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Intellectual Capital Efficiency and Investment Opportunities: Fixed Effect and System GMM Models

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ABSTRACT

The purpose of this study is to empirically examine the role of intellectual capital efficiency in creating investment opportunity set (IOS) in 188 Malaysian listed manufacturing companies during the 2006-2011 period. Value Added Intellectual Coefficient (VAIC™) is adopted as the measure of intellectual capital efficiency while factor analysis is used to construct an index of investment opportunity set (IOS) from three price-based growth variables. The fixed effect and GMM system two step models provide statistical evidence that the VAIC and its components have significant positive effect on IOS in manufacturing companies of Malaysia. The positive effect of intellectual capital efficiency on IOS implies that companies can benefit immensely from spending on their human and structural capital because this investment adds value to their companies.

KEYWORD

Intellectual Capital Efficiency, Investment Opportunity Set, Fixed Effect Model, System GMM Model

INTRODUCTION

The change in economic structure from traditional to knowledge-based economy have resulted in changes in investment strategy of many firms which leads to increase in intellectual capital (IC) [3]. Investing in the IC can lead to increase competitive advantages such as investment opportunity set (IOS) [6]. IOS increase the market value of companies and ultimately, the nation's economic growth and development [31]. This issue is paramount for a developing economy such as Malaysia, particularly because it is aiming for a developed country status by 2020. Malaysian companies have been investing in their human capital through R&D, education and training programs to fuel the transitions toward a developed country via the K-economy vehicle. However, the latest report [49] on the development indicators such as gross domestic product, income level, and employment and market capitalization shows that Malaysia is still lagging behind the developed countries in this region such as Japan, China,and the Republic of Korea. Investing in the IC can contribute to the development of the country through the K - economy through increasing IOS.Malaysia has embarked on various plans, including the 2002 Economy Master Plan and New Economic Model to accelerate the transformation progress. Nucleus to these plans is intellectual capital (IC) as the country is relying on knowledge-based economy as its transformation and sustenance vehicle. Figure 1 illustrates the three basic elements of the Australian bureau of statistics (ABS) framework which is built on those of APEC and OECD frameworks [44]. To a great extent, the Malaysian framework of knowledge-based economy is consistent with that of the ABS. The advantage of the Malaysian knowledge economy structure stems on its emphasis on IC while simultaneously recognizes the importance of the traditional physical and natural factors of production such as raw materials, labour, capital and entrepreneurship.

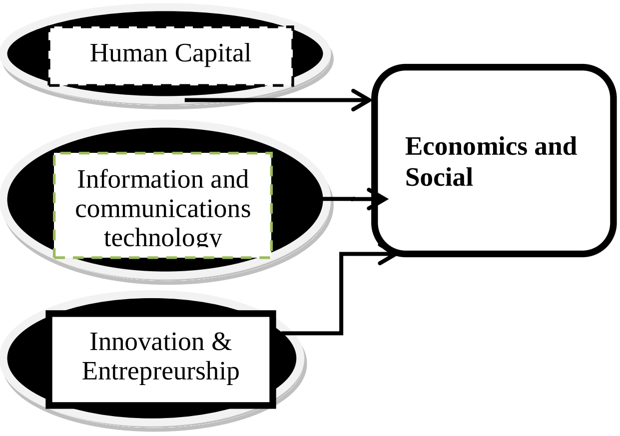

Fig. 1. Simplified dimensional structure of the ABS knowledge-based economy/society [45,pp.10]

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The emphasis on intellectual capital recognizes that this asset is crucial for creating investment opportunities set (IOS). IOS is one of the two components of firm value which represents the value of growth options or future potential investment [31]. The other component is the value of assets in place. IOS is a competitive advantage which is created from discretionary expenditures and firm-specific factors such as physical and human capital in place as well as industry-specific and macroeconomic factors [24]. It composes intellectual capital (IC) which is conceptualized as "the sum of all knowledge a company is able to use in the process of conducting business to create value for the firm" [15].

IC can be further dissected into (i) human capital (HC) which is "the combined knowledge, skill, innovativeness, ability of the company's individual employees to meet the task at hand, company's values, culture, and philosophy" and (ii) structural capital (SC) which comprises "the hardware, software, databases, organizational structure, patents, trademarks, and everything else of organizational capability that support those employees' productivity; in the other words, everything that gets left behind at the office when employees go home" [15,pp: 3].

According to the resource based view (RBV), IC as a valuable resource can be applied to exploit and create opportunities [6] and provide multifaceted options for future opportunities [25]. In other words, IC has some roles in identifying and creating IOS that eventually leads to the development of an economy. In addition, RBV indicates that IC as a strategic resource creates competitive advantage which is taken into account in this research through considering more IOS than rival. Most studies in the field of IC have only focused on the effect of IC on competitive advantages such as profitability, market to book equity [13; 27; 46]. Despite the increasing importance of IC, what is not yet clear is the empirical investigation of the impact of IC on IOS of manufacturing companies. Therefore, the main aim of this study is to examine the role of IC in creating IOS in manufacturing companies of Malaysia. In previous studies, the positive effect of IC on profitability has been documented by [35], [37] and [41] whereas pecking order theory estimates a positive effect of profitability on IOS [33]. Therefore, it is highly feasible to predict the effect of IC on IOS. According to RBV, the value of IC depends on its efficiency. Therefore, this research uses intellectual capital efficiency (ICE) instead of IC to find a plausible answer to the main research question: Does ICE have an influence on IOS of manufacturing companies Malaysia?

Malaysia has been ranked in the 23rd place in the world in terms of quantity of production [5]. There are wide ranges of well-developed manufacturing industries in Malaysia that can be divided into two focal industries of resource based and non- resource based. The economy of Malaysia is built upon these two manufacturing industries. These industries include those that are highly technology oriented such as electronics and electrical, aerospace, petrochemical, biotechnology, and those that are least technology oriented such as furniture manufacturing, food processing, wood and tobacco manufacturing.

LITERATURE REVIEW

In general evidence from past studies showed, intellectual capital efficiency has a positive effect on organizational performance. Most studies which used resource-based view as the underlying theory, used VAIC as a measure of intellectual capital performance while firm performance has been measured by accounting based measures such as ROA and ROE [12; 13; 34], as well as market based measure such as market- to- book ratio [12; 11; 30].

[29] showed that intellectual capital has significant influence on the performance of Islamic banks in Malaysia. They stated that intellectual capital is the most critical strategic asset for the success of the organizations. They argued that in a competitive business environment, intellectual capital is considered as the lifeblood of knowledge intensive organizations. The findings of this study also supported findings of previous studies such as [2] and [42]. In line with [29], [28] focused on companies in Trading and Services, Technology, Hotel and Consumer Products sectors listed on the Main Board of Bursa Malaysia from 2006 to 2010. The result indicated that HCE, SCE, CEE and VAIC are significantly positively related to market value, profitability and productivity. This research argued that in line with RBV, companies gain competitive edge and better performance through the acquisition, keeping and successive utilization of intangible resources which are important for competitive advantages and strong economic performance [28].

Unlike previous studies which focus on the general effect of IC on firm's performance, this study follows [33] in proposing that intellectual capital plays a more important role in companies operating in new economic environment. Specifically, this study proposes that IC is more critical in companies of advanced technologies whose core businesses include aerospace and defense, pharmaceutical and biotechnology. This proposition is based on [14] finding that advanced technology companies invest in intellectual capital much more than tradtional companies. Advanced technology companies require large investment in IC particularly R&D [14] because their employees need to be consistently updated with the state of the art technology to enable them to transform their creativity and innovativeness into new products and services. Drawing from this argument, this study hypothesizes that intellectual capital is more effective in creating investment opportunities in advanced technology than in traditional companies. Traditional companies are those doing businesses such as in beverages, food producers, forestry and paper which require minimal technologies.

RESEARCH METHODOLOGY

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This study selects its sample from manufacturing companies that are listed in Bursa Malaysia from 2006 to 2011. Besides the significance of IC in manufacturing companies, manufacturing sector is selected given the impressive contribution of about 25% of this sector to the country's GDP. Its gross output value has increased from MYR(Malaysian Ringgit) 655 billion in 2005 to MYR837 billion in 2010. In screening out the sample, companies are excluded if they report negative values of ICE (refer to Equation 1) and earnings or if they have missing data. The selection criteria produce a final sample of 188 companies which generate a balanced panel data of 1128 year-company observations. Data are sourced from DataStream and companies' annual reports. Panel data methodology by fixed effect and GMM system models are adopted due to its superiority in determining and computing effects that cannot be easily discovered in cross-section data.

This study employed the factor analysis to construct the combination factors into an index of investment opportunity set (IOS) [1;18; 19] from a set of variables; ratio of market to book value of assets (MBVA), ratio of market to book of equity (MBVE), and ratio of eraning to price (EP). To determine an adequate sample size for the factor analysis, KMO test was applied. The value of Kaiser-Meyer-Olkin (KMO) measure is greater than 0.5 that indicates factor analysis is validated [17]. At the same time, to achieve the suitability of data for factor analysis, Bartlett's test of sphericity is used. This test of sphericity is significant in the process representing the appropriateness of the data for factor analysis. Bartlett's test of sphericity supports the suitability of the data for factor analysis. The factor analysis confirms there is only one Eigenvalue > 1.0, suggesting only 1 common factor exists (Table.1).

Tab. 1. Results from factor analysis

Statistics	MBVA	MBVE	PE
Estimated commonality of the three IOS measures	0.871	0.881	0.287
Correlations between common factor and the three IOS measures	.903***	.896***	-.812***
Component	1	2	3
Eigenvalues Total	2.038	0.83	0.132
% of Variance	67.933	27.675	4.391
Cumulative %	68.933	95.609	100
Component Score Coefficient	0.933	0.938	-0.536
Kaiser-Meyer-Olkin	0.653		
Bartlett's Test of Sphericity	1688.90***		

Notes: MBVA = [MV (Equity) +BV (Debt)]/BV (Assets); MBVE = MV (Equity)/BV (Equity); and PE= ratio of eraning to price and *** denotes significant at the 1% level.

This study adopts one of the most widely accepted measure of efficiency of intellectual capital [45], i.e., Pulic's [36] value added intellectual coefficient (VAIC™). It is because of its consistency with the stakeholder and resource-based views and because it recognizes human capital as the main component of IC. VAIC™ also directly addresses [24] argument that IOS is created from both physical and human capital, beside the other firm-and industry-specific factors and macroeconomic factors. Specifically, VAIC™ can be dissected into intellectual capital efficiency (ICE) and capital employed efficiency (CEE). With ICE composes of human capital efficiency (HCE) and structural capital efficiency (SCE), the VAIC™ can be further dissected into;

$$VAIC_i^{TM}\, ICE_i + CEE_i = (HCE_i + SCE_i) + CEE_i \quad (1)$$

where
HCE = VA/HC,
SCE = SC/VA, and
CEE = VA/CE.

Equation 1 suggests that firm added value (VA) is created from 4 components, i.e., VA = OP + EC + D + A, where OP = operating profit; EC = employee cost; D = depreciation; and A = amortization. Human capital (HC) is the total salaries and wages for a company, Structural capital (SC) is the difference between VA and HC, and CE is book value of the net asset for a company. Note that in VAIC™, CEE represents the contribution of physical and financial capital as a prerequisite for creating value and delivering performance [36].

In testing the relationship between ICE and IOS, this study also controls for some variables (CV) which have potential in influencing IOS; financial Leverage (LEV = total debt/total assets), firm size (SZE = log of total assets), and financial flexibility (FLEX = (cash + cash equivalents)/net assets). The general panel regression equation is represented as;

$$IOS_{i,t} = \alpha + \beta_1 ICP_{i,t} + \beta_k \sum_{k=1}^{K} CV_{i,k} + \varepsilon \quad (2)$$

where $ICP_{i,t}$ is alternatively VAIC™ or one of its components for the *i*th company at the end of year *t*, α is the intercept, β is the estimated coefficient of the respective explanatory variable, ε is the error term, while the remaining *k* variables (CV) that are controlled for are as defined earlier.

RESULTS AND DISCUSSION

Table 2 displays the descriptive statistics of the variables after identifying outliers and cleaning data. The value of skewness and kurtosis indicates whether the data has a normal distribution. Skewness indicates the symmetry of a distribution; while kurtosis indicates the peakedness of a distribution. When the values for skewness and kurtosis are near zero, the distribution of data is normal [43]. [22], and [43] believe that when the sample size is large, a variable with statically significant skewness and kurtosis often does

not make a substantive impact on the analysis result. Further, [43] believe that in multiple regressions it is more important to ensure the normality of the residuals. The descriptive statistics (Table 2) confirm the improved range of kurtosis after outlier treatment.

Tab.2 .Descriptive Statistics

	Min	Max	Mean	Std. Deviation	Skewness	Kurtosis
VAIC	1.118	6.226	3.169	0.938	0.912	0.681
ICE	0.968	5.872	2.832	0.953	0.944	0.680
HCE	0.504	4.987	2.307	0.822	1.106	1.087
SCE	0.117	0.863	0.525	0.144	-0.187	-0.450
CEE	0.056	0.778	0.337	0.137	0.628	0.191
ROA	0.000	0.211	0.073	0.042	0.731	0.327
SIZE	4.512	7.118	5.482	0.503	0.987	1.197
FLEX	0.139	5.796	2.097	1.112	1.147	1.040
LEVE	0.000	0.586	0.221	0.129	0.289	-0.658
IOS	-1.317	2.951	-0.008	0.902	1.361	1.637

Notes: VAIC is value added intellectual coefficient and calculates through sum of total intellectual capital efficiency (ICE) and capital employed efficiency (CEE). ICE is intellectual capital efficiency and computes by sum of HCE and SCE. HCE is human capital efficiency and calculates through value added (VA) over human capital (HC). SCE is structural capital efficiency and calculates through SC /VA. SC is structural capital and calculates through [VA-HC]. HC is human capital and calculates through sum of total salaries and wages. VA is [operating profit+ employee cost+ depreciation +amortization]. CCE is customer capital efficiency and computes by CC /VA. ROA is return on assets and calculates through [earnings before interest and tax/ book value of total assets]. SIZE is company size and computes by log^{10} of total assets. FLEX is financial flexibility and calculates through [cash and cash equivalents/ book value of the net asset]. LEVE is financial leverage and calculates through [book value of total debt/book value of total assets], IOS is investment opportunity set.

Based on Table.2, the average score for VAIC is 3.169, with a maximum score 6.226 and a minimum score of 1.118. The VAIC score indicates the level efficiency achieved from the use of a firm's intellectual and physical capital. Comparing the three components of VAIC which are HCE, SCE and CEE, it can be seen that the HCE component is the dominant contributor of ICE, with a mean of 2.307, making up 82% (2.307/2.832) of total ICE. This is followed by SCE with 18% (0.525/2.832) contribution. The results suggest that HCE is the most important element in creating ICE. Thus, in the context of this study, firms with higher HCE are most likely to have higher ICE. This finding is in line with that by [38].Finally, the relationships between VAIC (and its components) and investment opportunity set (IOS) are estimated using regression models. Fixed effect is chosen after the results of the Hausman test (Table 3) show that fixed effects are exclusively supported in all models. The Pooled regression model is rejected in selecting between pool and fixed effect models based on Wald test (Prob<0.05) and between pool and Random effect models based on Breusch-Pagan Lagrange multiplier (LM) (Prob<0.05). The results of the Modified Wald test indicate heteroscedasticity problem in all models after running regression models. As well as, the results of Wooldridge test for autocorrelation show autocorrelation in residuals. As a result, panel-corrected standard errors (PCSE) method was employed for capturing autocorrelation and heteroscedasticity in the residuals [47]. Further, results from Pasaran cross-sectional dependence (CD) test confirm lack of the correlation between error term for one company and the error term for another company (cross-sectional dependence/contemporaneous correlation). The low correlations among independent and control variables (<0.90), and VIF statistics lower than 10 (<10) indicate no multicollinearity among independent and control variables. Other fundamental assumptions regarding regression are also evaluated, such as normality of error distribution, and linearity of the relationship between dependent and independent variables (Results of tests are not reported to conserve space).

Tab. 3. Results of Wald , LM and Hausman test

Model (IV)	Wald test	LM	Hausman test	Proposed Model
VAIC	F(5, 934) = 37.97 [a]	Chibar2(01) = 905.51 [a]	Chi2(5) = 31.19 [a]	Fixed Effect
ICE	F(5, 934) = 37.46 [a]	Chibar2(01) = 911.22 [a]	Chi2(5) = 31.13 [a]	Fixed Effect
HCE	F(5,934) = 37.30 [a]	Chibar2(01) = 908.38 [a]	Chi2(5) = 31.72 [a]	Fixed Effect
SCE	F(5, 934) = 37.73 [a]	Chibar2(01) =926.40 [a]	Chi2(5) = 28.97 [a]	Fixed Effect
CEE	F(5, 934) = 38.12 [a]	Chibar2(01) = 944.84 [a]	Chi2(5) =25.21 [a]	Fixed Effect

Notes: Superscripts [a] indicate significance at the 1%, level.

As hypothesized,the regression results in Table 4 show that VAIC and each of its components consistently have a significant positive relationship with IOS. This result lends a strong support for [16] proposition that intellectual capital is an important factor in elevating innovations of, in their study, firms in the construction industry. Structural capital is more important than human capital in creating investment opportunities. On the surface, this finding might be interpreted as evidence that companies should focus more on investing in structural capital (structure and information system which are needed to support those employees' productivity) to create value. Nonetheless, it is more logical to suggest that providing the right structural capital is critical for manufacturing companies because by nature, these companies have to consistently employ cutting edge technologies. The nature of technology of manufacturing companies itself requires that the right technological tools and systems such as the hardware, software, databases and everything else must be made available to the employees to enable them to optimize their efficiencies [15]. Adequate and right investment in structural capital would enable the employees to leverage on the R&D activities to the optimal level that contribute to more innovation and finally IOS.

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The models produce adjusted R squares of about 0.33 which means that 33 percent change in the target variable (IOS) is due to predictor variables (independent and control variables). It is worth mentioning that the strength of the effect of the CEE on IOS is larger than all components of VAIC. This is despite the fact that VAIC is mainly contributed by ICE and the fact that HCE is the dominant factor in ICE. This finding suggests that although ~~ICE~~ explains the larger portion of VAIC, it is CEE that relates more strongly to IOS. It reveals that financial and physical capital is the most important component of VAIC when it concerns the creation of IOS.

In regard to the influence of control variables on IOS, profitability is by far the most important predictor followed by the firm size. The other two control variables, financial leverage and flexibility, practically play no particular role in determining IOS in all models. The positive relationship between IOS and size as well as IOS and ROA confirm the findings of an earlier research by [4].

Tab. 4. Results of cross section and period fixed effect model

Model		Model=1	Model=2	Model=3
Independent variable		VAIC	ICE	HCE
C	Coefficient	-6.309***	-5.833***	-6.286***
	T-statistic	-5.21	-5.18	-5.17
IV	Coefficient	0.109***	0.098***	0.109***
	T-statistic	3.05	2.66	2.55
ROA	Coefficient	5.750***	5.951***	5.995***
	T-statistic	6.69	6.88	6.99
FLEX	Coefficient	0.058	0.056	0.056
	T-statistic	1.54	1.48	1.47
LEVE	Coefficient	0.079	0.088	0.094
	T-statistic	0.28	0.775	0.741
Size	Coefficient	1.019***	1.878***	1.021***
	T-statistic	4.57	5.75	4.58
Adjusted	R-squared	0.333	0.331	0.332

Model		Model=4	Model=5
Independent variable (IV)		SCE	CEE
C	Coefficient	-6.382***	-6.377***
	T-statistic	-5.23	-5.28
IV	Coefficient	0.546***	0.886***
	T-statistic	3.07	3.54
ROA	Coefficient	6.123***	5.892***
	T-statistic	6.9	7.36
FLEX	Coefficient	0.062	0.077
	T-statistic	1.61	1.58
LEVE	Coefficient	0.056	0.03
	T-statistic	0.21	0.11
Size	Coefficient	1.029***	1.027***
	T-statistic	4.62	3.54
Adjusted	R-squared	0.333	0.334

Notes: Superscripts ***, ** and *indicate significance at the 1%, 5% and 10% level, respectively.

ROBUSTNESS CHECKS

In static models, all regressors are assumed to be exogenous (.e.g. regressors should be independent from the residuals) especially after the inclusion of the fixed effects that account for the common omitted variables problem. Consequently, no correlation between the regressors and the residuals should exist. If we assume that all regressors are exogenous, this may violate the recently mentioned assumptions and lead to the coefficients (B's) estimators that are unbiased and consistent, whereas the results might be inefficient. However, these conditions may result in underestimation of the standard errors of the estimators and higher values of T-statistics, therefore invalidity in the standard errors and the resulting tests can be observed. To reduce invalidity problems and produce more efficient estimators the use of firm and period fixed effects are recommended. Though, the employ of fixed effects take out the general unobservable variables effect, nevertheless do not guarantee that the entire of the problems in the residuals stated above will be removed. Therefore, generalized methods of moments (GMM) are suggested when the regressors are not exogenous [39].

[21] developed the GMM, in this model a class of estimators is composed to use the moment conditions (orthogonally conditions) of the data generating process [20]. In the case of dynamic modelling, GMM is superior due to having advantages. GMM is utilized instrumental variable (IV) approach which contributes to the consistency of estimates in order to decrease the endogeneity problem. GMM is able to use an instrument of the second lagged dependent variable or the second lagged difference as a regressor. In addition, GMM also used difference of the variables to justify the unobservable time invariant variables. GMM is suggested for panel with small time period and large number cross section. GMM is suitable when the dependent variable is affected by its own past realizations and heteroscedasticity and autocorrelation are seen within cross sections [39].

First-difference GMM model and system GMM are advanced techniques of GMM. This study used system GMM method as robustness test of methodology for testing models. This study will include year dummies to take out common time-related shocks, macroeconomic shocks common to all firms, from the error term [39]. The key weakness of first-differenced GMM model is that it has poor finite sample features when the instruments are weak [8]. If

the number of cross sections or companies are large and the number of periods is short, the lagged levels in first-differenced GMM is possible to be weak instruments that contribute to imprecise or even biased estimators [8].

The system GMM estimator comes from the estimation of two kinds of simultaneous equations: first difference and the level. [8] use the lagged level to instrument the first difference and use the lagged first difference to instrument the level. The system GMM estimator is considered as a more efficient method that has a minor finite sample bias because of the utilization of more moment conditions, particularly when the instruments are weak. The system GMM models are estimated using the robust two-step estimation method and standard errors are corrected using [48] finite sample correction.

Table 5 (Appendix) reports the results from robust two step system GMM method for testing the relationship between VAIC and its components with IOS. Since of IOS of the current year can be effected from the previous year, IOS is considered as endogenous variable and Third Lag of IOS (l3.IOS) was considered as an instrumental variable (GMM style). Independent and control variables were considered as exogenous variables (IV style) in all models. The result of Sargan and Hansen tests (Prob > chi2=no-significant) confirm the validity of GMM and IV styles were considered in all models. The results from Arellano-Bond test for AR(2) in first differences confirm lack of autocorrelation in the residuals. The relationships between VAIC and its components with IOS are consistently positive and significant at all models. Generally, these results are comparable with the results reported in Table.4. These findings indicate the validity of the fixed effect method in testing models.

CONCLUSION AND IMPLICATIONS

This study investigates the role of intellectual capital efficiency (ICE) in enhancing firms' abilities to create investment opportunities in a sample of manufacturing firms. According to the resource-based theory, intangible strategic asset can create competitive advantages, including the investment opportunity set IOS. The study conceptualizes the relationships between ICE (and its main and sub-components) and IOS and the results consistently support those hypotheses. When properly managed, this costly human and structural capital should be more efficient in producing investment opportunities and value for the firms.

SC also needs to be considered as a valuable strategic asset and infrastructural base for a company in the knowledge era. It includes assets such as information systems, routines, procedures and databases. It also prepares the instrumentation and design in the process of making value [10]. Weak structural capital causes reduction in staff motivation and capabilities. Therefore, employees could not produce value and competitive advantage for a company if the firm's SC is weak [9]. Similarly, our statistical analysis showed that the relationship between CEE and IOS is also significant and as a matter of fact the strength is greatest compared to others. It means that CEE which includes financial and physical capital is empirically proven to create competitive advantage in the form of IOS. Overall, the results of this study affirm that companies treat investment in all types of capital equally important in order to optimize its ability to increase its investment opportunities and ultimately, its value. Since there is no previous evidence established on the IC-IOS link in manufacturing companies, future research involving different country setting is needed to draw a strong conclusion.

[7] believes that firms can create more business ideas and opportunities via human capital. Human capital is key in identifying investment opportunities which are related to creativity and abilities to come up with higher quality solutions to a problem [26]. Similarly, [23] have argued that losing key employees could be detrimental to firms because it temporarily diminishes the firm's productivity. Whereas [40] state that investment in human capital is needed because it can improve production efficiency, product or service quality, and product differentiation, earning strategic competitive advantages.In a nutshell, the evidence that intellectual capital is a strategic element that worth investing implies that firms' management should allocate ample budget for employing the right human capital and for providing training and conducting R&D activities to leverage on intellectual capital that can optimize the firms' scarce capital resources. At the policy level, strategies must be reformulated to emphasize investment in intellectual capital in companies which can leverage the most from it to help the nation achieve the target economic growth within the pre-specified time period. The current training and education policies, and the systems and standards must be reassessed to enhance the quality of human capital in this country. Since Malaysia is also one of those developing economies, which has been experiencing outflows of talents in manufacturing companies areas into foreign labor markets, the policy makers need to reformulate strategies which are competitive enough to bring these talents back into the countries.This is particularly important in the case of an economy which is trying to leverage on the knowledge-based economy which emphasizes on both human and structural capital (Figure 1) to be its main vehicle for transforming into a developed country status.

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Appendix: Table.5. Dynamic panel-data estimation, robust two-step system GMM

MODEL	Model1	Model2	Model3
IV	VAIC	ICE	HCE
Number of instruments	11	11	11
Number of obs	940	940	940
Number of groups	188	188	188
Obs per group: min and max	5,5	5,5	5,5
F(6, 187)	31.77***	30.71***	30.47***
IV-Coef(t statstic)	.128(2.45)**	.108(2.15)**	.122(2.07)**
LEVE	.118(.50)	.106(.44)	.100(.42)
FLEX	.014(.42)	.010(.31)	.010(.30)
ROA	6.344(4.08)***	6.661(3.95)***	6.723(4.02)***
SIZE	.404(2.64)***	.418(2.64)***	.423(2.68)***
Arellano-Bond test for AR(2) in first differences:z =	-1.03 Pr > z = 0.301	-1.08 Pr > z = 0.282	z = -1.08 Pr > z = 0.282
Hansen test of overid. Restrictions: chi2(4)=	5.80 Prob > chi2= 0.215	6.06 Prob > chi2 = 0.195	5.98 Prob > chi2 = 0.200
Difference-in-Hansen tests of exogeneity of instrument subsets: GMM instruments for levels			
Hansen test excluding group: chi2(2)	1.67 Prob > chi2 = 0.434	2.08 Prob > chi2 = 0.354	2.00 Prob > chi2 = 0.368
Difference (null H = exogenous): chi2(2)	4.13 Prob > chi2 = 0.127	3.98 Prob > chi2 = 0.137	3.98 Prob > chi2 = 0.136
MODEL	Model4	Model5	
IV	SCE	CEE	
Number of instruments	11	11	
Number of obs	940	940	
Number of groups	188	188	
Obs per group: min and max	5,5	5,5	
F(6, 187)	32.45***	29.79***	
IV-Coef(t statstic)	.688(2.72)***	.708(1.99)**	
LEVE	.132(.56)	.167(.67)	
FLEX	.132(.56)	.034(.96)	
ROA	6.561(3.57)***	6.925(3.78)***	
SIZE	.415(2.47)***	.524(2.63)***	
Arellano-Bond test for AR(2) in first differences:z =	z = -1.11 Pr > z = 0.268	z = -1.17 Pr > z = 0.243	
Hansen test of overid. Restrictions: chi2(4)=	6.58 Prob > chi2 = 0.160	6.96 Prob > chi2 = 0.138	
Difference-in-Hansen tests of exogeneity of instrument subsets: GMM instruments for levels			
Hansen test excluding group: chi2(2)	2.54 Prob > chi2 = 0.281	2.64 Prob > chi2 = 0.267	
Difference (null H = exogenous): chi2(2)	4.04 Prob > chi2 = 0.133	4.32 Prob > chi2 = 0.115	