (IC). Choong (2008) described IC as a non-monetary asset without physical substance but possessing value and capabilities to generate future benefit, while Mention (2012) opined IC as firm internal and external capital organised, managed and utilised through interactions with financial and tangible capital in developing new resources. IC capability in sending a signal about a business's performance has been proven in past research by Feimianti and Anantadjaya (2014), Lee and Mohammed (2014), Chowdhury, Rana, and Azim (2019), Vo and Tran (2021), as well as Dalwai and Salehi (2021), which revealed a positive impact of IC on financial, productivity and market value performance.

However, the intangibility and non-substance nature of IC leads to limited accounting standards regulating it, which in turn results in difficulties faced by researchers to measure IC. Therefore, in 1998, Pulic created a value added model known as the Value Added Intellectual Coefficient (VAIC) to effectively measure IC. Generally, this model captures information on how much value is added and created for every money invested in a firm's resources (Ramírez, Dieguez-Soto, & Manzaneque, 2021), so that better strategies could be designed for utilising IC performance. It consists of three components, namely physical, human and structural capital.

Physical capital (CE) can be defined as tangible capital created by humans and is utilised in the productive process of a firm (Lee & Mohammed, 2014). It needs to be combined with financial capital to maximise efficiency in value creation process (Feimianti & Anantadjaya, 2014). On the other hand, human capital (HC) is central to each firm's productive process since it acts as an originator of other components in IC and encompasses a collective set of workforce's capabilities and contributions (Vo & Tran, 2021). Whereas structural capital (SC) is a set of knowledge that remains with the firm every time it is needed comprising the firm's intellectual properties, system, process, procedure, culture and databases that might be legally protected and exclusively owned by a particular firm (Chowdhury et al., 2019). These three components create three measures of IC efficiency called Capital Employed Efficiency (CEE), Human Capital Efficiency (HCE) and Structural Capital Efficiency (SCE). The total VAIC value would be the sum of these three capital efficiencies.

Prior findings discovered that the original VAIC model is so convenient, straightforward, reliable, verifiable and above all facilitates clear understanding among stakeholders of a business (Chowdhury et al., 2019; Ramírez et al., 2021; Vo & Tran, 2021). However, it misses the most crucial component of IC in creating firm value, which is innovation capital (Bayraktaroglu, Calisir, & Baskak, 2019). OECD (2005) defined innovation capital as the execution of considerably new and improved products, goods or services, business processes and business networking. Firms with high innovation capability have better prospects to keep themselves at the forefront of the competition (Al-Khatib, 2022; Saunila & Ukko, 2012) owing to the vital role of innovation capital triggering reformation in a firm (Wang, 2011; Xu & Liu, 2020). According to Al-Khatib (2022) and Chen, Cheng, and Hwang (2005), innovation capital should be independently measured as the fundamental ingredient that drives a firm constant development and creation of new ideas. Hence, to improve the original VAIC model, innovation capital will be measured independently from other IC components (Al-Khatib, 2022; Chang & Hsieh, 2011; Chen et al., 2005; Phusavat, Comepa, Sitko, & Ooi, 2011) to make it more comprehensive and meaningful. In this study, innovation capital was measured by R&D expenditure representing innovation capital efficiency (InCE) measurement.

In Malaysia, IC has initiated to gain economic prominence in the last two decades (Gan, Saleh, Abessi, & Huang, 2013). In its response towards a sophisticated knowledge-based economy, Malaysia has incorporated initiatives in its national agenda to address the importance of IC. In its effort of becoming a developed nation, Malaysia launched the Knowledge-Based Economy Master Plan in 2002 (Anam Ousama, Fatima, & Rashid Hafiz - Majdi, 2012). In addition, Malaysia is constantly keeping up with the importance of innovation in wealth creation by promoting innovation as a source of sustainable economic growth proven by having innovation and productivity as among the important pillars in the series of Malaysia Plan, including in the tenth and eleventh Malaysia Plan.

Xu and Liu (2020) and Nimtrakoon (2015) mentioned that high-technology industries like manufacturing, electronics, pharmaceutical and software, which have benefitted substantially from IC, would eventually invest extensively in IC. Nevertheless, regardless of extensive IC studies conducted in different industries worldwide, comparative studies on IC are still very limited. The gap in the literature motivates this study to explore and compare IC efficiency measured by MVAIC of Malaysian manufacturing firms representing emerging countries in comparison with Singaporean manufacturing firms representing developed countries in ASEAN. By comparing these two countries, Malaysia can be greatly aided since the results might provide an intuition about their IC performance in realising the national agenda of becoming an innovation driven-country.

2. Hypotheses Development

The Pulic VAIC model has engrossed much attention among researchers to investigate IC efficiency in developed and emerging countries. However, mixed results were reported. One of the latest studies by Xu and Liu (2020) tested the influence of IC on Korean manufacturing firms' performance from 2013 to 2018 using an enhanced VAIC model. Results demonstrated that physical capital has the greatest impact on firm performance, while human capital is considered a performance-enhancing factor. Moreover, innovation capital was found to negatively affect a firm's profitability due to the high price of innovation.

In 2019, Bayraktaroglu et al. (2019) conducted empirical research on the Turkish manufacturing sector and observed that the efficiency of innovation capital plays a moderating role in the association between structural capital efficiency (SCE) and profitability. This implies that as R&D expenses increase, the impact of SCE on profitability also intensifies. The researchers also discovered that the efficiency of innovation capital directly influences a firm's productivity. Moreover, many IC efficiency studies have been conducted in various countries to examine the impact of IC on firm performance, including that by Feimianti and Anantadjaya (2014) in Indonesia, Chowdhury et al. (2019) in Bangladesh, Vo and Tran (2021) in Vietnam and Ramírez et al. (2021) in Spain. However, comparative IC efficiency studies remain inadequate.

One of the recent comparative studies has been done by Nadeem, Gan, and Nguyen (2017). They examined the relationship between IC and firm performance in BRICS (Brazil, Russia, India, China and South Africa) economies by drawing data from 6,045 publicly listed firms from 2005 to 2014. China was found to be the top IC performer, while South Africa was the least efficient in utilising IC. Meanwhile, human capital was the main contributor of IC in all BRICS economies. The result also emphasised the role of physical capital in contributing towards value creation process in combination with IC despite its small mean value reported for each country if compared to human and structural capital.

Another study by Nawaz and Haniffa (2017) examined the link between IC and financial performance among 64 Islamic financial institutions operating in 18 different countries, which involved Asia, Europe and the Middle East region, from 2007 to 2011. The finding demonstrated that IC, particularly human and physical capital, have a positive impact on firms' return on assets implying that the value creation ability of sampled firms is highly affected by human and physical capital with human capital as the major driver of the value creation process.

In the ASEAN context, three comparative studies have been commenced so far. Young, Su, Fang, and Fang (2009) examined the IC performance among commercial banks in eight Asian economies, namely Hong Kong, Taiwan, South Korea, Singapore, Malaysia, Thailand, the Philippines and Indonesia from 1996 to 2001. They discovered that physical and human capitals are the main components of IC that create value for commercial banks. However, banks from different countries have different levels of IC performance, which was preceded by commercial banks in Hong Kong, while the most improved IC performance was in Thailand. In addition, Phusavat, Comepa, Sitko-Lutek, and Ooi (2012) investigated the link between IC represented by National IC Indicator (NICI) and economic development represented by GDP per capita in five Southeast Asia countries including Indonesia, Malaysia, the Philippines, Singapore and Thailand. Their finding provided empirical evidence of the significant relationship between NICI and GDP per capita with each country having different IC efficiency. Furthermore, the study also proved that all of these Southeast Asia countries are still under the efficiency-driven stage, except Singapore, which has been grouped as an innovation-driven country. Global Competitiveness Report 2014-2015 produced by World Economic strengthened the finding by Phusavat et al. (2012).

While the above studies revealed different IC efficiency among countries, the most recent comparative study conducted by Nimtrakoon (2015) using data from five technology ASEAN countries including Singapore, Malaysia, Thailand, the Philippines and Indonesia reported no empirical significant difference in overall IC across ASEAN countries. However, a significant difference was observed among countries in four individual components of IC, which were HCE, SCE, CEE and relational capital efficiency. This finding indicates that technology firms in ASEAN have more or less the same level of IC efficiency with each country placing a different degree of importance on IC components to generate corporate value with HC contributing the most for the majority of the countries.

Due to scarce comparative studies on IC being performed, more cross-sectional research is required to assess IC performance in a particular country and set a benchmark against IC top performers. Since Malaysia was grouped in the transition phase from efficiency-driven to innovation-driven, while Singapore was regarded as an innovation-driven country, this study expected that their IC efficiency level would be different. Hence, the following hypotheses were proposed:

H1 : MVAIC is different between emerging countries (Malaysia) and developed countries (Singapore).

This study also assesses the efficiency of individual components of MVAIC in comparing IC efficiency between these two countries as shown in the hypotheses below:

H1.1 : HCE is different between emerging countries (Malaysia) and developed countries (Singapore).

H1.2 : SCE is different between emerging countries (Malaysia) and developed countries (Singapore).

H1.3 : InCE is different between emerging countries (Malaysia) and developed countries (Singapore).

H1.4 : CEE is different between emerging countries (Malaysia) and developed countries (Singapore).

3. Methodology

Sample Selection and Data Collection

The population for this study involved two stock exchanges, which were Malaysia (Bursa Malaysia) and Singapore (Singapore Exchange). For homogeneity, the companies used were taken only from the manufacturing industry as it is classified as high technology industry that possesses a high level of IC in their operation and is believed to substantially benefit from IC investment (Nimtrakoon, 2015; Xu & Liu, 2020). However, the sample was limited to manufacturing firms with R&D expenditure to test the study objective on innovation capital, which has been proven to be the secret recipe to a constant generation of new ideas and better product solutions (Al-Khatib, 2022). Firms with R&D expenditure were also expected to be large in size as smaller manufacturers could not afford expensive R&D costs (Xu & Liu, 2020).

Each country's stock exchange was assessed for three sequential years, from 2012 to 2014 and their annual reports were reviewed. These three years were selected as the most stable state of the Malaysian manufacturing industry since its continuous drop in contribution to the country's Gross Domestic Product (GDP) from 2000, as reported by The World Bank (2015a) to avoid too much fluctuation that may be caused by factors uncovered by this study. Data from manufacturing firms with R&D expenditure in 2014 were used as the reference year to identify samples with consistently available data for these three years (2012-2014). The final sample for one year of 56 was obtained, which was then multiplied by three years making a total sample of 168. However, due to extreme outliers, the final sample size dropped from 168 to 145.

Measurement of Variables

The variables in this study were MVAIC and its four components (CEE, HCE, SCE, and InCE). The following formula was used:

$$MVAIC = CEE + ICE \quad (1)$$
$$ICE = HCE + SCE + InCE \quad (2)$$

Where:

1) CEE: The value is derived from VA/CE. It indicates how much new value has been created per one unit of investment in the capital employed.

2) HCE: The value is derived from VA/HC. It indicates how much value has been created per one unit of investment in the employees.

3) SCE: The value is derived from SC/VA. It indicates the amount of structural capital needed to generate a dollar of value added in a firm.

4) InCE: The value is derived from the R&D expenditure/Book Value of Common Stock.

The detail of each component of MVAIC is illustrated using the following formula:

1) VA = OUTPUT- INPUT = OP + EC + D + A, in which VA is Value Added, OP is the operating profit, EC is employee cost, D is depreciation and A is amortisation. VA is derived from the differences between output and input. The output contains revenue of all products and services offered to the market, whereas input represents all expenses incurred in earning that revenue but excludes employee costs.

2) CE (Capital Employed) = Total Asset – Intangible Asset.

3) HC (Human Capital) = Total Salaries and Wages.

4) SC (Structural Capital) = VA – HC

4. Results and Discussions

Descriptive Statistics

The descriptive statistics are demonstrated in Table 1. The mean value of MVAIC was 2.8953 suggesting that manufacturing firms create USD 2.8953 for every USD1.00 investment made in all strategic resources of the firms including physical, financial and intellectual resources. The most contributing component towards MVAIC value was HCE with the largest mean value of 2.1877 compared to SCE, InCE and CEE with mean values of 0.4413, 0.0348 and 0.2315, respectively. This result is consistent with prior empirical findings by Xu and Liu (2020), Nadeem et al. (2017), Nawaz and Haniffa (2017), Young et al. (2009) and Nimtrakoon (2015), which also revealed HCE as the most influential component of MVAIC in value creation. Hence, this finding proved how an employee can be the greatest asset to an organisation. The small standard deviation for all variables ranging from 0.0451 to 1.8513 indicates concentrated data close to the mean value.

Table 1
Descriptive Statistics for Entire Sample

Variable	N	Mean	Standard Deviation
MVAIC (Ratio)	145	2.8953	1.8513
HCE (Ratio)	145	2.1877	1.6086
SCE (Ratio)	145	0.4413	0.45954
InCE (Ratio)	145	0.0348	0.0451
CEE (Ratio)	145	0.2315	0.1506

Table 1 also exhibits MVAIC consisting of HCE, SCE and InCE with a higher combined mean value of 2.6638 compared to CEE with only 0.2315. This finding indicated that IC representing intangible assets (HCE, SCE and InCE) is the dominant source of firm efficiency in creating value rather than physical and financial assets. This result confirmed findings from previous studies that a firm's reliance on tangible capital is reduced to survive in a fiercely competitive market, as IC had become the vital source of firm competitive advantage (Bayraktaroglu et al., 2019; Chang & Hsieh, 2011; Xu & Liu, 2020; Zeghal & Maaloul, 2010). However, according to Nadeem et al. (2017), the significance of physical capital cannot be denied in complementing IC to achieve better efficiency.

The above descriptive analysis was conducted on the entire sample of data, but with each country having different characteristics of selected variables. Thus, it is reasonable to inspect selected variables by individual countries. Descriptive Statistics for Individual Countries are presented in Table 2. According to the table, on average, overall MVAIC showed that Malaysia reported a slightly higher MVAIC of 2.9635 compared to Singapore with 2.8201. The same goes for three components of MVAIC (HCE, SCE and CEE) except for InCE, in which Singapore has a greater mean value of InCE but is still very low amounting to 0.0455 compared to Malaysia with 0.0251. The very low InCE value here could be due to the limited measurement of innovation capital represented only by R&D expenditure from the firm income statement. It also might be because the firm recorded it as an investment in human resources and not separated as R&D expenditure even though the firms might probably have incurred R&D expenses (Phusavat et al., 2011).

Table 2
Descriptive Statistics for Individual Countries

Variable	Malaysia (N = 76)		Singapore (N = 69)	
	Mean	Standard Deviation	Mean	Standard Deviation
MVAIC (Ratio)	2.9635	1.3184	2.8201	2.3087
HCE (Ratio)	2.2442	1.0851	2.1253	2.0429
SCE (Ratio)	0.4570	0.2507	0.4240	0.6143
InCE (Ratio)	0.0251	0.03601	0.0455	0.0515
CEE (Ratio)	0.2371	0.0963	0.2252	0.1943

When comparing these two countries, the difference in the mean score of other MVAIC components was not significant though Singapore has higher InCE compared to the other components of MVAIC (HCE, SCE and CEE) as shown in Table 3. Only InCE was found to be significantly different, in which Singapore has significantly higher efficiency in managing its innovation capital. This result is expected since Singapore, as a more developed nation, spends more on innovation activities including R&D activities compared to Malaysia (The World Bank, 2015b). Overall, HCE was the major influence of value creation for both countries with mean values of 2.2442 and 2.1253 for Malaysia and Singapore, respectively. On average, both countries manufacturing firms primarily rely on IC to create value, thus reducing reliance on physical and financial capital (CEE).

Independent Sample T-Test

In testing the hypothesis, Independent Sample T-Test was conducted to compare the mean scores of MVAIC and its four components between Malaysian and Singaporean manufacturers. Country is regarded as the grouping variables of two groups, Malaysia and Singapore, while MVAIC and its components served as the continuous variables. Before interpreting the result, assumptions of homogeneity of variance were first checked using Levene's Test for equality of variances. Levene's Test determines whether the variance of scores for two groups (Malaysia and Singapore) is the same and which t-value should be used to interpret the result. The Sig. value for Levene's Test of > 0.05 means that equal variance is assumed and the first row of equal variance assumed will be used to interpret the result. However, if the Sig. value is < 0.05, it indicates equal variance is not assumed and the second row will be used (Pallant, 2011).

Table 3 demonstrates independent sample t-test for MVAIC and its four components. According to Levene's Test, the Sig. value for MVAIC and all its components were < 0.05 implying the variability in Malaysia and Singapore mean values of MVAIC, HCE, SCE, InCE and CEE were not the same; hence, equal variance was not assumed. On another test, which is the t-test for Equality of Means referring to the column labelled Sig. (2-tailed) for unequal variance, Sig. value for overall MVAIC and its components were > 0.05 except for InCE with Sig. value of < 0.05 (0.007). This result revealed no evidence supporting the overall significant differences in the mean score of MVAIC as well as its three components (HCE, SCE and CEE) across these two countries. In other words, manufacturing firms in Malaysia and Singapore utilise MVAIC, HCE, SCE and CEE to a similar extent for creating value for their firms. However, InCE was found to be employed to a different extent by Malaysia and Singapore in the value-creation process.

Table 3
Independent Sample T-Test for MVAIC and its Components

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
MVAIC	Equal variances assumed	12.381	.001	.465	143	.643	.1434576	.3086902	-.4667279	.7536430
	Equal variances not assumed			.453	105.816	.651	.1434576	.3164141	-.4838769	.7707920
HCE	Equal variances assumed	13.527	.000	.443	143	.658	.1188922	.2682347	-.4113252	.6491095
	Equal variances not assumed			.431	101.275	.667	.1188922	.2756389	-.4278832	.6656676
SCE	Equal variances assumed	18.278	.000	.431	143	.667	.0330550	.0766320	-.1184228	.1845328
	Equal variances not assumed			.417	88.289	.678	.0330550	.0793421	-.1246135	.1907236
InCE	Equal variances assumed	19.129	.000	-2.777	143	.006	-.0203579	.0073309	-.0348487	-.0058671
	Equal variances not assumed			-2.731	120.197	.007	-.0203579	.0074546	-.0351172	-.0055986
CEE	Equal variances assumed	18.821	.000	.473	143	.637	.0118709	.0251115	-.0377669	.0615086
	Equal variances not assumed			.459	97.304	.647	.0118709	.0258624	-.0394569	.0631986

Generally, even though manufacturing firms in Malaysia obtained slightly higher mean scores of MVAIC, HCE, SCE and CEE compared to Singapore, they are not statistically significant. Plus, Malaysia is still lacking in utilising its InCE to create value for the firm compared to Singapore. This finding is consistent with a prior study by Phusavat et al. (2012) who categorised Malaysia as an efficiency-driven country and Singapore as an innovation-driven country. The categorisation of their efficiency status was reflected in this current study finding when Singapore, as an innovation-driven country, has significantly higher InCE compared to Malaysia, an efficient-driven country. This result is also in line with the efficiency ranked by the Global Competitiveness Report 2014-2015 produced by World Economics.

Furthermore, the overall findings of H1 are partially supported by Nimtrakoon (2015) who reported no significant difference in overall MVAIC mean score across technology firms in ASEAN countries, but each country places a significantly different degree of importance on IC components to generate corporate value. In summary, there was no significant difference between Malaysia and Singapore concerning MVAIC, HCE, SCE and CEE, thus rejecting H1, H1.1, H1.2 and H1.4. However, significant differences were found in relation to InCE, hence providing support for H1.3. The most concrete reason for unsupportive results is due to the similarity of the manufacturing industry in both countries, particularly the sample size selected that is restricted to firms with R&D expenditures. This study indirectly controlled the firm size, thus producing no overall significant result for overall MVAIC. Moreover, other factors determining the innovativeness of a country were excluded in the current study like new product sales, innovative culture and top management support for innovation.

5. Conclusion

This study has explored and compared MVAIC and its four components (human, structural, innovation and physical capital) among manufacturing firms in Malaysia and Singapore.

Findings showed no significant difference in the mean score of MVAIC and its three components (HCE, SCE, CEE) between Malaysian and Singaporean manufacturing firms. The findings demonstrated that manufacturing firms in Malaysia and Singapore utilise human, structural and physical capital to a similar extent for creating firm value. Nevertheless, the mean scores of InCE between these two countries were found to be significantly different. As expected, Singapore as an innovation-driven country had better InCE compared to Malaysia, which is ranked in the transition phase between efficiency-driven to innovation-driven (Phusavat et al., 2011; Schwab, 2015).

This current study provided some contributions to the body of knowledge in several ways. First, by theoretically adopting the MVAIC model, a more comprehensive measure of a firm's IC efficiency can be established by assessing the efficiency of individual IC components as well as the aggregate MVAIC. Second, it contributes to the limited comparative study on IC efficiency across the countries by exploring and comparing MVAIC in manufacturing firms as one of the high-technology industries between emerging and developed countries.

In practice, by knowing the historical level of Malaysian innovativeness and IC capabilities, Malaysian regulators and practitioners will be more aware of the importance of innovation capital growth and development. In becoming a more developed nation as aspired in its TN50 and towards achieving the innovation-driven status, Malaysia should double their effort and emphasis on the enlargement of innovation capital including intensive R&D activities and development of new products, services, ideas and intellectual properties, while maintaining its efficiency in other intellectual capitals. The mechanism for improving IC management can be strategised in developing and managing key capabilities associated with IC. For instance, the result could serve as a basis for regulators to design attractive and open policies to attract foreign direct investment into Malaysia for promoting the exchange of IC capabilities.

Nevertheless, this study does not come without limitations. Measurement of innovation capital represented only by R&D expenditure was limited in this study. This is because even though the firms might probably have incurred R&D expenses, it has not been separated as R&D expenditures in their financial statement. Therefore, it is recommended for future research to consider other indicators of innovation capital like sales from new products, innovative culture and high management support for innovation to establish a more accurate measure of innovation capital in capturing the real efficiency of this strategic valuable capital in an organisation. Future studies should also prolong the year under review to investigate the presence of any changes to the IC efficiency afterwards for selected countries.

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