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Intellectual Capital and investment opportunity set in Advanced Technology Companies in Malaysia

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ABSTRACT: The purpose of this study is to empirically examine the role of intellectual capital in creating investment opportunity set (IOS) in an advanced technology setting using a sample of 138 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 preliminary analysis finds VAIC™ and its individual components are significantly higher in advanced than in low technology companies. The fixed effect panel regressions provide statistical evidence that the influences of VAIC and its components on IOS are stronger in advanced than in low technology companies. The positive effect of intellectual capital on IOS implies that companies can benefit immensely from spending on their human capital because this investment adds value to their companies.

KEYWORDS: Intellectual Capital, investment opportunity set, Technology based Companies.

1 INTRODUCTION

Investment opportunities are vital to the sustainability of firms and ultimately, the nation's economic growth and development [9]. This issue is paramount for a developing economy, such as Malaysia particularly because it is aiming for a developed country status by 2020. With only 6 years remaining, its main development indicators (GDP, income level and education) are still lagging behind those of developed markets in Asia [17].

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. The advantage of knowledge economy stems on its emphasis on IC while simultaneously recognizes the importance of the traditional physical and natural factors of production such as raw materials, labor, capital and entrepreneurship.

The emphasis on intellectual capital recognizes its ability to create 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 [9]. It 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 [8]. 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" [4, pp:3]. IC can be further dissected into 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 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" [4, pp: 3].

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Studies such as that by [7] and [3] have shown that investment in intellectual capital especially in R&D is much higher in advanced than in low technology companies. The reason being, advanced technology companies [3] need to consistently upgrade and update their employees' knowledge and skills, to ensure they keep up with the new technology such that their creativity and innovativeness can be proactively transformed into new products and/or services [14]. [5] argue that investment in intellectual capital is a critical success factor to improve the employees' innovation. This study bridge the gap in the literature by examining whether the impact of intellectual capital is stronger in advanced than in low technology companies.

The remaining discussion of this paper will proceed as follows. The next section includes a brief review of the relevant literature. It is followed by sections on the research methodology, reports and discussion of results, conclusions, and implications of the study.

2 LITERATURE REVIEW

Resource-based theory posits that strategic resources of company are capable of generating competitive advantage [1] which can prevail in the forms of superior long-term performance, higher profits relative to competitors, increased sales or market share, and investment opportunities. Intellectual capital fits the description of strategic assets because it is valuable, rare, poorly imitable and lacking tactically alike substitute [1, 15]. Real and financial assets of similar quality and quantity will normally produce similar outputs, but intellectual capital especially the human component of similar quality and quantity can generate different outputs because knowledge and skills can be enhanced through value-added R&D activities that promote creativity and innovativeness. Thus, from the perspective of resource-based theory, predicting IC-IOS linkage is very much within the feasible parameters.

In a study which investigates the role of IC in a sample of U.S. multinational firms, [13] forwards an argument based on the resource-based and stakeholder views and the evidence which is supportive. He uses trademarks and patents to measure IC. Similar positive and significant effect of IC on accounting performance is also documented in voluminous studies [16,2] that use VAIC™ for measuring IC and involve various countries including Malaysia [15,6].

Unlike previous studies which focus on the general effect of IC on firm's performance, this study follows [10] in proposing that intellectual capital plays more important role in companies operating in new economic environment. Specifically, this study proposes that IC is more critical in companies of advanced technologies which include those whose core businesses are aerospace and defense, pharmaceutical and biotechnology. [3] find advanced technology companies invest in intellectual capital much more than those in low technology companies. Advanced technology companies require large investment in IC or specifically R&D [3] 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 than in low technology companies. Low technology companies are those doing traditional businesses such as in beverages, food producers, forestry and paper, and leisure goods.

3 RESEARCH METHODOLOGY

This study selects its sample from manufacturing companies that are listed in Bursa Malaysia from 2006 to 2011. In addition to the importance of IC in technology based industries, manufacturing sector is selected given the impressive contribution of about 25% of this sector to the nation'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 and earnings or if they have missing data. The selection criteria produce a final sample of 138 companies which generate a balanced panel data of 828 year-company observations. These companies are then screened out based on their businesses as listed in Table 1 to create two sub-samples which finally consist of 35 advanced and 33 low technology companies.

Table 1. Classification of Business Activities under Advanced and Low Technology Groups.

Advanced Technology Companies	Low Technology Companies
Aerospace and Defense	Beverages
Electricity	Food Producers
Industrial Engineering	Forestry and Paper
Media	Leisure Goods
Mobile Telecommunications	Personal Goods
Pharmaceuticals and Biotechnology	Tobacco
Technology Hardware and Equipment	
Number companies = 35	Number companies = 33

Source: [7].

Data are sourced from DataStream and companies' annual reports. Panel data methodology is adopted due to its superiority in determining and computing effects that cannot be easily discovered in cross-section and time series data.

To measure investment opportunities, we use factor analysis to create a price-based composite index 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 gross plant, property and equipment to market value of assets (PPEMVA). The factor analysis is validated with KMO test which supports the adequacy of the sample size for a factor analysis (KMO > 0.5) and Bartlett's test of sphericity which 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 also reports the descriptive statistics for the IOS components.

This study adopts Pulic's [12] value added intellectual capital (VAIC^{TM}) for measuring the efficiency of intellectual capital because it considers the stakeholder and resource-based views and it recognizes human capital as the main component of IC. VAIC^{TM} also directly addresses[8] argument that IOS is created from both physical and human capital, beside the other firm- and industry-specific factors and macroeconomic factors. That is, VAIC^{TM} can be dissected into;

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

where HCE = VA/HC, SCE = SC/VA, CEE = VA/CE, VA = OP + EC + D + A, OP = operating profit, EC = employee cost, D = depreciation, A = amortization, HC (human capital) = total salaries and wages for a company, SC (structural capital) = VA – HC, and CE = book value of the net asset for a company.

Another advantage of VAIC^{TM} is it includes CEE based on the argument that physical and financial capital is a prerequisite for creating value and delivering performance [12].

In testing the relationship between ICE and IOS, this study also controls for some variables (CV); 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;

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

where $ICP_{i,t}$ is the alternatively, VAIC^{TM} 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 above.

4 RESULTS AND DISCUSSION

Table 2 reports the descriptive statistics. As predicted, VAIC as an index of ICP and each of its elements are significantly higher in advanced than in low technology companies. One exception is CEE which is a good piece of evidence that it is the quality of human capital that makes the difference in an organization. Note also that advanced technology companies are benefiting more from their capital than the low technology companies especially in terms of human and structural capital. The fact that the benefits from human and structural capital in advanced technology companies are combined with less advantage on physical capital correctly justify the importance of training and R&D activities to transform human creativity and innovativeness into new outputs.

Although advanced technology companies, due to its more complex nature, tend to hire highly qualified individuals (high employee costs (EC)), the outputs that these individuals generate through their capabilities to effectively and efficiently use the companies' assets seem to generate operating profits (OP) that are high enough to more than offset their employee costs. *Ceteris paribus*, each ringgit (MYR) spent on the employees adds MYR1.546 to the firms' value. In low technology companies, the same MYR1 investment would generate an additional value of MYR1.319. Still, investment in human capital produces greater added values than the same investment in structural capital and even more so than in physical capital. Overall, the total addition in value due to intellectual capital efficiency is also significantly higher in advanced (2.828) than in low (2.457) technology companies.

Table 2. Descriptive statistic

Tech Groups Variable	All Sample Mean (S.D)	Advanced Tech. Mean (S.D)	Low Tech Mean (S.D)	Mann-Whitney U Adv. *vs* Low
VAIC	2.628	2.828	2.457	
	(0.340)	(0.313)	(0.335)	9240***
ICE	2.068	2.289	1.943	
	(0.316)	(0.307)	(0.260)	8623***
HCE	1.397	1.546	1.319	
	(0.209)	(0.229)	(0.153)	9033***
SCE	0.672	0.743	0.624	
	(0.122)	(0.082)	(0.131)	9064***
CEE	0.559	0.539	0.515	
	(0.135)	(0.100)	(0.190)	18983
IOS Components				
MBA	0.901	0.979	0.859	
	(0.125)	(0.140)	(0.106)	10165***
MBE	0.830	0.978	0.743	
	(0.216)	(0.240)	(0.192)	9416***
PPEMVA	0.660	0.574	0.672	
	(0.191)	(0.151)	(0.244)	15024***
Firm-specific Factors				
FLEX	1.458	1.509	1.455	
	(0.435)	(0.443)	(0.535)	18629*
LEV	0.438	0.394	0.447	
	(0.172)	(0.176)	(0.196)	16923***
SIZE	2.305	2.316	2.326	
	(0.079)	(0.069)	(0.080)	1993

*Note: ***, **, and * indicate significant at 1%, 5%, and 10%, respectively.*

Consistent with the higher intellectual capital efficiency, advanced technology companies are also reporting higher performance in term of IOS components. This is despite the fact that in general, the ratios are less than 1, indicating that the market value the companies at less than their book value.

Finally, the relationships between VAIC (and its components) and investment opportunity set (IOS) are estimated using panel data fixed effect model regression model after the Hausman test shows fixed effects are exclusively supported in All companies, advanced technology group and the -low technology group. Panel-corrected standard errors (PCSE) method was employed for capturing autocorrelation and heteroscedasticity in the residuals The regression results in Table 3 show that VAIC, and each of its components consistently have a significantly positive relationship with IOS in all and sub-samples.

Table 3. Results of cross section and period fixed effect model.

Ind. Var.	VAIC	ICE	HCE	SCE	CEE
All companies					
Coef t-stat	0.909 (6.54)[a]	0.949 (5.59)[a]	1.335 (5.24)[a]	1.774 (4.60)[a]	1.302 (4.56)[a]
Adj. R^2	0.780	0.775	0.774	0.771	0.771
DW VIF	2.031 <1.59	2.024 <1.61	2.015 <1.60	2.020 <1.61	2.00 <1.66
Advanced technology companies					
Coef t-stat	0.928 (3.36)[a]	0.902 (2.88)[a]	1.102 (2.60)[b]	3.541 (3.26)[a]	3.220 (2.97)[a]
Adj. R^2	0.785	0.780	0.778	0.784	0.781
DW VIF	1.91 < 1.92	1.89 <1.96	1.88 <1.96	1.92 <1.94	1.96 <1.94
Low technology companies					
Coef t-stat	0.583 (3.05)[a]	0.596 (2.47)[b]	0.903 (2.86)[b]	0.996 (2.20)[b]	0.861 (2.14[b]
Adj. R^2	0.830	0.827	0.825	0.825	0.825
DW VIF	1.83 <1.55	1.81 <1.55	1.81 <1.55	1.80 <1.55	1.84 <1.57

Notes: Superscripts [a], [b] and [c] indicate significance at the 1%, 5% and 10% level, respectively.All models pass the following diagnostic tests (heteroscedasticity, autocorrelation, multicollinerity, and linearity of the IV-DV relationships) except the normal distribution of the residuals. Results of the control variables are not reported to conserve space.

As hypothesized, the relationships between VAIC (and each of its components) and IOS are apparently more prevalent in advanced technologies consistent with the argument that IC is more critical in companies that employ advanced technologies than in firms of low technologies. This result lends a strong support for [5] position that intellectual capital is an important factor in elevating innovations, in their study, of firms in construction industry.

The results also show that the value addition of intellectual capital is more prevalent in the form of structural capital in both technology groups, only that this effectiveness is stronger in advanced than in low technology companies. One of the possible explanations is because the nature of technology itself requires 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 reach their most efficiency [4].

5 CONCLUSION AND IMPLICATIONS

This study investigates the role of intellectual capital in enhancing firms' abilities to create investment opportunities in a sample of manufacturing firms that are categorized as advanced technology companies. The findings of this study show that the role of intellectual capital performance in creating investment opportunities is consistently greater in advanced than in low technology companies. Intuitively, this result means intellectual capital plays a greater role in companies where technologies are highly dynamic. This finding corroborates with previous studies [16, 10, 11] which show that R&D expenditure, as part of structural capital that constitutes intellectual capital, is higher in advanced than in low technology companies. Advanced technology companies require manpower (HC) with specialized expertise and skills and state-of-the-art technology to remain competitive in the industry. When properly managed, this costly human and structural capital should be more efficient in producing investment opportunities and value for the firms. Since there is no previous evidence established on the IC-IOS link in technology companies, future research involving different country setting is needed to draw a strong conclusion.

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. Since advanced technology companies benefit more from investment in IC, more of the country's monetary and non-monetary IC-related

resources should be placed on this industry to optimize its investment opportunities and values. 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 high technology areas into foreign labor markets, the policy makers need to reformulate strategies which are competitive enough to bring these talents back into the countries.

Evidence on the important of intellectual capital should also be acknowledged by establishing standards for measuring and disclosing IC in financial reports such that the information is more accessible for the potential investors. Similarly, firms must be made more reliable on the disclosure of R&D activities in their financial reports because this information is crucial for differentiating the competitive strategies of one firm from another.

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