THE DIFFERENT PROPORTION OF IC COMPONENTS AND FIRMS' MARKET PERFORMANCE: EVIDENCE FROM TAIWAN

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ABSTRACT

The study adjusts Pulic's (2000) intellectual capital approach, "Value Added Intellectual Coefficient (VAIC™), to measure firms' value creation and market performance. The research here adds two new intellectual capital components, Research and Development (R&D) expenditure and intellectual property, into Pulic's approach. Data were collected from 2005-2007 annual reports of companies listed on the Taiwan Stock Exchange Corporation (TSEC) and Market Observation Post System (MOPS). The results support the hypothesis that firms' intellectual capital has a positive impact on market performance and its profitability in a modified VAIC method. The author finds that R&D expenditure and intellectual property (TCE) capture additional information about value creation. Furthermore, firms with a different intellectual capital contribution create a different market performance. Thus, in the knowledge-based economy, not only should the value of intellectual capital (IC) be considered, but also the allocation of IC. Finally, both information technology (IT)- and Non-IT corporations must value and manage their intellectual capital, particularly R&D and intellectual property, in order to create long-term competitiveness and create a higher market return.

JEL: G30

KEYWORDS: Intellectual capital, R&D expenditure, intellectual property, VAIC™

INTRODUCTION

The concept of Intellectual Capital (IC) helps executives to elucidate the intangible resources and knowledge assets of an organization. In existing IC research, a greater emphasis is placed on the antecedents of IC, and the causal relationship between IC and market performance. However, there is little research into why components of IC evolve relatively differently, and into the causal relationship between certain IC components and market performance during a certain period. The accumulation of IC is a dynamic and continuous process. Because, of resource limitations, firms are able to engage in the creation of intellectual capital given a certain time frame, different weights are often distributed to different subcomponents of IC. The question of how firms recognize the potential offered by intellectual capital over others, and the relationship between the organization's priorities and market performance are, therefore, pragmatic.

This paper adopts the IC perspective to survey the evolutionary dynamics of intellectual capital. A basic argument is that firms often cultivate IC in a similar and possibly sequential manner, which may be a consequence of organizational adaptation to the industrial environment over time, while heterogeneity in intellectual assets between firms may be the result of firms' actions in the environment. In terms of the generally accepted consensus on the content of IC, three interdependent IC components are examined in this study: human capital, structural capital and social capital. Because the sample in this study is mainly high technology firms, the study also considers the relative change in technological capital (Chang, 2007). A regression analysis is presented using the financial data of companies in Taiwan.

The remainder of the paper is organized as follows. First, the study briefly reviews existing literature relevant to the study, and then develops some testable hypotheses. Following is a discussion of the

empirical results and the implications of the research findings. The final section provides some concluding comments and a discussion of the limitations of this research.

LITERATURE REVIEW

When the success of a competitive strategy is dependent on the firm's invisible assets, the proper allocation of invisible assets is also largely determined by the content of the strategy (Itami, 1987). The issue of fit among organization, resources and environment is a dynamic process. The alignment between organizational system, structures, processes and changes in the environment significantly impact an organization's market performance in resource acquisition and performance. Whether such an adaptation is environmentally derived or out of managerial choice (see Hrebiniak & Joyce, 1985 for more discussion on organizational adaptation), the history of intellectual capital depicts the progress of an organization's market performance. Intellectual capital is an emerging topic of interest to firms, which derives an increasing financial performance from sharing information, knowledge and innovation. Considerable research and appropriate praxis have been developed to measure a company's intellectual capital, among which the following can be cited: Itami (1987), Coleman (1988), Burt (1992), Edvinsson & Malone (1997), Brooking (1996), Stewart (1997), Ross *et al.* (1997), Sveiby (1997), and Bounfour (2002), etc.

Human Capital, Structural Capital and Social Capital

Human capital (HC) refers to individual employee's knowledge, skills, abilities, and experience in an organization (Bontis, 1998; Bounfour, 2002; Brooking, 1996; Edvinsson & Malone, 1997; Ross *et al*., 1997; Stewart, 1997, Sullivan, 1998; Nelson & Winter, 1982). Furthermore, HC has been defined on an individual level (Hudson, 1993) as being a firm's combined individual capabilities for creating business value for the organization. HC is a source of innovation and strategic renewal, depending on how effectively an organization uses it. In an economic sense, the term focuses on the value of individual tacit knowledge possessed and produced by the members of the organization (Becker, 1992; Nelson & Winter, 1982). Undoubtedly, HC cannot be directly owned by the company (Edvinsson & Malone, 1997) and can be withdrawn from an organization or can be imitated by competitors when employees leave. Thus, an organization not only pays attention to its investment in human capability, but also embeds human activities in the process at the organizational level as structural capital.

Structural capital (SC) is the supportive infrastructure and information systems which enable individuals' know-how to be turned into group property. The concept of SC allows intellectual capital to be measured and developed in an organization. The SC of the organization is conceived as being a product process which contains elements of efficiency, transaction time, procedural innovativeness, and access to information for codification into knowledge. Therefore, SC is extremely important to organizations, as it is the only type of intellectual capital an organization actually owns (Bontis, 1998; Bounfour, 2002; Brooking, 1996; Edvinsson & Malone, 1997; Ross *et al*., 1997; Sillivan, 1998; Stewart, 1991; Winter, 1987, Youndt & Snell, 2004). SC also deals with the mechanisms and structures of the organization which can help and support its employees (i.e. HC) in their quest for optimum intellectual performance, and therefore, overall business performance. The reason for this is that, even though an individual has a high level of intelligence, if an organization has poor systems and procedures by which to track his or her actions, the overall intellectual capital will not reach its greatest potential (Winter, 1987). Thus, SC also refers to institutionalized knowledge and codified human knowledge/experience stored in systems, processes, databases, routines, patent, manuals, structures, and the like.

According to Edvinsson & Malone (1997), SC will enable a firm to develop relationships within internal networks, as well as those which are external to the firm. Not only is the process coordinated together with employees within the organization, but it also influences the nature of the relationships which are developed between the clients/customers and firms in the wider network. The following paragraph

reviews the concept of customer capital, which is otherwise referred to as social capital, external capital and relationship capital (Swart, 2006).

Social capital (SC) mainly comprises knowledge of marketing channels and customer relationships, and Bontis (1998) proposes that the value of relationships, including those of customers, suppliers, and competitors, plays a major role in firms' future opportunities for growth. Furthermore, SC alludes to issues like customers' trust, and the understanding and loyalty of the relationship between a firm and its customers. Hence, the purpose of building either individual or organizational capability is to create SC which will allow companies to enhance their financial capital on a sustainable basis (St. Onge, 1996, Wright, 2000). The essence of customer capital is the value, namely the contribution to current and future revenue, which results from an organization's relationship with its customers. Some studies address the relationship between customer satisfaction and financial performance, but very few of them actually provide empirical results. Some researchers find that there is a significantly positive relationship between customer satisfaction and financial performance (Ittner & Larker, 1998a; Banker *et al*., 2000), but others do not (Ittner and Larker, 1998b; Arthur Anderson&Co., 1994). Theorists quickly point out that the importance of social capital is that, since employees are free, there is a significant risk that organizations may incur a capital loss unless individual knowledge is transferred, shared, transformed, and institutionalized (Youndt and Snell, 2004). This highlights the need for investing, not only in structural capital (internal side) to efficiently enhance the organizational process, but also in social capital (external side) to protect the knowledge-based sources of advantage organizations, and sustain their potentially competitive advantage.

Research & Development (R&D) Expenditure and Intellectual Property

Investment in research and development (R&D) is one of the fundamental ways for organizations to create new knowledge and increase their performance. R&D investment increases the opportunities for organizational members to identify and apply technology and its associated options to their products and processes in order to increase firms' profitability. The more an organization invests in R&D, the more it supports its individual members to enhance their knowledge and expertise and thus, it builds human capital and increases its performance. R&D also establishes that most of the outcomes of research and development efforts become codified and institutionalized in patents, routines, processes, databases, and other organizational level repositories as organizational (or structural) capital (Hall, 1992). In order to make their knowledge difficult for competitors to imitate, organizations expend considerable efforts in combining stands of knowledge possessed by individuals and creating integrated knowledge which is embedded in their processes, routines, and products (Grant, 1991) which is called intellectual property.

In recent years, R&D expenditure and intellectual property have received more attention, because ideas and innovations related to the products or processes have become the most important resource, replacing land, energy, and raw materials. Particularly in terms of information technology and telecoms, the roles of R&D expenditure and intellectual property have changed rapidly. In R&D expenditure, Abernethy *et al*. (2003) examine several studies, and conclude that there is a significant positive rate of return on R&D expenditure in the corporate sector, and that corporate returns may be twice the rate of return on tangible investment. Chen *et al*. (2005) also advise that R&D expenditure has a positive effect on profitability, and that intellectual property has a positive effect on firms' value and financial performance. Intellectual property represents a proprietary technological advantage which may enable a firm to either actively enter a new market, or protect its processes in the current market situation before its competitors imitate it (Sullivan 1998), and increases the ability of the firm to obtain a return on its investment in R&D (Porter, 1980). Therefore, intellectual property is expected to be positively related to R&D investment (Hayton, 2005) and directly influence firms' financial performance.

METHODOLOGY AND HYPOTHESIS DEVELOPMENT

This study analyzes the financial data of companies on the Taiwan Stock Exchange between 2005 and 2007, and Table 1 outlines the sample selection procedure for the study. Having deleted off-market firms, missing data on the selected variables, and a net income of less than 0 in the current year, the final sample consists of a total of 1773 firm-year observations, including 854 IT companies and 918 non-IT companies. Missing data generally occurs in the value of the selected intellectual capital variables.

Table 1: Sample Selection and Sample Firms' Profile – Sample Selection Procedure

	Firm-years
Listed companies during 2005~2007	2140
Deleting missing number and off-market companies	365
Final sample	177
IT Companies	854
Non-IT Companies	918

The table shows the process of sampling selection. After deleting the missing number and off-market companies, the final sampling includes 854 IT companies and 918 non-IT companies.

Pulic's Valued Added Intellectual Capital Approach (VAIC^{TM})

While many survey methods (internal measures) are proposed in addition to those based on accounting information (external measures), it is difficult to compare companies using such methods (Boremann, 1999; Pulic, 2000 and 2004). Therefore, this research adopts an accounting tool for IC management, namely the Valued Added Intellectual Capital (VAIC^{TM}) (Pulic, 2000) to evaluate the intellectual capital. A primary focus of this method is the efficiency of resources which creates value for the firms. The basic principle of VAIC^{TM} is to calculate the value added (VA) of a firm by subtracting input from output, excluding labor expenses from the input. In financial terms, this is equal to (1):

$$VA = GM - sgaExp. + LExp. = Operating\ Income + LExp. \quad (1)$$

where VA is value added; GM is gross margin; sgaExp.: selling, general, and administrative expenses; LExp.: labor expenses that Pulic (2000b) calls human capital.According to Pulic (2000b), the value of human capital (HC) and structural capital (SC) is described by the labor expenses and the difference between VA and HC. From this description, HC and SC are denoted as follows:

$$HC = LExp. \quad (2)$$
$$SC = VA - HC \quad (3)$$

where HC is human capital; SC is structural capital; Pulic states that human capital and structural capital are reciprocal. The less the participation of human capital, the more structural capital is involved. The next step is to evaluate social capital, and according to Pulic's VAIC, social capital is calculated by the capital employed which equals the book value of the net assets of the firm.

$$SC = CE\ (capital\ employed) = Book\ Value\ of\ Net\ Assets \quad (4)$$

In terms of technology capital, R&D expenditure and intellectual properties are taken into consideration, and the study includes R&D expenditure and the value of intellectual property as a proxy for technological capital (TC), following Chang's research (2007). To account for the effect, the study uses the same denominator of the dependent variable (Tobin's *q*) as the scaling variable for technological

capital.

$$\text{Technology Capital Efficiency TCE} = \frac{\text{R\&D Expenditure + Value of Intellectual Property}}{\text{Book Value of Common Stocks}} \quad (5)$$

The study sets out to calculate the efficiency of the four forms of IC, and Tobin's *q* is adopted as a proxy of the firm's market performance (*MPerf*) with those resources. Up to this point, the study has four indicators (predicting variables) and one dependent variable:

Human Capital Efficiency HCE = VA / HC

Structural Capital Efficiency SCE = SC / VA

Social Capital Efficiency CEE = VA / CE

$$\text{Technology Capital Efficiency TCE} = \frac{\text{R\&D Expenditure + Value of Intellectual Property}}{\text{Book Value of Common Stocks}}$$

$$\text{MPerf} = \frac{\text{Market Value of Equity + Book Value of Debt}}{\text{Book Value of Assets}}$$

Market value of equity variable is based on closing share prices on the last trading day of the year

Hypothesis Development

To test the relationship between the weight of the IC components and firms' market performance in IT- and Non-IT market scope, a series of regression analyses is conducted, which substitutes for the various performance measures as dummy and dependent variables.

Hypothesis 1 (H_1): There is a positive relationship between intellectual capital components including HCE, SCE, CEE and TCE, and market performance.

$$MPerf_t = \alpha_0 + \alpha_1 HCE_t + \alpha_2 SCE_t + \alpha_3 CEE_t + \alpha_4 TCE_t + \varepsilon_t \quad (6)$$

By setting the dummies for companies which are listed separately on the Taiwan Stock Exchange (TWSE), such as IT companies and non-IT companies, as well as the different IC-components, H1 allows us to test the difference between the location of the listing of the companies. IT and non-IT are dummy variables for companies which are listed on the Taiwan Stock Exchange, while HCE, SCE, CEE and TCE are different IC-components as described above. Coefficients β1 and β2 will be equivalently significant if Hypothesis 2 is true.

Hypothesis 2 (H_2): There is no difference regarding that companies are IT or non-IT companies.

$$MPerf_t = \beta_1 IT_t + \beta_2 NonIT_t + \alpha_1 HCE_t + \alpha_2 SCE_t + \alpha_3 CEE_t + \alpha_4 TCE_t + \varepsilon_t \quad (7)$$

To investigate the relationship between market performance and IC-components of different weights, equation 8 is used, and a different return of market performance is included in the subsequent tests. A key postulate is that the relationship between market performance and IC-components will be misleading if the effect of different IC allocations is ignored. In the test, a null hypothesis is used to examine the relationship between the return of market performance and IC components across different weights of IC-components.

$$\ln(MPerf_t) = \alpha_0 + \alpha_1 HCE_t + \alpha_2 SCE_t + \alpha_3 CEE_t + \alpha_4 TCE_t + \varepsilon_t \quad (8)$$

$$\text{Test}: \begin{cases} \ln(MPerf_t) \geq r_1, HCE, SCE, CEE, TCE \text{ with different weight} \\ r_1 < \ln(MPerf_t) < r_2, HCE, SCE, CEE, TCE \text{ with different weight} \\ \ln(MPerf_t) \leq r_3, HCE, SCE, CEE, TCE \text{ with different weight} \end{cases}$$

$H_{3a}: w_{HCE} = w_{SCE} = w_{CEE} = w_{TCE}$

H_{3b}: Not all w_i is equal

EMPIRICAL RESULTS

Tables 2 and 3 present descriptive statistics and a correlation analysis of the dependent and the independent variables. The mean Tobin *q* is about 20.6420 and 16.4452 for IT and non-IT companies. In the light of the high degree of correspondence with Tobin Q and HCE (0.3006), and with SCE (0.4477), and with CEE (0.3064), and with CEE (0.3064) and with TCE (0.2920), the results for VAIC subcomponents demonstrate that an increase in value creation efficiency influences the profitability and market performance of IT firms. For non-IT companies, the market performance is correlated with IC components 0.1282, 0.4068, 0.2229, and 0.3021 respectively. Furthermore, the Tobin *q*-TCE relationships (0.2920 and 0.3021) are highly correlated, which roughly supports H_1, that firms with more R&D expenditure and intellectual property have a significantly positive effect on firms' value and financial performance. Therefore, R&D expenditure and intellectual property should be included when calculating firm's intellectual capital and analyzing their value creation.

Table 2: Descriptive Statistics for Selected Variables

Variable		Average	Variance	Std dev.	Skewness
Tobin Q	IT Company	20.6420	114.8787	10.7182	2.8419
	Non-IT Company	16.4452	39.5528	6.2891	2.0465
HCE	IT Company	3.5381	28.8494	5.3712	9.6178
	Non-IT Company	4.7898	122.0005	11.0454	7.6010
SCE	IT Company	0.5611	0.0481	0.2194	-0.4925
	Non-IT Company	0.5304	0.0665	0.2578	-0.2068
CEE	IT Company	0.4089	0.1312	0.3622	4.7353
	Non-IT Company	0.3055	0.0745	0.2729	3.9539
TCE	IT Company	0.0466	0.0053	0.0725	4.8599
	Non-IT Company	0.0174	0.0011	0.0334	4.5094

The mean Tobin q is about 20.6420 and 16.4452 for IT and non-it companies. For IC components, the mean are 3.5381, 0.5611, 0.4089, and 0.0466 respectively in IT companies; 4.7898, 05304, 0.3055, and 0.0174 respectively in non-IC companies. Variance, Std dev. and skewness are shown in Table 2.

Table 4 shows the results of testing H_1 and H_2. Firstly, the modified VAIC approach is supported both by IT and non-IT companies, in that explanatory power is increased from 27% to 34% (*F*-value = 111.8566) and 21% to 31% (*F*-value = 103.9851) respectively. The relationship between intellectual capital and market performance (H_1) has received support (*p*-value = 0.0000, 0.0000, 0.0000, and 0.0000 respectively) in IT companies, and SCE, CEE, and TCE are proved (*p*-value = 0.0000, 0.0000, and 0.0000 respectively) while HCE is not (*p*-value = 0.3854). This also makes the difference as to whether these companies are

listed in IT or Non-IT companies (H_2).

Table 3: Correlation Analysis of Selected Variables

		Tobin Q	HCE	SCE	CEE	TCE
Tobin Q	IT Company	1.0000				
	Non-IT Company	1.0000				
HCE	IT Company	0.3006	1.0000			
	Non-IT Company	0.1282	1.0000			
SCE	IT Company	0.4477	0.4702	1.0000		
	Non-IT Company	0.4068	0.4393	1.0000		
CEE	IT Company	0.3064	0.0434	0.1423	1.0000	
	Non-IT Company	0.2229	-0.0826	-0.0209	1.0000	
TCE	IT Company	0.2920	-0.0780	-0.037	0.2021	1.0000
	Non-IT Company	0.3021	-0.1063	-0.1155	0.2363	1.0000

The results for VAIC subcomponents demonstrate that Tobin Q has highly correspondent with HCE, SCE, CEE, CEE and TCE in value creation efficiency influence both IT and non-IT firms' profitability and market performance. Furthermore, the Tobin q-TCE relationships are highly correlated that roughly support H_1 that firms with more R&D expenditures and intellectual property have significantly positive effect on firms' value and financial performance.

Table 4: Analysis of the relations of *MPerf* and IC in different Company Type

Coefficient	**VAIC Approach**				**Modified VAIC Approach**			
	IT		Non-IT		IT		Non-IT	
	Adj. R^2	*F*-value	Adj. R^2	*F*-value	Adj. R^2	*F*-value	Adj. R^2	*F*-value
	0.2700	106.0234	0.2179	86.17847	0.3423	111.8566	0.3100	103.9851
	Beta	p-value	Beta	p-value	Beta	p-value	Beta	p-value
Intercept	7.0404	0.0000***	9.3880	0.0000***	5.4786	0.0000***	8.4605	0.0000***
HCE	0.2455	0.0002	-0.0238	0.2010	0.2837	0.0000***	-0.0152	0.3854
SCE	17.2964	0.0000***	10.4881	0.0000***	17.6898	0.0000***	11.1777	0.0000***
CEE	7.3993	0.0000***	5.2648	0.0000***	5.6986	0.0000***	3.5896	0.0000***
TCE					40.9514	0.0000***	59.3982	0.0000***
					F-test	**p-value**		
Hypothesis: IT Comp.= Non-IT Comp.					4.4430	0.0000****		

*Table 4 shows modified VAIC approach have higher explanatory power than Pulic's VAIC approach both in It and non-IT companies. In modified VAIC approach, HCE, SCE, CEE, and TCE are significant in IT companies while HCE is not significant in non-IT firms. ***, ** and * indicate significance at the 1, 5 and 10 percent levels respectively.*

In earlier hypothesis testing, support was found in the relationship between market performance and intellectual capital (Table 4), and the results of a further investigation into the different allocation in intellectual capital considering IT- and non-IT companies' return of market performance, confirm that companies place different weights, and distribute their resources of intellectual capital across different returns of market performance. In IT companies (Table 5), firms' return on market performance is highly associated with its IC value creation, while there is no significance between the first 20% and 40%~60% level, and 20%~40% and 60%~80% level. Additionally, the results (Table 6) clarify that HCE, SCE and CEE are negatively related to the firms' return, while TCE is significantly positively correlated to the return of market performance. This may indicate that even though IT companies need more employees to develop their designs and products, this may also erode its profits if they do not have a well-supported infrastructure, and information systems which are able to turn individual know-how into group property.

In non-It companies (Table 7), only the relationship between the first 20% level and the level of 60%~80% is insignificant. The results illustrate that HCE, SCE, CEE and TCE are not significant in the

ranking of the first 20%. SCE and CEE are significantly positively related to the firm's return on market performance, and furthermore, firms' will obtain a higher return if they invest in the development of TCE. In conclusion, employers should understand the level of market return they desire, so that they can decide how to distribute their investment in intellectual capital.

Table 5: Analysis of the Companies' Return of *MPerf* and IC Considering Critical Value

ln(*MPerf*)	IT Companies *F*-Value (*p*-value)				
	0~0.2	**0.2~0.4**	**0.4~0.6**	**0.6~0.8**	**0.8~1.0**
0 ~0.2	1.0000				
0.2~0.4	13.2879 (0.0000***)	1.0000			
0.4~0.6	0.9625 (0.4226)	0.0724 (0.0000***)	1.0000		
0.6~0.8	12.3085 (0.0000***)	0.9623 (0.3478)	12.7877 (0.0000***)	1.0000	
0.8~1.0	0.6582 (0.0169**)	0.0495 (0.0000***)	0.6839 (0.0269**)	0.0535 (0.0000***)	1.0000

ln(*MPerf*)	Non-IT Companies *F*-Value (*p*-value)				
	0~0.2	**0.2~0.4**	**0.4~0.6**	**0.6~0.8**	**0.8~1.0**
0 ~0.2	1.0000				
0.2~0.4	8.2474 (0.0000***)	1.0000			
0.4~0.6	1.8296 (0.0000***)	0.2218 (0.0000***)	1.0000		
0.6~0.8	0.8838 (0.2582)	0.1072 (0.0000***)	0.4831 (0.0001***)	1.0000	
0.8~1.0	4.8887 (0.0000***)	0.5928 (0.0033***)	2.6720 (0.0000***)	5.5312 (0.0000***)	1.0000

*IT firms' return of market performance is highly associated with its IC value creation. In here, we compare different firms' return level in first 20%, 20%~40%, 40%~60%,60%~80%, and 80%~100% level. ***, ** and * indicate significance at the 1, 5 and 10 percent levels respectively.*

SUMMARY AND CONCLUSION

This study is based on intellectual capital and financial perspectives, and examines the application of the concept of intellectual capital to value creation. The research attempts to connect intellectual capital deployment with changes in corporate market performance, and particularly tries to establish a line between the two. Based on research conducted by Edvinsson and Malone (1997), Ross *et al*. (1997), Sveiby (1997), Stewart (1997), Bontis (1998) and Chang (2007), this study proposes to use a taxonomy for corporate intellectual capital, namely human capital (HCE), structural capital (SCE), social capital (CEE), and R&D expenditures and intellectual property (TCE). The study analyzes the financial data of companies on the Taiwan Stock Exchange between 2005 and 2007, and after deleting off-market firms, missing data of the selected variables, and firms with a net income of less than 0 in a current year, the final sample consisted of a total of 1773 firm-year observations, including 854 IT companies and 918 non-IT companies.

Table 6: Analysis of the relations of *MPerf* and IC Considering Different ln(*MPerf*) in IT Companies

ln(*MPerf*)		0~0.2		0.2~0.4		0.4~0.6		0.6~0.8		0.8~1.0	
		Adj. R^2	***F*-value**								
		0.4707	25.5105 (0.0000***)								
		Beta	***p*-value**								
	HCE	(7.7311)	0.0000***								
0~	SCE	4.3965	0.2931								
0.2	CEE	0.0000	N/A								
	TCE	21.6545	0.1623								
				Adj. R^2	***F*-value**						
				0.4138	20.4731 (0.0000***)						
				Beta	***p*-value**						
	HCE			(40.7938)	0.0004***						
0.2~	SCE			(36.3379)	0.0034***						
0.4	CEE			(34.4426)	0.0040***						
	TCE			0.0000	N/A						
						Adj. R^2	***F*-value**				
						0.3488	15.8169*** (0.0000***)				
						Beta	***p*-value**				
	HCE					(3.5907)	0.3885				
0.4~	SCE					9.4430	0.1261				
0.6	CEE					0.0000	N/A				
	TCE					75.6531	0.0000***				
								Adj. R^2	***F*-value**		
								0.2493	10.2670 (0.0000***)		
								Beta	***p*-value**		
	HCE							(61.7723)	0.0017***		
0.6~	SCE							(56.0410)	0.0099***		
0.8	CEE							(59.1923)	0.0039***		
	TCE							0.0000	N/A		
										Adj. R^2	***F*-value**
										0.2890	12.0898 (0.0000***)
										Beta	***p*-value**
	HCE									(6.3901)	0.3006
0.8~	SCE									30.0183	0.0010***
1.0	CEE									0.0000	N/A
	TCE									45.6573	0.0110***

*The results clarify that HCE, SCE, CEE and TCE are highly related to the firms' different level of return. ***, ** and * indicate significance at the 1, 5 and 10 percent levels respectively.*

According to the predicted hypotheses, the correlation between Tobin *q* and IC components are positively related, which is a similar finding to most research studies which discuss intellectual capital and firms' market performance. To make a further comparison with VAIC^{TM}, the explanatory power of the modified VAIC model was increased from 27% to 34% (F-value = 111.8566) and 21% to 31% (F-value = 103.9851) respectively in IT- and non-IT companies, and the directional signs for HCE(+), SCE(+), CEE(+), RDE(+), and IPE(+) are significantly positively associated with firms' value and profitability, while HCE is not significant in non-IT companies. Compared with the findings of most researchers, the results support that an investment in the development of TCE has had an impact on their competitive advantage, and that a higher market performance is consistent with a higher investment in TCE, which was illustrated by both IT companies and non-IT companies. Furthermore, if companies invest more in their intellectual capital, they will create higher return on market performance. Moreover, the findings of the study indicate that, when industries conduct a business evaluation in the future, not only should the value of IC be considered, but IC allocation is also a critical aspect which should not be ignored. It is important that firms and managers should value and manage their IC, particularly R&D and intellectual property, in order to create long-term competitiveness and achieve a higher value.

Table 7: Analysis of the relations of *MPerf* and IC Considering Different ln(*MPerf*) in Non-IT Companies

ln(*MPerf*)		0~0.2		0.2~0.4		0.4~0.6		0.6~0.8		0.8~1.0	
		Adj. R^2	***F*-value**								
		(0.0144)	0.6039 (0.6607)								
		Beta	***p*-value**								
0~0.2	HCE	0.0108	0.9192								
	SCE	(2.6363)	0.2605								
	CEE	(0.1953)	0.8816								
	TCE	(15.0869)	0.3474								
				Adj. R^2	***F*-value**						
				0.2327	9.4939 (0.0000***)						
				Beta	***p*-value**						
0.2~0.4	HCE			(0.0293)	0.8104						
	SCE			12.0158	0.0000***						
	CEE			2.8790	0.0579*						
	TCE			59.1333	0.0017***						
						Adj. R^2	***F*-value**				
						0.2972	12.8391 (0.0000***)				
						Beta	***p*-value**				
0.4~0.6	HCE					(0.0323)	0.4108				
	SCE					6.9569	0.0001***				
	CEE					5.9838	0.0000***				
	TCE					29.0948	0.0703*				
								Adj. R^2	***F*-value**		
								0.2530	10.4814 (0.0000***)		
								Beta	***p*-value**		
0.6~0.8	HCE							0.0029	0.9338		
	SCE							9.4736	0.0008***		
	CEE							(0.0512)	0.9876		
	TCE							69.4119	0.0000***		
										Adj. R^2	***F*-value**
										0.2042	7.9924 (0.0000***)
										Beta	***p*-value**
0.8~1.0	HCE									0.0519	0.6159
	SCE									14.6685	0.0001***
	CEE									3.7412	0.1802
	TCE									80.4388	0.0031***

*The results clarify that HCE, SCE, CEE and TCE are highly related to the firms' different level of return while 0~0.2 return level is not significant. ***, ** and * indicate significance at the 1, 5 and 10 percent levels respectively.*

This research is not without its limitations, the first of which is that the results use Tobin *q* as firms' different levels of market return. Additional research could examine other financial ratios, and eventually introduce clearer interactions between a firm's market performance and its IC components. Secondly, researchers may adopt different methodology to examine the interaction among IC components, and finally, future research could revisit some of the basic assumptions of the Pulic's VAIC™ method and assess their potential consequences for the validity of empirical testing and results.

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