Extended Value Added Intellectual Coefficient in Advanced and Low Technology Manufacturing Companies in Malaysia

Receipt: 15 , 10 , 2012 Acceptance: 20 , 1 , 2013

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Abstract

The main purpose of this study is to empirically compare of intellectual capital (IC) and its efficiency between advanced and low technology manufacturing companies using a sample of 135 Malaysian listed manufacturing companies during the 2006-2012 period. The manufacturing companies are classified into different sectors based on their products and services (Standard Industrial Classification (SIC) code) on OSIRIS databases. Then, they are categorized into one of the two groups: advanced and low technology. The results of Mann-Whitney U and independent samples t tests indicate that there is a significant difference in investment on IC and its components, and efficiency of IC and its components between advanced and low technology manufacturing companies.

Keywords: Intellectual Capital, Extended Value Added Intellectual Coefficient, Advanced Manufacturing Companies, Low Technology Manufacturing

1. Introduction

Malaysia has switched from an economy based on agricultural merchandises and mining to an economy dependent on industrialization from the past three decades, when manufactures and services respectively contribute 32 and 57 percent of its GDP in 2005. This could be attributed to the country's mission to develop as a knowledge-based economy (K-economy). The country has been changing from a neoclassical economy, which is heavily based on traditional inputs of land, labor, and physical capital to a knowledge-driven economy, which develops by capitalizing on the knowledge, skill, creativity of its human capital and corporate culture (Goh, 2005; Salleh and Selamat, 2007).

The key of K-economy policy initiatives is outlined in the Malaysian K-Economy Master Plan (Mustapha and Abdullah, 2004). Scheduled reforms in the education part contain advance privatization, twinning preparations with foreign organizations, and the creation of advanced technology organizations and community colleges (Goh, 2005). Infrastructure will be advanced that permits for the usage of automatic diagnostic equipment in hospitals and networking among public departments, their dealers, and their customers (Mustapha and Abdullah, 2004). Despite the emphasis on intellectual capital, Malaysian companies do not show any significant progress toward investing in this capital component. Figure.1 indicates the percentage of the market value of tangible and intangible assets for the listed companies in Bursa Malaysia from 2006 to 2011.

As shown in the Figure.1 (Appendix), both net tangible assets are not indicating a consistent declining pattern and disclosed intangible assets are not showing a stable increasing trend. This is a sharp contrast with the patterns of tangible and intangible assets in the U.S, which show a clear trend of increasing emphasis on intangible assets under which intellectual capital is categorized. The percentage of tangible assets which increases in the recent years is somewhat contradicting Liu's (2010) report that Malaysian manufacturing companies have been investing in their HC through R&D, education and training programs to fuel the transitions toward a developed country via the K-economy vehicle. To a certain extent, the fact that the investment in intangible assets is still immaterial explains Malaysian ranking at the 48th place in the KEI index. Figure.2 specifies the percentage of the market value of tangible and intangible assets for the top 10 companies in Malaysia in 2012, each representing a different industry (Appendix).

Edvinsson and Malone (1997) define *IC* as the entire knowledge of a firm which can be applied in conducting its businesses for the purpose of generating value for the company. They propose that the value of a firm can be decomposed into financial capital and intellectual capital (IC). In turn, human capital (HC) and structural capital (SC) are the key components of IC and structural capital (SC) can be subdivided into customer capital (CC) and organizational capital (OC). Furthermore, OC is decomposed into process capital (PC) and innovation capital (InC). Human capital is described as the composed knowledge, ability, innovativeness, skill of the firm's individual staffs to meet the duty at hand, firm's values, beliefs, and philosophy by Edvinsson and Malone (1997). They define SC as the hardware, software, databanks, organizational structure, copyrights, brands, and the everything else of the organizations that support those staffs in executing their tasks. CC which is also termed relational capital or social capital is defined as the relationships built up with the clients and customers (Skandia, 1994) or efforts and investment spent to gain the stability and allegiance of customer relations by Edvinsson and Malone (1997). They simplify the definition of OC as the company philosophy and systems for managing the organization's capability. Edvinsson and Malone (1997) describe InC as a subset of OC which includes intellectual property (copyrights, brands and trademarks) and intangible assets (i.e., other talents and theory that a company is run). InC can also be described as the investment that a firm places to enable their human resources to create and develop new products and services. PC is defined as the techniques, manner, procedures, and schedules that implement and increase the delivery of commodities and services (Edvinsson and Malone, 1997; Skandia, 1994).

Technology-based firms rely significantly on innovation via exploitation of newfangled technologies and continuously place the highest priority on research and activities for the development and delivery of new products and services (Ng, 2006). Hatzichronoglou (1997) explains that technology companies are those that have innovated more, succeeded in new markets, used available capitals more productively, and in general, paid a higher remuneration to the individuals that they employ. Rogers (2001) asserts that employees of high-technology companies include scholars with a string of publications who are working on projects to advance in their own career, knowledge capital, and future earning power.

In contrast to high-technology companies, low-technology companies operate in stable environments with the slower evolution of technology and emphasis on the refinement of existing technologies to allow the efficiency (Porrini, 2004). In low-technology companies, innovations resulted from R&D investment are easily imitated by rivals, so they cannot serve as an effective barrier for entering rivals in the market. An important deduction from the characteristics of the high-technology companies is that a company, which relies more on knowledge capital, should be highly capable of creating technological innovations and consequently has superior growth opportunities. Therefore, it is reasonably expected that the high technology companies are more capable to capitalize on intellectual capital to materialize the growth potentials (Zucker et al., 1998).

Previous studies have shown that intellectual capital (IC) is more recognizable in high technology companies than low technology companies (Nunes et al., 2010; Porrini, 2004; Wang and Chang, 2005). Others, such as Pal and Soriya (2012) are more indirect in providing similar supporting evidence. In their study, Pal and Soriya (2012) compare the performance of IC in pharmaceutical (high technology) and textile (low technology) manufacturing companies in India. They argue that the pharmaceutical company is typically considered as 'an innovative and knowledge intensive sector' that hires creative and technically skillful persons who can aid a company to realize the effective and profitable productivity. In contrast, textile industry is considered as 'the labor-intensive' industry using non-specialist and unskilled labor in traditional manufacturing systems that signifies Indian's old economic. Consistent with these explanations, Pal and Soroya (2012) find that intellectual capital efficiency is different in these manufacturing sectors. Kujansivu and Lönnqvist (2007) document that for Finnish companies, the value of IC is the highest in the electronics industry and lowest in the services industry. Zéghal and Maaloul (2010) compare value added intellectual coefficient (VAIC) and its components among 300 companies in high-technology, traditional and services and their result indicate that IC and its components are vary in these three groups.

Most studies on IC have only focused on comparing IC among different companies in sectors such as banking or financial sector (Pal and Soriya, 2012; Śledzik, 2012; Zeghal and Maaloul, 2010). As far as this study is concerned, none has been done on comparing IC and efficiency of IC in manufacturing companies with different level of technology. Therefore, the main purpose of this study is to empirically compare of intellectual capital (IC) and its efficiency between high and low technology manufacturing companies. This is a paradox given the argument that high-technology companies are more dependent on intellectual capital (Nunes et al., 2010; Porrini, 2004; Wang and Chang, 2005) than their low-technology counterparts because these are the companies that rely mostly on innovation for its competitiveness.

One of the obstacles in examining IC empirically is the difficulty to quantify this variable, which could also explain why this item is not recorded explicitly in the financial statement. The difficulty to quantify IC is evident by the fact that the literature has not shown a commonly accepted definition and classification for IC (Pablos, 2004). To empirically test intellectual capital, this study adopts an extended version of the Pulic's model (2000). Referred as Value Added Intellectual Coefficient (VAIC^{TM}), Pulic's model is a composite index that disaggregates intellectual capital into two main components; human capital (HC) and structural capital (SC). The VAIC^{TM} model is proposed to measure the efficiency of intellectual capital in creating or adding value to the firms. The extent of acceptance of this model may be evidenced by a finding by Volkov (2012) who states that as of June 2012, VAIC^{TM} model of Pulic (2000) has been used in 46 researches and has been cited by 2373 researchers. This study takes a step further by adopting an extended version of the VAIC^{TM} model which is proposed by Nazari and Herremans (2007) (henceforth, *eVAIC*). This study proposes *eVAIC* to measure intellectual capital, which is introduced by Nazari and Herremans's (2007) because it disaggregates structural capital further into customer capital (CC) and organizational capital (OC). More importantly, *eVAIC* further segregates organizational capital into process capital (PC) and innovation capital (InC).

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

Numerous studies have attempted to examine intellectual capital (IC) and intellectual capital efficiency (ICE) in different sectors. (Joshi et al., 2013) compare value added intellectual coefficient (VAIC) and its components among 33 companies listed on Australian Stock Exchange for the period of 2006-2008 in financial sectors such as commercial and investment banks, insurance firms, real estate investment trust, and diversified financial companies. Their findings indicate that investment firms have the best VAIC due to the greater level of human capital efficiency (HCE) in comparison to banks, insurance and real estate investment trust companies. The lowest VAIC is reported for the diversified financial companies. HCE seems to be the key component of VAIC as it contributes the most to the value of VAIC. For instance, HCE creates 98.4% of VAIC in Australian Foundation Investment firms. Their results also show that two-thirds of the sample firms have very low level of VAIC.

Joshi et al. (2013) argue that these firms concentrate more on physical capital rather than the HC and SC, leading to lower VAIC. Joshi et al. (2010) also investigate this issue in 11 Australian banking sector from 2005 to 2007 and their results show that there is a significant positive effect of HC on value added (VA). The results suggest that investing in human capital (HC) contributes to human capital efficiency (HCE), that is to say, the banks with a huge number of employees have higher human costs, but it has a significant positive effect on their HCE. They examine VAIC and find that HCE is more than capital employed efficiency (CEE) and structural capital efficiency (SCE).

Madiha et al. (2012) investigate the effect of VAIC and its components on the performance (Tobin's Q ratio) of six conventional commercial banks and six Islamic banks in Pakistan for the period from 2006 to 2010. They find that HCE is higher than SCE and CEE in all banks most likely because of the effective and efficient application of minimal staffs who rely on technology in order to decrease the expenses on HC. Kweh et al. (2013) examine intellectual capital performance (ICP) of small sample of Malaysian public-listed software companies (25 companies in only one sector) in the Main market and ACE market in 2010. The results show that investment in HC is more than structural and employed capital in their sample and HCE and CEE in the Main market companies are more than ACE market companies while SCE in ACE market companies is more than Main market companies. Overall, efficiency of intellectual capital (IC) in ACE-market companies is more than Main-market companies. Kweh et al. (2013) believe that managers of 80 per cent of software firms are inefficient in managing and transforming intellectual capital into tangible and intangible values because of the technical problem.

In another study, Nik Maheran et al. (2007) show that CEE has a most important share in generating VAIC. They compare VAIC, ICE, HCE, SCE and CEE of 18 companies in banking, insurance and brokerage sectors from 2002 until 2006. The findings show that the commercial banks have the highest ICE, followed by insurance and brokerage companies. Nik Maheran et al. (2007) state that companies with a higher VAIC have lower HCE and SCE than CEE although the existence of HCE and SCE is a prerequisite to the significant effect of CEE on VAIC. In addition, the role of CEE in creating value is seen more perceptible than ICE and HCE. They also argue that the low efficiency of HC and SC is due to the lack of professional executives with the required skills and due to the customer-centric and technology-savvy orientation in the financial sector of Malaysia. Reviewing the literature regarding IC and its efficiency indicates that prior studies have not compared the investment and efficiency of IC and its components between advanced and low technology manufacturing companies and results for the various industries from previous studies shows mixed results.

3. Hypotheses Development

According to resource-based view (RBV), different companies own different packages of resources and capabilities, and some companies within similar industry may do specific activities better than the others because of their different resources (Wernerfelt, 1995; Barney, 1991; Dierickx and Cool, 1989; Wernerfelt, 2010). Therefore, it can be concluded that intellectual capital (IC) as a resource (and thus, its efficiency) varies among different companies in term of theory. Based on the resource-based view (RBV), this study proposes that human capital should be of more importance to companies of higher technology than lower technology. Drawing from these arguments, this study hypothesizes that:

H1: Intellectual capital investment in advanced technology companies is greater than that of low technology ones.

H2: Human capital investment in advanced technology companies is greater than that of low technology ones.

H3: Innovational capital investment in advanced technology companies is greater than that of low technology ones.

The proceed hypotheses are proposed based on the arguments that higher technology companies are more efficient than their low technology counterparts in using the IC and its components. Higher technology companies rely more heavily on the quality of human capital and the other components of IC because they operate in a more dynamic environment which forces them to be consistently on the innovative and creative mode to remain competitive. Of all components of intellectual capital efficiency (ICE), this study focuses on the roles of human capital efficiency (HCE) and innovational capital efficiency (InCE) which are expected to be leveraged most efficiently by companies of higher technology than those of lower technology.

H4: Efficiency of intellectual capital in advanced technology companies is greater than that of low technology ones.

H5: Efficiency of human capital in advanced technology companies is greater than that of low technology ones.

H6: Efficiency of innovational capital in advanced technology companies is greater than that of low technology ones.

4. Research Methodology

This study selects its sample from manufacturing companies that are listed in Bursa Malaysia from 2006 to 2012. Data are sourced from DataStream and companies' annual reports. 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 129 companies which generate 903 year-company observations. These companies are then screened out based on their businesses as listed in Table.1 (Appendix), to create two sub-samples which finally consist of 63 advanced and 66 low technology companies. This study adopts extended version of the VAIC^{TM} model which is proposed by Nazari and Herremans (2007) for measuring the intellectual capital(IC) and the intellectual capital efficiency(ICE) because it considers the stakeholder and resource-based views and it recognizes human capital as the main component of IC. That is, VAIC^{TM} can be dissected into;

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$$VAIC_i^{TM} = ICE_i + CEE_i = (HCE_i + SCE_i) + CEE_i$$
$$= HCE + (CCE + OCE) + CEE$$
$$= HCE + (CCE + PCE + InCE) + CEE$$

Where HCE = VA/HC,

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,

SCE = SC/VA,

SC (structural capital) = VA – HC,

CEE = VA/CE,

CE = book value of the net asset for a company.

$CCE = \frac{CC}{VA}$

Where, CCE = customer capital efficiency,
CC (customer capital) = marketing cost,
OCE=SCE-CCE
OCE = organizational capital efficiency,

$InCE= \frac{\text{Inc}}{VA}$

Where, InCE = innovation capital efficiency,
InC (innovation capital) = research and development expenditures

PCE=OCE-InCE
Where, PCE = process capital efficiency,

To compare the means of two variables in two independent samples, this study used independent samples *t* test. In order to use independent samples *t* test efficiently, there are two significant conditions: normality and having similar variances of data (Bland and Altman, 1995). If non-normal distribution of the data is seen, the Mann-Whitney U test should be employed as a non-parametric statistic test to the hypotheses (Shirley, 1977). Normal distribution of data will be checked based on the Skewness and Kurtosis statistics of the data. If non-normal distribution of the data is observed, Box Cos transformation can be applied to convert the data and achieve normal distribution. This is done after determining the outliers and cleaning the data.

5. Results and Discussion

Results of descriptive statistics from original data represented the deviation of skewness and kurtosis from zero that denotes on presence of non-normally distributed data and outliers. Replacements are made to extreme values identified as univariate outliers in accordance with Tabachnik and Fidell (2007). After replacing univariate outliers, companies with multivariate outliers also were omitted (Tabachnik and Fidell, 2007). Although, descriptive statistics showed the improved range of skewness and kurtosis after the outlier treatment, but non-normal distribution of data was seen. Box- Cos transformation could not achieve normal distribution of data. As a result, Non-parametric test (Mann Whitney U test) should be used for testing the hypotheses. Table.2 shows results from Mann Whitney U test (Appendix). According to these results, null hypothesis is rejected and significant difference between variables in advanced and low technology companies is seen.

Hair et al. (2010) and Tabachnik and Fidell (2007) believe that when the sample size is large (N>30), a variable with statically significant skewness and kurtosis can be considered as a variable with normal distribution. Since the sample size is large, normal distribution of data can be considered in this study. In additional, results from Levene's test for equality of variances prove the similar variances of data. As a result, two essential conditions for using independent samples *t* test as a parametric test are meet. Table.3 (Appendix) shows the results from parametric test (independent samples *t* test) . Based on parametric and non- parametric tests, it can be detected that significant difference is seen in intellectual capital (IC), intellectual capital efficiency (ICE), human capital (HC), human capital efficiency (HCE), innovational capital (Inc), and innovational capital efficiency (InCE) in advanced and low technology companies. While details of the descriptive statistics are reported in Table.4, the relative positions of intellectual capital (IC) and its components, and efficiency of intellectual capital and its components in the advanced and low technology manufacturing companies are plotted in Figures.3 and 4 to simplify comparison (Appendix).

As predicted, intellectual capital investment in advanced technology companies is greater than that of low technology ones. Based on Table.4 (Appendix), the average investment on IC is 69522(Malaysia Ringgit (MYR)) and 52817(MYR) for advanced and low technology companies respectively. Therefore, the first hypothesis (H1) is accepted. Table.4 also shows that investment in HC and InC is greater in advanced technology companies than low technology companies. Based on Table 4, the average investment on human capital (HC) is 29118(MYR) and 20858 (MYR) for advanced and low technology companies, and the average score for innovational capital (InC) is 3429 (MYR) and 520 (MYR) for advanced and low technology companies respectively. As a result, the second and third hypotheses (H2and H3) are accepted. Table.4 also displays that efficiency of intellectual capital, human capital, and innovational capital in advanced technology companies is greater than that of low technology ones. Therefore, fourth, firth, and sixth hypotheses (H4, H5, and H6) are accepted. The average score for intellectual capital efficiency (ICE) is 3.394 and 2.881for advanced and low technology companies respectively. These values are somewhat consistent with results of the research done by Aminiandehkordi et al. (2014) show that the average of ICE is 3.088 for 110 companies listed on the ACE Market of Bursa Malaysia from 2009 to 2012. The average score for human capital efficiency (HCE) is 2.822 and 2.404 for advanced and low technology companies respectively. The HCE scores in this study are lower compared to those reported by Shamsudin and Yian (2013) who report an average of HCE = 5.905 in the financial sector in Malaysia. The average score for innovation capital efficiency (InCE) is 0.073 and 0.025 for advanced and low technology companies respectively.

Comparing the components of ICE, it can be seen that the HCE component is the dominant contributor of ICE, making up 83% (2.822/3.394) and 83% (2.404 / 2.881) of total ICE for advanced and low technology companies respectively. Aminiandehkordi et al. (2014) report 80% of ICE comes from HCE for 110 companies listed on the ACE Market of Bursa Malaysia from 2009 to 2012. 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 Rehman et al. (2011).

6. Conclusion and Implications

This study compares investing in intellectual capital and its components, and efficiency intellectual capital and its components between advanced and low technology companies. In line with resource based view (RBV), the findings of this study show that intellectual capital investment and its components, and efficiency intellectual capital and its components is grater in advanced technology companies than low technology companies. In additional, it can be deduced that more investment in IC and its components lead to more efficiency on IC and its components. Intuitively, this result means intellectual capital plays a greater role in companies where technologies are highly dynamic. 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. Less efficiency of human capital (HC) than amount of investment in it in low technology companies may be due to inefficient employees who could have been hired without considering their competencies, knowledge, experiences, skills, behavior, intelligent, creative, cognitive abilities in order to generate value added. This finding corroborates with previous studies (Wang and Chang, 2005; Nunes et al., 2010) which show that R&D expenditure (innovational capital), as part of structural capital that constitutes intellectual capital, is higher in advanced than in low technology companies. Low efficiency of innovational capital, due to low investing on it in low technology companies, might be associated with the high risk of investing in innovation capital than tangible assets (Baysinger and Hoskisson, 1989; Hoskisson and Hitt, 1988). 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. 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 values.

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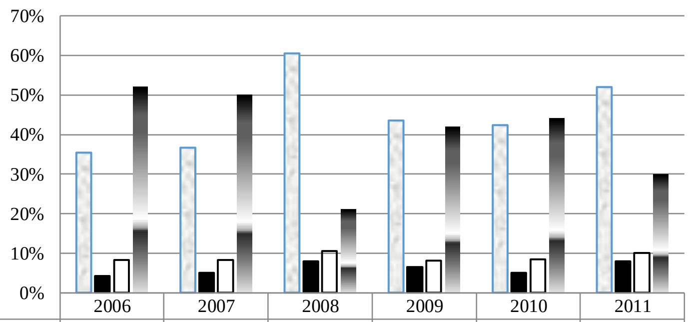
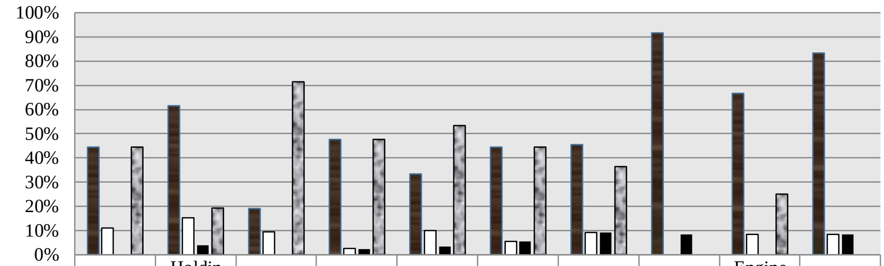
Appendix



	2006	2007	2008	2009	2010	2011
Tangible Net Assets	35%	37%	61%	44%	42%	52%
Disclosed Intangible Assets	4%	5%	8%	6%	5%	8%
Disclosed Goodwill	8%	8%	11%	8%	8%	10%
Undisclosed Value	52%	50%	21%	42%	44%	30%

Figure.1: Compositions of assets of companies listed on Bursa Malaysia

Source: Brand Finance (URL http://brandfinance.com)



	Banks & DFS	Holding Companies-Divers	Telecommunications	Agriculture	Lodging	Chemicals	Food	Real Estate	Engineering & Construction	Transportation
■ Tangible Net Assets	44%	62%	19%	48%	33%	44%	45%	92%	67%	83%
□ Disclosed Intangible Assets	11%	15%	10%	3%	10%	6%	9%	0%	8%	8%
■ Disclosed Goodwill	0%	4%	0%	2%	3%	6%	9%	8%	0%	8%
▨ Undisclosed Value	44%	19%	71%	48%	53%	44%	36%	0%	25%	0%

Figure.2: Percentage of market value of tangible and intangible assets for the top 10 companies in Malaysia in 2012

Source: Brand Finance, URL http://brandfinance.com

Table.1: Classification of Business Activities under Advanced (High) 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 = 63	**Number companies = 66**

Source: Hatzichronoglou(2013)

Table.2: Non-parametric test (Mann Whitney U Test)

Null hypothesis	Mann Whitney U Test	standardized test statistic	Asymptotic sig	Decision
The distribution of IC is the same across categories of groups	91779	-2.576	0.010	Reject the null hypothesis
The distribution of ICE is the same across categories of groups	89299	-3.209	0.001	Reject the null hypothesis
The distribution of HC is the same across categories of groups	95547	-2.009	0.041	Reject the null hypothesis
The distribution of HCE is the same across categories of groups	93514	-2.133	0.033	Reject the null hypothesis
The distribution of InC is the same across categories of groups	41001	-15.633	0.000	Reject the null hypothesis
The distribution of InCE is the same across categories of groups	43415	-15.013	0.000	Reject the null hypothesis

IC is intellectual capital and computes by sum of HC and SC. HC is human capital and calculates through sum of total salaries and wages. SC is structural capital and calculates through [VA-HC].VA is [operating profit+ employee cost+ depreciation +amortization]. 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. InC is innovation capital and calculates through sum of total research and development expenditure (R&D). InCE is innovation capital efficiency and computes by R&D/VA.

HC is human capital and calculates through sum of total salaries and wages. HCE is human capital efficiency and calculates through value added (VA) over human capital (HC). VA is [operating profit+ employee cost+ depreciation +amortization]. IC is intellectual capital and computes by sum of HC and SC. SC is structural capital and calculates through [VA-HC]. ICE is intellectual capital efficiency and computes by sum of HCE and SCE. SCE is structural capital efficiency and calculates through SC /VA. InC is innovation capital and calculates through sum of total research and development expenditure (R&D). InCE is innovation capital efficiency and computes by R&D/VA.

Note: 1 and 2 indicate advanced and low technology companies respectively. * Investment (Malaysian Ringgit (MYR'000)) on HC, SC, IC, CE, PC, and InC. HC is human capital = sum of total salaries and wages. SC is structural capital = VA-HC. VA is value added = operating profit + employee cost + depreciation + amortization. IC is intellectual capital= HC + SC. CC is customer capital = sum of total marketing cost. OC is organizational capital= SC - CC. PC is process capital = OC - InC. InC is innovation capital = sum of total research and development expenditure (R&D). HCE is human capital efficiency = $\frac{VA}{HC}$. SCE is structural capital efficiency = $\frac{SC}{VA}$. ICE is intellectual capital efficiency = HCE +SCE. CCE is customer capital efficiency = $\frac{CC}{VA}$. OCE is organizational capital efficiency = SCE - CCE. PCE is process capital efficiency = OCE - InCE. InCE is innovation capital efficiency = $\frac{R\&D}{VA}$.

Table.3: Parametric test (independent samples *t* test)

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
HC	4.228	901	.000	8260	4426	12093
	4.188	750	.000	8260	4388	12131
HCE	5.693	901	.000	0.417	.27336	.56100
	5.611	626	.000	0.417	.27116	.56319
IC	3.439	901	.001	16705	7171	26239
	3.415	805	.001	16705	7102	26308
ICE	6.170	901	.000	0.513	.34954	.67561
	6.092	670	.000	0.513	.34737	.67778
InC	12.449	901	.000	2908	2450	3367
	12.177	463	.000	2908	2439	3378
InCE	10.317	901	.000	0.048	.03874	.05694
	10.195	693	.000	0.048	.03863	.05705

Table.4: Descriptive statistics

	Company	N	Minimum*	Maximum*	Mean*	Std. Deviation*	Skewness	Kurtosis
HC	1	441	199	155828	29118	34954	1.868	3.409
	2	462	115	98560	20858	22731	1.913	3.175
SC	1	441	265	233457	40404	50851	2.138	4.632
	2	462	166	163534	31959	39715	1.791	2.296
IC	1	441	713	382416	69522	83529	2.081	4.533
	2	462	345	236395	52817	61221	1.803	2.403
CE	1	441	344	129090	17374	23279	2.261	5.768
	2	462	153	471629	12181	27752	5.949	6.641
PC	1	441	122	195945	25367	38161	2.611	5.159
	2	462	235	148027	26481	35863	1.827	2.346
InC	1	441	17	22201	3429	4952	1.977	3.382
	2	462	0	3038	520	813	1.838	2.749
CC	1	441	35	65615	11680	15769	1.905	3.058
	2	462	25	25708	4825	6039	1.802	3.003
HCE	1	441	1.100	8.119	2.822	1.414	1.621	2.527
	2	462	1.009	4.080	2.404	0.679	0.016	-0.508
SCE	1	441	0.091	0.877	0.572	0.168	-0.336	-0.454
	2	462	0.009	0.757	0.545	0.155	-1.268	1.117
ICE	1	441	1.191	8.996	3.394	1.562	1.421	1.933
	2	462	1.019	4.83۷	2.881	0.845	-0.124	-0.646
CEE	1	441	0.013	0.623	0.240	0.130	1.734	6.504
	2	462	0.002	0.795	0.181	0.145	5.153	6.565
PCE	1	441	0.002	0.778	0.337	0.198	0.041	-1.010
	2	462	0.0۰5	0.753	0.399	0.191	-0.442	-0.785
InCE	1	441	0.001	0.400	0.073	0.086	1.754	2.738
	2	462	0.000	0.292	0.025	0.049	2.888	7.339
CCE	1	441	0.003	0.465	0.169	0.113	0.560	-0.507
	2	462	0.001	0.552	0.120	0.110	1.392	1.862
VAIC	1	441	1.355	9.364	3.634	1.576	1.374	1.814
	2	462	1.060	5.159	3.062	0.867	-0.134	-0.562

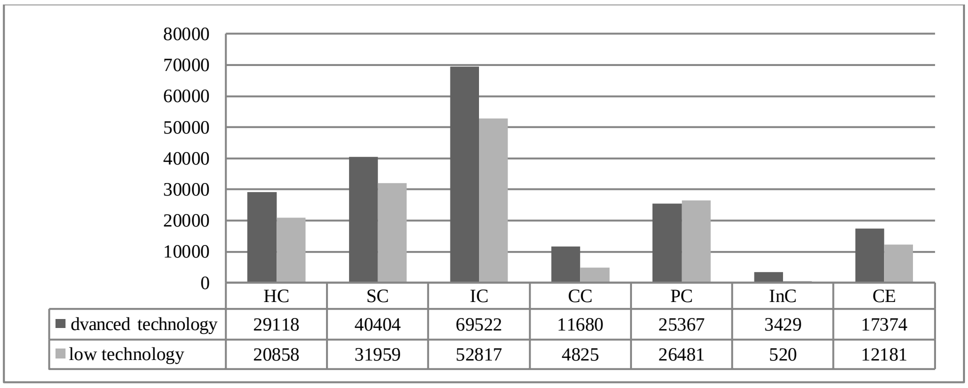
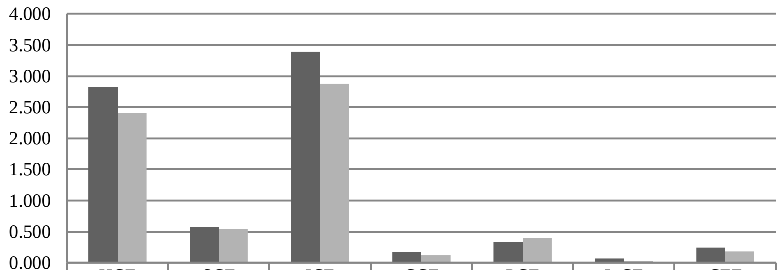
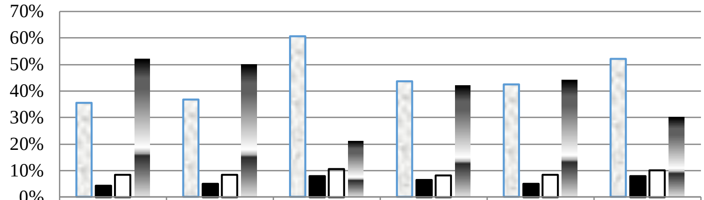


Figure.3: Investment (MYR'000) in intellectual capital and its components between advanced and low technology manufacturing companies



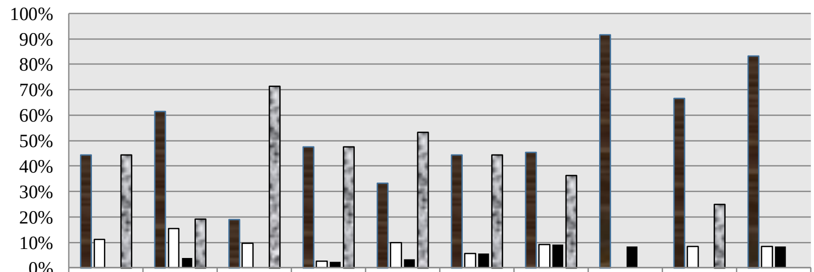
	HCE	SCE	ICE	CCE	PCE	InCE	CEE
dvanced technology	2.822	.572	3.394	0.169	0.337	0.073	0.240
low technology	2.404	.545	2.881	0.120	0.399	0.025	0.181

Figure .4: Efficiency of intellectual capital and its components between advanced and low technology manufacturing companies



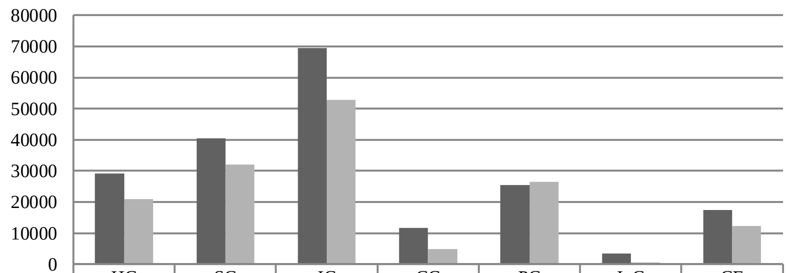
	2006	2007	2008	2009	2010	2011
Tangible Net Assets	35%	37%	61%	44%	42%	52%
Disclosed Intangible Assets	4%	5%	8%	6%	5%	8%
Disclosed Goodwill	8%	8%	11%	8%	8%	10%
Undisclosed Value	52%	50%	21%	42%	44%	30%

Figure.1: Compositions of assets of companies listed on Bursa Malaysia
Source: Brand Finance (URL http://brandfinance.com)



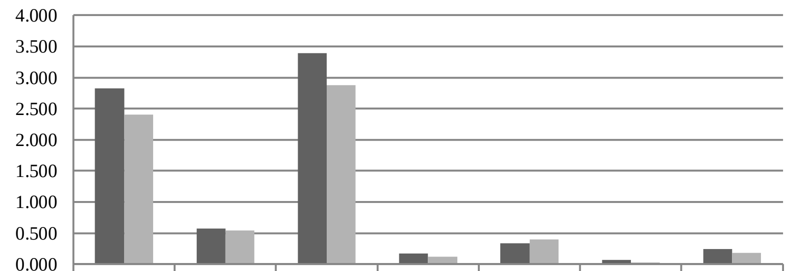
	Banks & DFS	Holding Companies-Divers	Telecommunications	Agriculture	Lodging	Chemicals	Food	Real Estate	Engineering & Construction	Transportation
Tangible Net Assets	44%	62%	19%	48%	33%	44%	45%	92%	67%	83%
Disclosed Intangible Assets	11%	15%	10%	3%	10%	6%	9%	0%	8%	8%
Disclosed Goodwill	0%	4%	0%	2%	3%	6%	9%	8%	0%	8%
Undisclosed Value	44%	19%	71%	48%	53%	44%	36%	0%	25%	0%

Figure.2: Percentage of market value of tangible and intangible assets for the top 10 companies in Malaysia in 2012
Source: Brand Finance, URL http://brandfinance.com



	HC	SC	IC	CC	PC	InC	CE
dvanced technology	29118	40404	69522	11680	25367	3429	17374
low technology	20858	31959	52817	4825	26481	520	12181

Figure.3: Investment (MYR'000) in intellectual capital and its components between advanced and low technology manufacturing companies



	HCE	SCE	ICE	CCE	PCE	InCE	CEE
dvanced technology	2.822	.572	3.394	0.169	0.337	0.073	0.240
low technology	2.404	.545	2.881	0.120	0.399	0.025	0.181

Figure .4: Efficiency of intellectual capital and its components between advanced and low technology manufacturing companies

Table.1: Classification of Business Activities under Advanced (High) 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 = 63	**Number companies = 66**

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Note: 1 and 2 indicate advanced and low technology companies respectively. * Investment (Malaysian Ringgit (MYR'000)) on HC, SC, IC, CE, PC, and InC. HC is human capital = sum of total salaries and wages. SC is structural capital = VA-HC. VA is value added = operating profit + employee cost + depreciation + amortization. IC is intellectual capital= HC + SC. CC is customer capital = sum of total marketing cost. OC is organizational capital= SC - CC. PC is process capital = OC - InC. InC is innovation capital = sum of total research and development expenditure (R&D). HCE is human capital efficiency = $\frac{VA}{HC}$. SCE is structural capital efficiency = $\frac{SC}{VA}$. ICE is intellectual capital efficiency = HCE +SCE. CCE is customer capital efficiency = $\frac{CC}{VA}$. OCE is organizational capital efficiency = SCE - CCE. PCE is process capital efficiency = OCE - InCE. InCE is innovation capital efficiency = $\frac{R\&D}{VA}$.