African Journal of Business Management Vol.5 (6), pp. 2345-2355, 18 March, 2011
Available online at http://www.academicjournals.org/AJBM
DOI: 10.5897/AJBM10.1039
ISSN 1993-8233©2011 Academic Journals

Full Length Research Paper

The dynamics of intellectual capital in organizational development

William S. Chang[1]* and Jasper Hsieh[2]

[1]Department of Finance, Ming Chuan University, 250 Sec. 5, Zhong-shan N. Rd. ROC 111, Taipei, Taiwan.
[2]Department of Arts and Creative Industries, Dong Hua University, No.1, Sec.2, Da Hsueh Rd., Shoufeng, Hualien, Taiwan.

Accepted 3 February, 2011

Extant research implies that heterogeneity of resources is the foundation for firm-wise competitive advantage. However, accumulation of these resources is a continuous process. By taking an organizational life cycle perspective, this paper examines the dynamics of intellectual capital (IC) within Dynamic Random Access Memory companies in Taiwan. The results indicate that firms place relatively different weights on the development of IC components across life cycle stages and such investments have different consequences in terms of financial performance.

Key words: Organizational lifecycle, intellectual capital, value added intellectual coefficient.

INTRODUCTION

The idea of Intellectual capital (IC) helps executives to elucidate intangible resources and knowledge assets of organization. In extant IC research, a greater emphasis however, is on antecedents of IC and the casual relationship between IC and market performance. Considering that the accumulation of intellectual capital is a dynamic and continuous process. Little is surveyed on why components of IC evolve relatively different and on the causal relationship between certain IC component and market performance at a certain period of time. In light of that the limited resources 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 when and why firms prioritize one dimension over the others and the relationship between the organizations' priorities and market performance are therefore, pragmatic. This paper takes on an organizational lifecycle perspective to survey the evolutionary dynamics of intellectual capital.

A basic argument is that firms often cultivate intellectual capital in a similar and possibly sequential manner. It may be a consequence of organizational adaptation to industrial environment over time while heterogeneity in intellectual assets between firms may be a result of firms' enaction to the environment. In terms of the generally accepted consensus on the content of intellectual capital, three interdependent IC components are examined in this study: human capital, structural capital and social capital. Due to the sample in this study is mainly with high technology industry; the study therefore, also considers the relative change in technology capital, including research and development (R and D) expenditure and intellectual property (Chang, 2007).

The notion of organizational lifecycle

When competitive success of a strategy is dependent on the firm's invisible assets, the dynamic change of invisible assets is also largely determined by the content of a 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 organizations' behaviour in resources acquisitions and performance. Whether such adaptation is environmentally derived or out of managerial choice (Hrebiniak and Joyce, 1985), the history of organizational changes depicts the progress of organizational life. To

*Corresponding author. E-mail: shulienchang@yahoo.com. Tel: +886-989070424.

capture the evolution of organization, the notion of lifecycle has been a useful metaphor to describe the maturational and generational processes driven by mechanisms of reproduction in natural populations (O'Rand and Krecker, 1990).

A basic tenet to organizational lifecycle (OLC) is that the evolution of organizations tends to follow a pattern that is usually characterized by sequences of progressive stages. The creation, transformation and decline of organizations could be described as the results of reactions to environmental forces and organizations' strategic choices (Greiner, 1972; Hannan and Freeman, 1977; Aldrich, 1979; Kimberly and Miles, 1980). Organizations in different stage of life cycle would implement different internal structures and processes in the hope to respond to change in the environment. This process of organizational evolution corresponds to the scientific metaphors "punctuated equilibrium" or "phyletic gradualism" in evolutionary biology that organizations adapt to new environmental challenges over the course of organizational life and gradually becomes what they are today. Owing to the fact that their criteria of effectiveness change over different life cycles, behaviours of younger organizations are thus perceivably different from mature ones (Cameron and Whetten, 1981; Quinn and Cameron, 1983).

The use of Organizational Life Cycle as an approach in the study of strategy has been observed in various papers. For instance, researchers observed that managerial priority varies in different life stages (Smith and Miner, 1983; Smith et al., 1985). In a seminal article Miller and Friesen (1984) develop a longitudinal study on corporate life cycle. Lifecycle configurations in this paper center on organizational strategy, structure, decision making methods and organizational situations. In different phases changes are observed in these configurations and imply different challenging facing the organizations. At the same time, the politics accompany strategic changes are different at different organizational life stages (Gray and Ariss, 1985). Baird and Meshoulam (1988) argue that organizations move from one stage to another because the misfit between the organization and its environment. At the same time organization’s efficacy and survival are challenged. Managers of organizations therefore, seek to change organizational goals and strategies in order to correspond to the new set of issues. Their argument is that different stages of corporate life cycle (five stages are proposed) require alterations in the firm's objectives, strategies, managerial processes, technology, culture, and decision-making.

Milliman et al. (1991) investigate strategic human resource management in multi-national companies across different life cycles. They stress the importance of congruence, the fit to flexibility over different stages of OLC with research directions proposed. Dodge et al. (1994) identify sixteen external and internal problems associated with small businesses. Although, the relation between OLC and perceived problems is not significant, they found businesses in early life cycle concentrate more on capital requirements than those in later life stage. Jawahar and McLaughlin (2001) develop a descriptive stakeholder theory over organizational life cycle. They argue that stakeholders’ significance is relative and dynamic which change over different OLC. The different resource allocation decisions and uses of strategy need to address changes in stakeholders’ demands simultaneously.

Typologies of organizational life stages are many. In a collective work Quinn and Cameron (1983) provided a thorough review on the different typologies used in literature. In this research a more intuitive one proposed by Miller and Friesen (1984) that a five-stage model including birth, growth, the maturity, revival and decline stage is adopted as in Table 1.

Intellectual capital

Intellectual capital is an emerging topic of interest to firms that derives the increasing financial performance from sharing information, knowledge and innovation. Considerable research and appropriate praxis have been developed to measure a company’s intellectual capital, amongst Itami (1987), Coleman (1988), Burt (1992), Edvinsson and Malone (1997), Brooking (1996), Stewart (1997), Ross et al. (1997), Sveiby (1997), and Bounfour (2002). Based on research conducted by Edvinsson and Malone (1997), Rosss et al. (1997), Sveiby (1997), Stewart (1997), Bontis (1998) and Chang (2007), this study proposes to use the following equation for corporate intellectual capital:

Intellectual capital (IC) = Human capital (HC) + Structural capital (SC) + Social capital (CE) + Technological capital.

While many survey methods (internal measures) are proposed in addition to those based on accounting information (external measures), it is difficult to compare company to company using such methods (Boremann, 1999; Pulic, 2000, 2004). In this research, the study adopted an accounting tool for intellectual capital (IC) management, namely the valued added intellectual coefficient (VAIC^{TM}) (Pulic, 2000) for evaluation of intellectual capital. A primary focus of this method is on the efficiency of resources that creates values for the firm.

A basic principle to VAIC^{TM} is to calculate the value added (VA) of a firm by subtracting input from output, whereby labor expenses are not included in the input. In financial terms, this is equal to:

VA = GM – sgaExp. + LExp. = Operating income + LExp.

VA: value added, GM: gross margin, *sgaExp.*: selling, general, and administrative expenses, *LExp.*: labor expenses which Pulic (2000b) interprets as human

Table 1. Strategic behaviors and organizational lifecycles.

Organizational life stages	Strategic behaviors
Stage one: Birth	In this period, a new firm is attempting to become a viable enterprise (Miller and Friesen, 1984). The focus is on viability, or simply identifying a sufficient number of customers to support the existence (Churchill and Lewis, 1983) of the organization. Organizations in this stage tend struggle to enact or create (Bedeian, 1990) their own environment.
Stage two: Growth	As firms move into the Growth stage they seek to grow, develop some formalization of structure (Quinn and Cameron, 1983), and establish their own distinctive competences (Miller and Friesen, 1984). The centre is upon achieving rapid sales growth based on formalized structure and amassing resources in an attempt to realize advantages accruing to larger scale.
Stage three: Maturity	Maturity represents an organizational form where formalization and control through bureaucracy are the norm (Quinn and Cameron, 1983). The companies in maturity stage have passed the second stage, growing to a point that they may seek to protect what they have gained instead of targeting new territory.
Stage four: Revival	The revival organization displays a desire to return to a leaner time (Miller and Friesen, 1984), where collaboration and teamwork foster innovation and creativity.
Stage five: Decline	Even though firms may exit the life stage at any stage, a decline stage can trigger the demise. A final stage that companies' profitability drops because of the external challenges and because of the lack of innovation.

Note: Adapted from Miller and Friesen (1983, 1984).

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 in the followings:

HC = LExp.
SC = VA- HC

HC denotes human capital whereas SC structural capital; Pulic states that human capital and structural capital are reciprocal. The less human capital participates, the more structural capital is involved.

The next step is to evaluate social capital. According to Pulic's VAIC, social capital is calculated by capital employed which equals to the book value of the net assets of the firm.

CE= Capital employed = Book value of net assets

For technology capital, R and D and intellectual properties are taken into consideration. To proxy for technological capital (TC), the study includes R and D expenditure and the value of intellectual property following Chang's propositions (2007). To account for the effect, the study uses the same denominator of the dependent variable (market profitability) as the scaling variable for technological capital.

Technology capital efficiency,

$$TCE = \frac{\text{R and D expenditure} + \text{value of intellectual property}}{\text{Book value of common stocks}}$$

The study sets out to calculate the efficiency of the four forms of IC and the EPS, ROA and ROE are adopted as the proxy of firm's profitability (*MPerf*) with those resources. Up to this point the study now has four indicators (predicting variable) and dependent variables for testing (Table 2).

RESEARCH METHOD

According to research of the Taipei-based Market Intelligence and Consulting Institute, the worldwide semiconductor market has gradually become mature since 2000, and growth momentum has become weaker due to the impact of the financial crisis. During the second quarter of 2009, Taiwan's foundry chipmakers and several key chip designers continued to lead a rebound for local chipmakers despite the global economic downturn. Furthermore, the semiconductor industry will experience consolidation among

Table 2. IC indicator definition.

IC indicator	Definition
Human capital efficiency HCE= VA/HC	HCE is the human capital efficiency coefficient for the company, VA is value added and HC is the total salaries and wages for the company.
Structural capital efficiency SCE=SC/VA	SCE is the structural capital efficiency for the company, SC is the structural capital and VA is the value added.
Efficiency of the financial capital employed CEE=VA/CE	Pulic argued that to have a broad picture of efficiency of value creating resources, it is important to take financial and physical capital into consideration. CEE is the capital employed efficiency coefficient, VA is value added, and CE is the book value of the net assets of the company.
Technological capital efficiency TCE=TC/common stock equity	Technology is another IC component defined in the most prior studies. TC includes the expenditure on technology development and the value of intellectual properties.

Note: With regard to the selection of the IC indicators, the authors refer to studies by Pulic (2000a, b) VAIC model and Chang (2007) for modified VAIC adding TCE into the regression. The reason for selecting theses indicators because the application of VAIC as an aggregate and standardized measure of corporate intellectual ability, specifically, the explanatory power of VAIC and its components towards share price changes.

companies with the development trend of product function integration, in particular communications and multimedia products, Taiwanese semiconductor companies will face even more opportunities in the future. Thus, the main focus of this study is Taiwan's publicly listed semiconductor companies. The research data were collected annually from 1996 to 2008. The full sample includes 24 (from all 58 companies) companies and the final sample size was 197 (eliminate missing date 55) entries of annual financial data. The data for financial performance and non-financial measurement were obtained from the InforTime database, while the other information was collected manually from published annual reports.

Miller and Friesen's (1983, 1984) five phases of organizational life are adopted in the present study in which sales growth as a key attribute in determining organizational lifecycles. On average, the sales growth rate is usually high in the maturity stage and otherwise, companies in this stage will have invest in higher marketing and capital expenditure causing lower current ratio and higher debt ratio to maintain its competitive advantages. However, in other stages of the life cycle, companies prefer to contain more liquidity assets with a reduced sales growth rate, enabling the company to prevent emergencies. Based on the previous discussion, this paper applies the classification method to derive the patterns of organizations' life stage by taking current ratio, debt ratio, total asset turnover, sales, growth profit margin and size of Employees into consideration.

Using Ward's method and the number of derived clusters ranged 5 cluster solutions to divide all the 197 samples into different life stages, including birth, growth, maturity, survival and decline stage. In order to reduce the sensitivities of outliers causing by different ranges, scales, or units, the study may be cases where Z-score transformation is appropriately adopted to standardize the contribution of all variables to the distance measured. Consequently, 45 samples are in the birth stage, 114 are in the growth stage, 22 in the maturity stage, 14 in the survival stages, and 2 are regarded as being in the declined stage. The descriptive analysis of semiconductor companies' life stage is described in Table 3. For example, the result shows that companies in the growth stage have the higher sales, the lowest current ratio, the higher debt ratio, the lowest asset turnover rate, and the highest number of employees. Additionally, the classification method is successful in identifying cross-sectional differences in company characteristics across five life-cycle stages.

Hypothesis development

To test the relationship between IC components and firms' market performance in different life stages, the study conducts a series of regression analyses that substituted the various performance measures as dummy and dependent variables.

Ho_1: There is a positive/negative relationship between intellectual capital components including HCE, SCE, CEE and TCE, and market performance.

$$MPerf_t = \alpha_0 + \alpha_1 HCE_t + \alpha_2 SCE_t + \alpha_3 CEE_t + \alpha_4 TCE_t + \varepsilon_t \quad (1)$$

To investigate the relationship between market performance and IC-components in different life stages, we use equation (2) and include five different life stages in the following tests. A key postulate is that the relationship between market performance and IC-components would mislead if the effect of lifecycle is ignored. In the first test, the study uses a null hypothesis to examine the relationship between market performance and IC components across different life stages. In the second test, it uses a pair-wise comparison to further investigate the difference between life stages in terms of the relationship between IC components and market performance.

Ho_2: The relationship between market performance and IC components are significantly depending on life stages.

$$MPerf_t = \gamma_1 Birth_t + \gamma_2 Growth_t + \gamma_3 Maturity_t + \gamma_4 Revival_t + \gamma_5 Decline_t + \alpha_1 HCE_t + \alpha_2 SCE_t + \alpha_3 CEE_t + \alpha_4 TCE_t + \varepsilon_t \quad (2)$$

Test 1: When the null hypothesis H_2a is rejected, H_2b is supported by:

Table 3. Company characteristics in different life stage (mean).

	Life cycle descriptor					
Life cycle stages	**Sales**	**Current ratio**	**Debt ratio**	**Asset turnover**	**Growth profit margin**	**Employee**
Birth	4.6E + 06	220.70	45.21	4.27	396.84	320
Growth	2.6E + 06	470.21	20.00	20.90	94.27	194
Maturity	1.1E + 07	182.32	37.50	11.48	82.18	2224
Survival	4.2E + 07	321.42	28.36	25.94	-8.55	1538
Decline	2.2E + 05	279.96	37.51	21.71	14294.65	91

Notes: Sales is measured companies' annual sales; current ratio is measured as current assets divided by current liability; debt ratio is measured as total liabilities divided by total assets; asset turnover is measured as sales divided by average total assets; growth profit margin is measured as percentage of (net profit – cost of sales) divided by net profit, and the employee is the number of workers.

Table 4. Descriptive statistics for predicting variables.

Descriptive statistics										
	Birth stage		**Growth stage**		**Maturity stage**		**Survival stage**		**Decline stage**	
	Mean	**Std. deviation**	**Mean**	**Std. deviation**	**Mean**	**Std. deviation**	**Mean**	**Std. deviation**	**Mean**	**Std. deviation**
HCE	1.81	1.93	3.22	2.71	6.15	5.69	7.28	9.40	1.82	1.92
SCE	2.85	12.92	0.59	0.89	0.50	2.13	0.82	0.17	-0.25	1.32
CEE	0.26	0.24	0.38	0.18	0.21	0.15	0.37	0.26	0.46	0.55
TCE	0.04	0.08	0.14	0.19	0.03	0.03	0.36	0.35	0.69	0.98
Valid N (list wise)	45				114			22	14	2

$$H_{2a}: \gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = \gamma_5 = 0$$
$$H_{2b}: \text{Not all } \gamma_i \text{ equal zero}$$

Test 2: A pair-wise comparison between organizations in different life stages. When H_{2c} is rejected, and H_{2d} is supported:

$$H_{2c}: \gamma_i = \gamma_j, i \neq j$$
$$H_{2d}: \gamma_i \neq \gamma_j$$

Where i and j represents the five different organizational life stages

Measurement of variables

In this study, EPS, ROA and ROE for companies' financial performance were used. Indicators that were use to capture IC across different life stages are shown in Table 4. The HCE (mean) of the growth, maturity, and survival stages are 3.22, 6.15, and 9.40, while SCE, CEE, and TCE have the highest value (mean) in birth, decline, and decline stages, respectively, indicating that Taiwan's semiconductor companies with dynamics intellectual capital investment in different life stages.

EMPIRICAL RESULTS

Due to a small sampling in the decline stage, in the following statistics, authors combine survival and decline stages named impasse stage. Table 5 present the results of adding additional TCE component into Pulic's VAIC™ model from testing hypothesis 1. The modified VAIC model provides the higher explanation power (Adj. R^2 = 0.60, F-value = 72.23) than Pulic's VAIC™ (Adj. R^2 = 0.52, F-value = 75.76) model. In the earlier hypothesis testing we found supports in the relationship between market performance and intellectual capital. Furthermore, when taking organizational lifecycle into consideration, the explanation power is higher (Adj. R^2 = 0.66, F-value = 56.88) than the other two models which shows somewhat stronger significance in terms of the relationship between IC components and market performance (EPS is used).

The relationship between intellectual capital and market performance (H_2) has received better support when considering organizational lifecycle. To investigate further into the relationships between IC components and individual financial measures, we consequently enter three different financial indicators for dependent variable including EPS, ROA and ROE in the equation. When using EPS as dependent variable (Table 6), *Adj.* R^2 for birth (F-value =23.20), growth (F-value = 59.17) and maturity stage (F-value = 27.58) are respectively significant. Interestingly each IC component has shown different degree of significance across different life stage.

The same phenomenon is observed when we substitute dependent variable with ROA and ROE. While *Adj.* R^2 for the relationship between IC and dependent variable across different life stages support our research hypothesis, the relative changes in IC components across

Table 5. Regression results of the companies' MPerf and IC considering the OLCs.

	Model A	Model B	Model C
	$MPerf_t = \alpha_0 + \alpha_1 HXE\tau + \alpha_2 \Sigma XE\tau + \alpha_3 XEE\tau + \varepsilon_\tau$	$MPerf_t = \alpha_0 + \alpha_1 HCE_t + \alpha_2 SCE_t + \alpha_3 CEE_t + \alpha_4 TCE_t + \varepsilon_t$	$MPerf_t = \alpha_0 + \gamma_1 Birth + + \gamma_2 Grwoth + + \gamma_3 Maturity + + \gamma_4 Impasse + \alpha_1 HCE_t + \alpha_2 SCE_t + \alpha_3 CEE_t + \alpha_4 TCE_t + \varepsilon_t$
Intercept	-2.18	-2.42	-0.90
HCE	0.39*** (5.48)	0.40*** (6.14)	0.26*** (3.99)
SCE	-0.04 (-0.97)	-0.06 (-1.45)	-0.04*** (-1.16)
CEE	15.54*** (11.16)	13.18*** (9.99)	14.78 (11.49)
TCE		8.03*** (6.42)	5.24*** (4.13)
Birth			-2.10** (-2.29)
Growth			-1.85** (-2.21)
Maturity			0.00 (N/A)
Impasse			3.94*** (3.34)
Adj. R^2	0.52	0.60	0.66
F-value	72.23	75.76	56.88
Sig.	0.00***	0.00***	0.00***

Note: The regression coefficient in the table are unstandardized regression coefficient (beta coefficients), and the values in parentheses are *t*-statistics. ***, **, * indicates that the estimated coefficient is significantly different from zero at the 1, 5, and 10% levels respectively. The table shows that the modified VAIC model (including TCE and lifecycle stages) provides the better explanation of independent variable. Dependent variable: EPS.

across different life stages are most remarkable (Tables 7 and 8). For instance, human capital (β=.44) and social capital (β=.45) show equal significance in birth stage when uses EPS as dependent variable. Moves on to growth stage and maturity stage, social capital gains a stronger significance and human capital loses importance to technological capital. In impasse stage, social capital alone appears to be the most noteworthy factor to EPS. Overall, the empirical results provide evidence on the dynamics of intellectual capital components. The empirical results also reveal the followings:

i) Modified VAIC model provides the higher explanation power than Pulic's and additionally when we consider companies' lifecycle into the model, we found human capital and technological capital provides the positive value-driven information while birth, growth, and impasse stages are significant.
ii) Efficiency of financial capital employed provides companies with the highest value-drive information in the maturity stage and the lowest value-driven information in the birth stage; and
iii) Technological capital efficiency provides the positive

Table 6. Regression results of the 5 life-stage using EPS as dependent variable.

Model		Unstandardized coefficients Beta	Unstandardized coefficients Std. error	Standardized coefficients Beta	t	Sig.	Adj R^2	F	Sig.
Birth	(Constant)	-1.84	0.56		-3.27	0.00	0.669	23.195	0.000***
	HCE	0.87	0.20	0.44	4.39	0.00***			
	SCE	-0.06	0.03	-0.20	-2.14	0.04**			
	CEE	7.01	1.57	0.45	4.45	0.00***			
	TCE	-0.31	4.33	-0.01	-0.07	0.94			
Growth	(Constant)	-3.81	0.61		-6.20	0.00	0.673	59.169	0.000***
	HCE	0.44	0.10	0.26	4.29	0.00***			
	SCE	0.15	0.28	0.03	0.53	0.60			
	CEE	15.64	1.53	0.61	10.25	0.00***			
	TCE	5.51	0.61	0.23	-6.20	0.00***			
Maturity	(Constant)	-2.13	0.72		-2.98	0.01	0.835	27.583	0.000***
	HCE	0.13	0.10	0.18	1.30	0.21			
	SCE	0.04	0.17	0.02	0.22	0.83			
	CEE	19.57	3.58	0.75	5.47	0.00***			
	TCE	39.95	13.26	0.28	3.01	0.01***			
Impasse	(Constant)	1.00	4.18		0.24	0.82	0.371	3.216	0.056*
	HCE	-0.02	0.25	-0.02	-0.10	0.92			
	SCE	3.65	4.00	0.19	0.91	0.38			
	CEE	24.38	8.94	0.70	2.73	0.02**			
	TCE	-0.49	5.97	-0.02	-0.08	0.94			

Note: Dependent variable: EPS; independent variable: HCE, SCE, CEE, and TCE; the regression coefficients shown in the table are both unstandardized and standardized regression coefficients (beta coefficients), and the value in the table includes t-statistics and *F*-value; ***, **, * indicates that the estimated coefficient is significantly different from zero at the 1, 5, and 10% levels respectively.

influence when companies move into the growth and maturity stages to maintain/develop their competitive advantages while human capital is more important in birth and growth stages.

A further examination into IC components in the different organizational life stages reports a similar finding using cluster-wise comparison. The results reported in Table 9 support H_2 that IC components in different have different value-driven information. Specifically, they show that the firms' reasons for investing in IC vary across different life stage, just as the literature implies. However, efficiency of the financial capital employed is not significantly different when the birth and impasse stages, and growth and maturity stages were measured.

Finally, the empirical results are intended to provide valuable information to assist in the decision making of company managers. First, managers should not only focus on those intangibles, but also consider life cycle stages, since IC components alone do not provide enough value-relevant information. Second, due to the availability of various value creation strategies, such as investing in human capital and continuously improving the development of technologies, the management can progress its market performance by improving IC as the company moves into different life cycle stages. Therefore, value-relevant information regarding IC will play a significant role in determining company market performance under different life cycle stages.

CONCLUSION AND IMPLICATIONS

The purpose of this paper is to explore the relationship between dynamic intellectual capital and firms' market performance by taking organizational life cycle stages into consideration. The study use sales, current ratio, debt ratio, asset turnover, growth profit margin and the number of employees to categorize semiconductor companies into five different life cycle stages. Empirical analyses based on the companies' annual financial reports completed by 24 firms and collect 197 sampling in semiconductor industries and life cycle stages support the study hypotheses derived from life cycle theories.

The results indicate that firms invest in different proportions of IC across life cycle phases as reported in the life cycle literature. That is, firms in the birth stage have a greater structural capital and lower human capital, efficiency of the financial employed and technological capital, a higher debt ratio and growth profit margin with

Table 7. Regression results of the 5 life-stage using ROA as dependent variable.

Coefficient									
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Adj R^2	F	Sig.
		Beta	Std. error	Beta					
Birth	(Constant)	-6.70	2.09		-3.20	0.00	0.646	21.044	0.000***
	HCE	2.71	0.74	0.38	3.67	0.00***			
	SCE	-0.16	0.10	-0.15	-1.59	0.12			
	CEE	28.42	5.85	0.51	4.86	0.00***			
	TCE	-6.23	16.08	-0.04	-0.39	0.70			
Growth	(Constant)	-11.21	1.73		-6.48	0.00	0.803	115.098	0.000***
	HCE	2.50	0.29	0.41	8.74	0.00***			
	SCE	-0.42	0.79	-0.02	-0.53	0.60			
	CEE	59.50	4.31	0.64	13.81	0.00***			
	TCE	4.96	3.75	0.06	1.32	0.19			
Maturity	(Constant)	-5.34	1.41		-3.79	0.00	0.916	58.096	0.000***
	HCE	0.23	0.19	0.12	1.19	0.25			
	SCE	0.10	0.33	0.02	0.32	0.76			
	CEE	60.50	7.04	0.85	8.59	0.00***			
	TCE	98.14	26.10	0.25	3.76	0.00***			
Impasse	(Constant)	-4.54	3.81		-1.19	0.26	0.865	25.081	0.000***
	HCE	0.10	0.23	0.05	0.46	0.65			
	SCE	9.47	3.65	0.26	2.60	0.02**			
	CEE	61.52	8.14	0.90	7.56	0.00***			
	TCE	-2.39	5.44	-0.05	-0.44	0.67			

Note: Dependent variable: ROA; independent variable: HCE, SCE, CEE, and TCE; the regression coefficients shown in the table are both unstandardized and standardized regression coefficients (beta coefficients), and the value in the table includes t-statistics and *F*-value; ***, **, * indicates that the estimated coefficient is significantly different from zero at the 1, 5, and 10% levels respectively.

Table 8. Regression results of the 5 life-stage using ROE as dependent variable.

Coefficient									
Model		Unstandardized coefficients		Standardized coefficients	t	Sig.	Adj R^2	F	Sig.
		Beta	Std. error	Beta					
Birth	(Constant)	-16.14	3.37		-4.79	0.00	0.744	32.927	0.000***
	HCE	5.26	1.19	0.39	4.43	0.00***			
	SCE	-0.26	0.16	-0.13	-1.58	0.12			
	CEE	59.55	9.41	0.56	6.33	0.00***			
	TCE	-20.55	25.88	-0.06	-0.79	0.43			
Growth	(Constant)	-18.13	1.72		-10.53	0.00	0.893	235.266	0.000***
	HCE	3.24	0.29	0.39	11.33	0.00***			
	SCE	-0.16	0.79	-0.01	-0.21	0.84			
	CEE	88.49	4.29	0.70	20.62	0.00***			
	TCE	7.53	3.74	0.06	2.01	0.05**			
Maturity	(Constant)	-6.32	1.44		-4.40	0.00	0.968	159.369	0.000***

Table 8. Contd

	HCE	0.56	0.20	0.18	2.86	0.01***			
	SCE	0.02	0.34	0.00	0.06	0.96			
	CEE	99.98	7.18	0.85	13.93	0.00***			
	TCE	13.15	26.61	0.02	0.49	0.63			
Impasse	(Constant)	-13.83	6.96		-1.99	0.07*	0.855	23.122	0.000***
	HCE	0.27	0.41	0.07	0.65	0.53			
	SCE	6.61	6.66	0.10	0.99	0.34			
	CEE	106.18	14.87	0.88	7.14	0.00***			
	TCE	5.02	9.94	0.06	0.51	0.62			

Note: Dependent variable: ROE; independent variable: HCE, SCE, CEE, and TCE; the regression coefficients shown in the table are both unstandardized and standardized regression coefficients (beta coefficients), and the value in the table includes t-statistics and *F*-value; ***, **, * indicates that the estimated coefficient is significantly different from zero at the 1, 5, and 10% levels respectively.

Table 9. Results of comparing IC components in different life stages.

		Life stages		
		Birth	**Growth**	**Maturity**
Growth	HCE	0.51*** (0.01)		
	SCE	209.54*** (0.00)		
	CEE	1.82*** (0.01)		
	TCE	0.18*** (0.00)		
Maturity	HCE	0.12*** (0.00)	0.23*** (0.00)	
	SCE	36.81*** (0.00)	0.18*** (0.00)	
	CEE	2.55*** (0.01)	1.40 (0.19)	
	TCE	8.56*** (0.00)	48.67*** (0.00)	
Impasse	HCE	0.05*** (0.00)	0.09*** (0.00)	0.40** (0.03)
	SCE	606.33*** (0.00)	2.89*** (0.01)	16.47*** (0.00)
	CEE	0.74 (0.21)	0.41*** (0.00)	0.29*** (0.00)

Table 9. Contd

TCE	0.04*** (0.00)	0.20*** (0.00)	0.00*** (0.00)

Note: The results in the table are *F*-test and the values in parentheses are *p*-value. ***, **, * indicates that the estimated coefficient is significantly different from zero at the 1, 5, and 10% levels respectively. The significant level is 0.05.

Table 10. ANOVA for final cluster results (after standardization).

ANOVA				
	Cluster		**F**	**Sig.**
	Mean square	**df**		
Zscore: Sales	44.46	4	151.50	0.00***
Zscore: Current ratio	0.00	4	18.66	0.00***
Zscore: Debt ratio	17.71	4	50.73	0.00***
Zscore: Asset turnover	5.74	4	11.64	0.00***
Zscore: Growth rate	42.97	4	264.26	0.00***
Zscore: Employee	36.71	4	137.24	0.00***

Note: The F tests used only for descriptive purposes because the clusters have been chosen to maximize the differences among cases in different clusters. *** indicates that the estimated coefficient is significantly different from zero at the 1%.

lower current ratio as opposed to firms in the growth stages. The present study confirms that semiconductor companies place different weights and distribute intangible resources to certain IC components across different life cycle stages. Moreover, the companies' financial performance resulted from IC should take time to accumulate and there may be a time lag between the development and the harvesting of new capabilities (Kujansivu and Lonnqvist, 2007; Lin and Edvinsson, 2008). Taking this perspective, the study tries to make sense based on the literature reviews.

When organizations in the start-up stage would focus on identifying a sufficient number of customers, a consequence of that may be reflected in a higher growth profit margin and lower asset turnover rate before they move into growth stage. Firms in growth stage would establish their own distinctive competencies causing the lower employees. In the case of semiconductor industry in Taiwan, a higher human capital efficiency in the mature stage is possible the efforts from previous stage. In order to prolong competitive advantage, companies in mature stage may be actively in pursuing value chain integration by building up allies and networks. As a result, higher human and social capital efficiency in the next stage could be the outcome.

The impasse stages is the most interesting one that firms seek to revive by returning to fit, however, they would continue to degenerate if higher structural capital is maintained. Several potential research questions remain. First, the present study assumes that life cycle stages were separated by some specific financial performances. It is possible causing different results if the further research considers more different variations. Secondly, the present study aligned survival and decline stages due to small sampling size. The paper only can provide limited supports for this combination stage.

REFERENCES

Aldrich H (1979). Organizations and environments. Englewood Cliffs, NJ: Prentice-Hall.

Baird L, Meshoulam I (1988). Managing two fits of strategic human resource management. Acad. Manag. Rev., 13(1): 116-128.

Bedeian A (1990). Choice and determinism: a comment. Strateg. Manag. J., 11(4): 571-573.

Bontis N (1998), Intellectual capital: an exploratory study that develops measures and models. Manag. Decis., 36(2): 63-76.

Bounfour A (2002). How to measure Intellectual Capital's dynamic value: the IC-dVAL approach. Presented at the 5th World Congress on Intellectual Capital, McMaster University, Hamilton, Ontario, Canada.

Brooking A (1996). The Management of Intellectual Capital. Long Range Planning, 30(3): 364-365.

Burt RS (1992). Structural holes: the social structure of competition. Cambridge, MA: Harvard University Press.

Cameron KS, Whetten DA (1981). Perceptions of Organizational Effectiveness over Organizational Life Cycles. Admin. Sci. Quart., 26(4): 525-544.

Chang S (2007). Valuing intellectual capital and firms' performance: Modifying Value Added Intellectual Coefficient (VAIC(TM)) in Taiwan IT industry. Unpublished Doctoral dissertation, Golden Gate University, San Francisco.

Churchill NC, Lewis VL (1983). The five stages of small business growth. Harv. Bus. Rev., 61(3): 30-50.

Coleman JS (1988). Social capital in the creation of human capital . Am.

J. Sociol., 94: 95-120.
Dodge HR, Fullerton S, Robbins JE (1994). Stage of the organizational life cycle and competition as mediators of problem perception for small businesses. Strateg. Manag. J., 15(2): 121-134.
Edvinsson L, Malone M (1997). Intellectual Capital. Harper Collins Publishers, New York, NY, 225 p.
Gray B, Ariss SS (1985). Politics and strategic change across organizational life cycles. Acad. Manag. Rev., 10(4): 707-723.
Greiner LE (1972). Evolution and Revolution as Organizations Grow. Harv. Bus. Rev., 50(4): 37-46.
Hannan MT, Freeman J (1977). The Population Ecology of Organizations. Am. J. Soc., 82(5): 929.
Hrebiniak LG, Joyce WF (1985). Organizational Adaptation: Strategic Choice and Environmental Determinism. Admin. Sci. Quart., 30(3): 336-349.
Itami H, Roehl TW (1987). Mobilizing Invisible Assets. Harvard University Press.
Jawahar IM, McLaughlin GL (2001). Toward a Descriptive Stakeholder Theory: An Organizational Life Cycle Approach. Acad. Manag. Rev. 26(3): 397-414.
Kimberly JR, Miles RH (1980). The Organizational Life Cycle: Issues in the Creation, Transformation, and Decline of Organizations. Jossey-Bass.
Kujansivu P, Lonnqvist A (2007). How do investments in intellectual capital create profits? Int. J. Learning Intellectual Capital, 4(3): 256-275.
Lin CY, Edvinsson L (2008). National intellectual capital: comparison of the Nordic countries. J. Intellectual Capital, 9(4): 525-545.
Miller D, Friesen PH (1983). Successful and Unsuccessful Phases of the Corporate Life Cycle. Org. Stud., 4(4): 339.
Miller D, Friesen PH (1984). A Longitudinal Study of the Corporate Life Cycle. Manag. Sci., 30: 1161-1183.
Milliman JV, Glinow MA, Nathan M (1991). Organizational life cycles and strategic international human resource management in multinational companies: Implications for congruence theory. Acad. Manag. Rev., 16(2): 318-339.
O'Rand AM, Krecker ML (1990). Concepts of the Life Cycle: Their History, Meanings, and Uses in the Social Sciences. Ann. Rev. Sociol., 16(1): 241-262.
Pulic A (2000). VAIC?–An accounting tool for IC management. Int. J. Tech. Manag., 20(5): 702-714.
Pulic A (2004). Do we know if we create or destroy value? Int. J. Entrep. Innov. Manag., 4(4): 349-359.
Quinn RE, Cameron K (1983). Organizational life cycles and shifting criteria of effectiveness: Some preliminary evidence. Manag. Sci. 29(1): 33-51.
Smith KG, Mitchell TR, Summer CE (1985). Top level management priorities in different stages of the organizational life cycle. Acad. Manag. J., 28(4): 799-820.
Smith N, Miner J (1983). Type of Entrepreneur, Type of Firm, and Management Motivation. Strateg. Manag. J., 4(4): 325-340.
Stewart TA (1997). Intellectual Capital. Nicholas Brealey, London.
Sveiby KE (1997). The New Organizational Wealth: Managing and Measuring Knowledge-based Assets, Barrett-Kohler, San Francisco, CA.