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Exploration of the Role of Intellectual Property as a Moderator in the Correlation between Ownership Structure and Corporate Performance

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ABSTRACT

This study is to verify the relationship between ownership structure and corporate performance, as well as the persistence of the relationship, by means of the relevant information of value creation provided by intellectual property. More than four thousand data of Taiwan listed companies during the period of 2002-2011 are analyzed in this research. Dynamic perspective is adopted to develop the persistence of the relationship between ownership structure and corporate performance. Regression results show that potentially non-linear relationship exists in the relationship between ownership and corporate performance. Evidence demonstrates that the impact of ownership on performance is a kind of corporate life cycle function, especially in the maturity stage as well as in the high-tech industry where it is particularly obvious. More importantly, the concept of intellectual property and the ownership mechanism of different industry attributes provide different information about value creation in different life cycle processes through dynamic design approach. For robustness, the measured variables of ownership are further lagged by a period to alleviate potential endogeneity issue. Overall, this study mainly contributes to extending the importance of corporate life cycle, and through this, more finely assessing the effect of ownership and the impact on corporate performance.

Keywords: intellectual property, ownership structure, corporate performance, lifecycle

INTRODUCTION

Global financial crisis and frequent fraud scandals point directly to the importance of corporate governance. Although corporate governance is more than mere ownership structure, ownership structure has been consistently considered as one of the core pillars of corporate governance. The relationship between ownership structure and corporate performance has been receiving considerable attention and discussion in the literature. Berle and Means (1932) are the pioneers in proposing the Ownership Dispersion Hypothesis. When corporate ownership is dispersed among small stockholders, and control is centered in the hands of the manager, corporate control will be separated from ownership. Jensen and Meckling (1976) propose the agency theory, in which corporate manager or agent is not necessarily consistent with the interests of the principal entirely when they run corporate business for the principal. Firm managers are responsible for operation and have information advantage. Together with the difficulty in monitoring by the principal, managers will seek to maximize their own interests and cause the conflict of interest with the principal, giving rise to the agency cost that further affects corporate performance. In order to reduce the agency cost, a range of corporate governance mechanisms would be deployed by shareholders to mitigate this conflict to align the interests of mangers with those of the shareholders.

Based on the agency theory, Jensen and Meckling (1976) propose the convergence- of-interest hypothesis. It suggests that when corporate ownership and management are separated, managers, in the pursuit of maximizing self-interests, may incur perquisite consumption or make sub-optimal decisions for the entire firm that damages

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Contribution of this paper to the literature

- This study applies AHP technique to provide a more reasonable basis of analysis for the selection of value driving factors of intellectual property, and so it helps to simplify the analysis model of intellectual property.
- Research results can be offered to corporate management for improving operational performance, and as a basis of management decisions.
- Research results can provide a basis for adjusting management decisions for the management across different industries.

corporate value. It indicates that the best way to solve this agency problem is to increase the equity stake of managers. When management equity ownership is higher, the losses generated by their perquisite consumption and sub-optimal decisions will be mostly taken by managers themselves. Thus managers are less likely to make decisions that negatively affect corporate value, the objectives of managers and shareholders will tend to align, and so interests and costs can converge, and the corporate performance will improve and positively affect corporate performance. This hypothesis is widely supported by subsequent studies (Demsetz and Villalonga, 2001).

When managers increase equity stake, shareholder controls on them will diminish accordingly. Jensen and Ruback (1983) propose the conflict of interest hypothesis, arguing that based on the consideration of their own job security, managers may perform some anti-takeover behavior. When managers' shareholding reaches a certain proportion, in order to consolidate their power, they may take actions to harm shareholders' wealth by controlling corporate decisions. Furthermore, due to the increase in their shareholding fraction, the threat of being dismissed is considerably reduced, worsening such situation and negatively affecting corporate performance. This conclusion is supported by subsequent studies (Fan and Wong, 2002).

Morck et al. (1988) propose that both hypotheses exist within the corporation. Empirical results (Morck et al., 1988) show that there is non-linear relationship between corporate ownership structure and performance. When insider ownership ratio is less than 5%, the two are related positively, increasing corporate performance and conforming with the convergence of interest hypothesis; when insider ownership ratio is in the range of 5% to 25%, a negative relation occurs, decreasing corporate performance and conforming with the conflict of interest hypothesis; when insider ownership ratio is greater than 25%, positive relation is restored.

As the era of knowledge economy arrives, the profitability basis for traditional land- and labor- capital intensive firms has become increasingly less competitive. In recent years, it is replaced by a highly valued resource of new corporate competitiveness, namely "Intellectual Capital." The term intellectual capital was first used by economist Galbraith in 1969. As we all know, the value creation process of intangible assets and knowledge management is the key to success in knowledge- based industries, especially in high-tech industries. Many researchers also argue that these industries mainly take advantage of widely used intellectual capital (Tseng and James Goo, 2005). The value creation process in research and development, capital expenditure, and marketing expenditure is noticeably characteristic of these industries. Most of the previous studies in intellectual capital have proven that intellectual capital is the driving factor on the promotion and creation of success (or failure) in business operations, positively affecting corporate performance or corporate value. Previous studies have shown that ownership structure will affect corporate investment, further affecting corporate performance, especially in high-tech industry (Chan et al., 1990; Cho, 1998). Therefore, observing the role of different value driving factors of specific intellectual capital in the basic relationship between ownership structure and corporate performance can assist the construction of an intellectual capital model that affects firm's management decisions, and offer a definitive direction toward firm's value creation.

Most prior studies only explore the relationship between ownership structure and corporate performance, or the relationship between intellectual capital and corporate performance, without considering the corporate life cycle stage and characteristic of individual industries, thus causing a discrepancy in performance assessment. By means of the relevant information of value creation provided by intellectual capital, this study further verifies the basic relationship between ownership structure and corporate value, and the persistence of relationship. The sensitivity of ownership on performance is not only assumed to be different across different industries, it may also produce significant changes to different value driving factors of intellectual capital. Based on such a concept, this study further examines on whether the impact of ownership structure, value driving factors of intellectual capital and corporate performance will be different alongside different life cycle stages and across different industries.

LITERATURE REVIEW AND RESEARCH HYPOTHESES

In financial literature, the discussion on ownership structure and corporate performance has received substantial attention, but without a consensus. Many previous studies have indicated that the causality between insider ownership and performance is mainly based on the assumption that ownership is exogenous. Some studies

supported the existence of linear relationship (Lichtenberg and Pushner, 1994) while some others demonstrated the existence of non-linear relationship (McConnell et al., 2008). On the other hand, Pound (1988) proposes three hypotheses on the relation between institutional investor ownership and firm's operational performance: efficient monitoring hypothesis (that helps to increase firm value), conflict of interest hypothesis (that reduces firm value), and strategic alignment hypothesis (that damages firm value); these hypotheses are widely supported by subsequent studies (Faccio and Lasfer, 2000). In relevant literature, there are also studies focusing on the issue of ownership endogeneity, arguing that the ownership structure of a corporation is determined endogenously. In this process, the level of insider ownership and corporate performance are the outcome of market forces that can maximize shareholders' interest. This kind of endogenous ownership has also been supported by many empirical studies, suggesting that there is no systematic relation or reverse causality between ownership and performance (Kapopoulos and Lazaretou, 2007). According to Demsetz and Villalonga (2001), conflicting results in ownership structure and corporate performance may be caused by the choice of variable definitions, variation in sampling period, difference in statistical methods, and whether ownership structure is treated as an endogenous variable in these studies. To further understand how ownership structure affects corporate performance, Chan et al. (1990) and Cho (1998) research on the relationship between corporate investment and corporate performance. Empirical results show that investment positively affects corporate performance. They discover that stock price reaction to the increase in planned capital expenditure is a positive correlation; while it is a negative correlation to the decrease in planned capital expenditure. The study of Chan et al. (1990) also suggests that stock price shows a significant positive effect on R&D expenditure. Cho (1998) assumes that corporate investment affects corporate performance, which in turn affects ownership structure.

On the definition of intellectual capital, as the focus of each individual is different, user characteristics have to be identified in order to appropriately define intellectual capital. Effective management of knowledge economy and intangible assets can mitigate the difference between firm's market value and book value, especially in knowledge-oriented industries. This gap is often called intellectual capital (Tseng and James Goo, 2005). Most studies explore the impact of intellectual capital on organizational performance by addressing some indicators to the management of intellectual capital (Mavridis, 2005). Researches on intellectual capital mostly prove that intellectual capital is the driving factor to drive and create firm's operational success (or failure), positively affecting corporate performance (Johanson et al., 2001).

Due to the fact that intellectual capital cannot be specifically quantized, and fully described, together with the fact that it covers a rather broad scope, researchers define intellectual capitals differently, leading to the difference in the view of the components of intellectual capital by different researchers. Most researchers split intellectual capital into three component perspectives: human capital, structural capital and customer capital (Kamath, 2008); whereas sufficiently large amount of literature emphasizes on the importance of knowledge economy to organizational innovation, and split it into four component perspectives: human capital, innovation capital, process capital and customer capital (Hurwitz et al., 2002). This study applies the four perspectives, human capital, innovation capital, process capital and customer capital to explore the impact on corporate performance.

As corporate characteristics change with time, this study not only assumes that the sensitivity of ownership on performance may be different for different corporations, but also assumes that different changes may be experienced in different life cycle stages. The corporate life cycle model is developed based on the concept of product life cycle. Each stage may correspond to appropriate corporate target strategy, plan, organization, technology, control, and even culture (Ramaswamy et al., 2008). According to the life cycle stages experienced by products, a company can also be categorized as an appropriate life cycle stage (Black, 1998). Prior researches are already using the concept of corporate life cycle, but it is usually applied to the analyses of operational strategy and performance (Black, 1998). Recently, Ramaswamy et al. (2008) studies the relationship between corporate life cycle and corporate governance characteristics. Based on the mentioned literature basis of life cycle, and anticipating that a difference in corporate life cycle stage will affect the relationship between ownership structure variables and corporate performance, this study classifies the observation values into three stages, including growth, maturity and decline, by using various financial indicators and company's age (Black, 1998).

Based on the aforementioned theoretical exposition, this study attempts to develop the interrelationship between ownership and performance under different life cycle stages (growth, maturity and decline stage) and across different industries (traditional industries and high-tech industries), and value driving factors of intellectual capital. In accordance with the agency theory, concentrated ownership will mitigate agency problem. In other words, higher insider ownership implies a larger share in losses. Thus, a higher insider ownership benefits an increase in corporate performance, and experiences different changes in different life cycle stages. Therefore the hypothesis is proposed as follows:

H1: Positive correlation is shown between insider ownership structure and corporate performance. The effect is more pronounced among firms in the growth stage.

In addition to insider ownership structure, prior studies have shown that corporate investment also affects corporate performance, further affecting ownership structure, especially in high-tech industries. So, observing the role of various specific value driving factors of intellectual capital in the relationship between ownership structure and corporate performance will be helpful in constructing the intellectual capital model that affects firm's management decisions, and provide a clear direction for firm's value creation. Thus, these hypotheses are as follows:

H2: Intellectual capital proxies show positive correlations with corporate performance.

H3: Intellectual capital proxies show correlations with corporate performance. The effect is more pronounced in high-tech industries.

To extend the scope of research, this study adopts a dynamic approach to test the persistence of relationship between ownership and corporate performance. The entire research period is sub-divided into the first period (2002-2006) and the second period (2007-2011), in order to examine the correlation in different life cycle stages and periods. Assuming that no unusual institutional changes occur, the impact of ownership on performance will not change over time. Thus, these hypotheses are as follows:

H4: When a firm in a certain life cycle stage in the first period enters the same stage in the second period, the correlation of the measured values of ownership structure and intellectual capital to corporate performance should be persistent.

H5: When a firm in a certain life cycle stage in the first period enters the same or different stage in second period, the correlation of the measured values of ownership structure and intellectual capital to corporate performance should be persistent.

RESEARCH DESIGN, VARIABLE DEVELOPMENT AND MODEL DESIGN

Taking into account the differences in corporate life cycle stages, will the impact of ownership structure and intellectual property proxy to corporate performance change? Will this effect be consistent in different industries and across different periods? This study targets Taiwan's publicly listed companies in the ten years from 2002 to 2011. Associated institutions with special financial characteristics and those with insufficient data are eliminated. Eventually an unbalanced panel data of 630 firms and 4,313 firm-year observations are obtained. Information for variables and relevant data are obtained from the Taiwan Economic Journal Databank (TEJ), company annual reports and prospectuses of listed companies in the stock exchange, and market observation post system etc. The high-tech industries in this research refer to the classification of Hsinchu Science Park. In accordance with Article 3 of the Act For Establishment And Administration Of Science Parks, industries belonging to integrated circuits, computer and peripheral equipment, communications, photoelectricity, precision machinery and biotechnology (six major industries) categories are called high-tech industries. Other manufacturing categories are collectively called traditional industries.

Empirical studies suggest that the contents of corporate intellectual property are difficult to quantize and more suited to in-depth interviewing of qualitative research. The analytic Hierarchy Process (AHP) is developed by a professor of University of Pittsburg, United States of America. In 1971, Professor Thomas L. Saaty proposed a systematic solution to complex problems, mainly applied to uncertain situations and the problem of multi-criteria decision making. This study combines theory and experience in actual interviews in conjunction with expert questionnaire design. By deploying analytic hierarchy process, the weightings of the impacts of intellectual property on firm's operational performance are verified one-by-one. Choice of priority is thus obtained for individual measured indicator of intellectual property, which is expected to provide corporate operators with sufficient information for choosing suitable solutions based on objective results, while reducing the risk of decision making error. Items of high weighted priorities will be separately analyzed statistically in order to further develop the role of intellectual property in the interaction process of governance mechanism and ownership structure with corporate value. For the convenience of consolidated analysis by decision makers, it is layered, structured and quantized by the group decisions of those specialized or highly experienced in this field (Saaty, 2005).

(1) Definitions and descriptions of specific measurement indicators of each intellectual property perspective

This study chooses specific measurement indicators of each intellectual property perspective that are frequently mentioned (Bukh et al., 2001) to measure intellectual property proxy indicators. Paired comparison using AHP technique is first applied by 20 relevant scholars and researchers (including representatives of traditional industries and high-tech industries) to obtain relevant value driving factors of intellectual property that affects firm's operational performance. Then multiple regression model for the correlation between ownership structure and performance is applied. (*The definitions and descriptions of the specific measurement indicators of each intellectual capital perspective see* **Table 1**)

Table 1. Definitions and descriptions of the specific measurement indicators of each intellectual capital perspective

Intellectual capital perspective	Variable name	Definition and description
Human capital	Salary remuneration of each employee	Salary and other personnel cost/total number of employees
	Years served by employee	Total number of years served by firm's employees / total number of employees
	Employee training hours	The number of hours of training to each employee
Innovation capital	Research and development spending	Net balance of firm's research and development spending / sales
	Deflated number of patents	Firm's number of approved patents/median of patents in the industry
	Growth rate of capital revenue	The ratio of net sales revenue deducting the net revenue of previous year, and then divided by the net revenue of previous year
Customer capital	Marketing expenditure	The sum of marketing advertisement fees in operating cost
	Number of major customers	Number of customers with higher than 10% of firm's sales
	Market share	The percentage of sales revenue to (gross) industry revenue
Process capital	Capital expenditure	Firm's capital expenditure
	Total asset turnover	Net revenue/total asset
	Fixed asset turnover	Net revenue/fixed asset

(2) Sample observation values of categorized corporate life cycle

This study not only assumes that the sensitivity of ownership structure to performance is likely to vary due to different firms, but it is also likely to undergo different changes across different life cycle stages. Lewis and Churchill (1983) propose that ownership structure and corporate performance will change in accordance with the establishment age and scale. According to the regulations of Taiwan Stock Exchange, a company can only be listed at least one year after establishment. Therefore this research excludes firms at start-up stage. All sample observation values are categorized in three stages: growth, maturity and decline. A total of 944 companies belong to the growth stage, 2,514 companies belong to the maturity stage, and 855 companies belong to the decline stage. In addition to marketing expenditure, firm age (YL) and multiple financial indicators are used to classify these firm-year observation values into one of the three life cycle stages. To measure the intellectual property proxies, paired comparison using AHP technique is first applied by 20 scholars and researchers to obtain relevant value driving factors of intellectual property that affects firm's operational performance. This research uses four variables: research and development expenditure (RS), capital expenditure (CA), marketing expenditure (MK) and asset increase (AS). On average, in accordance with the analysis of multiple financial indicators, sales growth (SG) is usually higher in the growth stage. At the same time, firms in this stage are likely investing more in marketing expenditure (MK) and capital expenditure (CA), forcing companies to apply more conservative dividend policies to keep more funds. However, in the stages of maturity and decline, capital and marketing expenditures gradually decrease along with reduced sales growth rates, enabling companies to pay higher dividends. *(**Tables 2** and **3** show the detailed characteristics of all indicators and measurement methods. **Tables 4** to **6** show the mean of the life cycle stage indicators and the analysis of variance, organized in the order of full sample, the traditional firms and high-tech firms. Results show that the reliability of the life cycle classification method is quite high. Companies in the growth stage have the highest mean sales growth rate, capital expenditure rate and marketing expenditure rate, and the lowest dividend rate and firm age. It shows that the categorization of these samples is well matched to the characteristics of the three life cycle stages. see **Table 2** and **6**)*

Table 2. Definition of life cycle indicator variables and measurement categorization

Indicator variable	Definition	Measurement	Score
Years of firm life (YL)	The growth stage usually occurs early in the life cycle	Measured as the difference between the current year and the year the business was incorporated	2 if in top 33% 1 if in middle 33% 0 if in bottom 34%
Sales growth rate (SG)	A growth firm usually has higher sales growth rate	The growth rate of net sales	0 if in top 33% 1 if in middle 33% 2 if in bottom 34%
Dividend payout rate (DP)	A growth firm likely applies more conservative dividend policies to keep more funds	The cash dividend of common stock divided by accounting earnings before extraordinary items	2 if in top 33% 1 if in middle 33% 0 if in bottom 34%
Capital expenditure rate (CA)	A growth firm will likely invest in higher capital expenditure	Capital expenditure divided by total asset	0 if in top 33% 1 if in middle 33% 2 if in bottom 34%
Marketing expenditure rate (MK)	A growth firm will likely invest in higher marketing expenditure	The marketing expenses divided by net sales revenue	0 if in top 33% 1 if in middle 33% 2 if in bottom 34%

Table 3. The characteristics of life cycle indicator variables

Indicator variable	Growth stage	Maturity stage	Decline stage
Years of firm life (YL)	Young	Adult	Old
Sales growth rate (SG)	High	Moderate	Low
Dividend payout rate (DP)	Low	Moderate	High
Capital expenditure rate (CA)	High	Moderate	Low
Marketing expenditure rate (MK)	High	Moderate	Low

Note: Years of firm life is measured as the difference between the current year and the year the business was incorporated; sales growth rate (SG) is the growth rate of net sales; dividend payout rate (DP) is the cash dividend of common stock divided by accounting earnings before extraordinary items; capital expenditure rate (CA) is the capital expenditure divided by total asset; marketing expenditure rate (MK) is the marketing expenses divided by net sales revenue.

Table 4. The ANOVA-test of life cycle indicator variables in mean (full sample)

Indicator variable	Growth stage	Maturity stage	Decline stage	ANOVA Test
Years of firm life (YL)				
2002-2006	18.22	24.15	32.02	
2007-2011	19.23	26.11	32.48	
2002-2011	19.19(Young)	25.43(Adult)	32.28(Old)	***
Sales growth rate (SG)				
2002-2006	0.52	0.21	0.05	
2007-2011	0.21	0.07	0.02	
2002-2011	0.35(High)	0.14(Moderate)	0.03(Low)	***
Dividend payout rate (DP)				
2002-2006	0.41	1.52	2.81	
2007-2011	0.89	2.11	3.69	
2002-2011	0.71(Low)	1.91(Moderate)	3.38(High)	***
Capital expenditure rate (CA)				
2002-2006	0.36	0.28	0.19	
2007-2011	0.37	0.24	0.11	
2002-2011	0.36(High)	0.26(Moderate)	0.15(Low)	***
Marketing expenditure rate(MK)				
2002-2006	0.09	0.05	0.02	
2007-2011	0.07	0.06	0.03	
2002-2011	0.08(High)	0.05(Moderate)	0.03(Low)	***

Note: *, ** and *** denote the significance at the 10%, 5% and 1% level, respectively.

Table 5. The ANOVA-test of life cycle indicator variables in mean (traditional industries)

Indicator variable	Growth stage	Maturity stage	Decline stage	ANOVA Test
Years of firm life (YL)				
2002-2006	25.08	29.51	39.01	
2007-2011	26.46	33.89	41.33	
2002-2011	26.08	31.22	40.45	***
Sales growth rate (SG)				
2002-2006	0.75	0.18	0.03	
2007-2011	0.79	0.07	0.03	
2002-2011	0.76	0.13	0.03	***
Dividend expenditure rate (DP)				
2002-2006	0.47	1.90	3.64	
2007-2011	1.13	2.68	4.39	
2002-2011	0.86	2.37	4.19	***
Capital expenditure rate (CA)				
2002-2006	0.47	0.36	0.28	
2007-2011	0.37	0.29	0.19	
2002-2011	0.42	0.33	0.27	***
Marketing expenditure rate (MK)				
2002-2006	0.13	0.07	0.03	
2007-2011	0.11	0.08	0.04	
2002-2011	0.12	0.08	0.03	***

Note: *, ** and *** denote significance at 10%, 5% and 1% level, respectively.

Table 6. The ANOVA-test of life cycle indicator variables in mean (high-tech industries)

Indicator variable	Growth stage	Maturity stage	Decline stage	ANOVA Test
Years of firm life (YL)				
2002-2006	11.91	17.39	23.77	
2007-2011	13.45	19.88	24.56	
2002-2011	12.89	18.98	24.47	***
Sales growth rate (SG)				
2002-2006	0.47	0.29	0.16	
2007-2011	0.17	0.09	0.04	
2002-2011	0.29	0.18	0.07	***
Dividend payout rate (DP)				
2002-2006	0.36	0.87	1.78	
2007-2011	0.89	1.78	3.54	
2002-2011	0.71	1.49	2.96	***
Capital expenditure rate (CA)				
2002-2006	0.36	0.25	0.13	
2007-2011	0.35	0.17	0.11	
2002-2011	0.35	0.20	0.12	***
Marketing expenditure rate (MK)				
2002-2006	0.06	0.05	0.03	
2007-2011	0.07	0.04	0.04	
2002-2011	0.07	0.05	0.03	***

Note: *, ** and *** denote significance at 10%, 5% and 1% level, respectively.

Variable development: This research uses industry-adjusted return on asset (IRA) to measure the corporate performance proxy. Major ownership structure variable is the insider ownership rate (OWN). This research defines insiders as the company's directors, supervisors, managers and major shareholders; and insider ownership rate is the sum of the ownership rates of the aforementioned people. This study also uses the square of insider ownership rate (OWN^2) to test whether non-linear relationship exists between ownership and performance (McConnell et al., 2008).

On control variables, this research incorporates firm size and debt ratio as control variables. Intellectual property and corporate efficiency are commonly believed to be higher when firm size is larger. So, this study uses the natural logarithm of total assets to control for firm size (Himmelberg et al., 1999). Furthermore, to control for firm's financial leverage, this research uses liabilities to equity ratio to control for long-term financial structure proxy. Agency conflicts theory explains that the possibility of lessening agency conflicts can be achieved through

Table 7. Variable name, symbol and measurement method

Variable name	Variable symbol	Measurement method
Performance variable		
Industry-adjusted return on assets	IRA	ROA minus the industry mean ROA
Ownership variable		
Insider ownership ratio	OWN	Insider held shares/company's outstanding shares
Intellectual property proxies		
Research and development expenditure rate	RS	Research and development expenses/net sales revenue
Capital expenditure rate	CA	Fixed asset expenditure/total asset
Marketing expenditure rate	MK	Marketing expenses/net sales revenue
Asset growth rate	AS	Change in total asset/total asset
Control variables		
Firm size	SIZ	Natural logarithm of total asset
Liabilities to equity ratio	LIA	Total liabilities/total equity

additional monitoring by creditors, which may increase corporate performance. Study of Myers (1977) suggests that when a company needs fund, managers will finance through internal fund first, and then debt, finally issuing new shares, according to the pecking order theory. Hence, there is a negative relationship between debt levels and corporate performance. The previous studies (Jensen et al., 1992; Moh'd et al., 1998) also reach the same conclusion. This research uses panel data so that unobservable company characteristics and the differences between individual companies can be more easily controlled. To ascertain whether "multicollinearity" exists, this study calculates correlation coefficients between specific variables, that is, the variance inflation factor (VIF). Determined by empirical method, multicollinearity does not occur. *(see* **Table 7** *lists the names, symbols and measurement methods of variables in the model).*

Model design: To assess the relationship between ownership and performance, a least regression model is fist constructed. For robust analysis, the fixed effects model of panel data is used. In model (1), industry-adjustment of firm is a function of measured values of insider ownership and intellectual property proxies, emphasizing on testing the relationship between ownership and performance across life cycle stages over the period of 2002 to 2011. To estimate the impact within the period, model (2) uses the product of insider ownership and intellectual property proxies. Furthermore, model (3) uses Granger causality test as a robust analysis to examine the causality between ownership and performance. Then lagged regression specifications are applied to alleviate potential simultaneity issues. Potential "multicollinearity", "autocorrelation" and "heteroscedasticity" considerations have been taken into account in these regression models. Actual facts show no occurrence of these problems.

$$IRA = \beta_0 + \beta_1(OWN)^2 + \beta_3(CA) + \beta_5(MK) + \beta_6(SIZ) + \beta_7(LIA) + \beta_8(AS) + \varepsilon \quad (1)$$

$$IRA = \beta_0 + \beta_1(OWN) + \beta_2(OWN)^2 + \beta_3(OWN) * (RS) + \beta_4(OWN) * (CA) + \beta_5(OWN) * (MK) + \beta_6(SIZ) + \beta_7(LIA) + \beta_8(AS) + \varepsilon \quad (2)$$

$$IRA = \beta_0 + \beta_1\big(OWN(-1)\big) + \beta_2\big(OWN(-1)\big)^2 + \beta_3\big(OWN(-1)\big) * \big(RS(-1)\big) + \beta_4\big(OWN(-1)\big) * \big(CA(-1)\big) + \beta_5\big(OWN(-1)\big) * \big(MK(-1)\big) + \beta_6(SIZ) + \beta_7(LIA) + \beta_8(AS) + \varepsilon \quad (3)$$

ANALYSIS OF EMPIRICAL RESULTS

This survey applies analytical hierarchical process method, aiming at understanding the priorities of the correlation between intellectual property perspectives and performance. After first consulting experts, a hierarchy is created by applying the concept of AHP. A questionnaire is composed with it. Then participating experts undergo actual assessment and fill in the survey. After that, the relative importance of each item relative to the corresponding item of previous hierarchy level is assessed in each level. The weighting factor between items is calculated based on that. Finally, weighting factors of each item in every level are combined to calculate the total score of measurement indicator under the four perspectives and their respective items. A higher score means a higher importance, or should have a higher priority. Through the 20 effective expert surveys by this study, it is realized that the major order in the impacts on industry operational performance is innovation capital, customer capital and structural capital. If the assessment indicators of the perspectives are combined to analyze in details, the four highest weightings are (in order of magnitude) research and development expenditure, capital expenditure, marketing expenditure and asset growth rate. Statistical assessment of analytical hierarchical process method mainly analyzes the consistency index (CI) and consistency ratio (CR) at all levels such that CR=CI/RI. If CR<0.1, the entire judgment assessment process reaches a satisfactory level, and the result of analysis conforms with testing

Table 8. OLS regression results of different life cycle stages, ownership and intellectual property proxies to performance

Dependent variable: IRA Independent variable:	Full sample		Growth companies		Maturity companies		Decline companies	
	pooled OLS	OLS (multiplied)	pooled OLS	OLS (multiplied)	pooled OLS	OLS (multiplied)	pooled OLS	OLS (multiplied)
OWN	0.081***	0.077***	0.057	0.072**	0.066***	0.060***	0.093*	0.092*
	(5.560)	(5.231)	(1.554)	(1.979)	(3.716)	(3.341)	(1.954)	(1.869)
RS	-0.008*		-0.085***		-0.004		-0.052	
	(-1.868)		(-3.173)		(-0.975)		(-1.468)	
CA	0.011***		0.009		0.015***		0.026***	
	(3.912)		(1.294)		(4.014)		(2.709)	
MK	-0.027***		-0.029***		-0.016**		-0.119***	
	(-4.783)		(-2.619)		(-2.256)		(-4.628)	
OWN*RS		-0.027**		-0.200***		-0.041		-0.113
		(-2.146)		(-3.026)		(-0.939)		(-1.298)
OWN*CA		0.021***		0.019		0.026***		0.067***
		(2.891)		(1.285)		(3.145)		(2.966)
OWN* MK		-0.035***		-0.070**		-0.024		-0.255***
		(-3.233)		(-2.427)		(-1.611)		(-3.783)
SIZ	0.002***	0.013***	0.001*	0.001*	0.001***	0.002***	0.002***	0.002***
	(4.986)	(4.260)	(1.889)	(1.828)	(3.181)	(3.361)	(3.299)	(3.267)
LIA	-0.003***	-0.004***	-0.003***	-0.003***	-0.003***	-0.003***	-0.011***	-0.012***
	(-9.237)	(-5.145)	(-4.223)	(-4.160)	(-6.570)	(-6.444)	(-6.012)	(-6.147)
AS	0.057***	0.051***	0.064***	0.064***	0.069***	0.069***	0.029***	0.029***
	(27.967)	(23.560)	(14.287)	(14.300)	(23.857)	(23.786)	(8.070)	(8.207)
Observations	4,313	4,313	944	944	2,514	2,514	855	855
Adjusted R-squared	0.301	0.256	0.336	0.335	0.331	0.329	0.258	0.252

Note: In the brackets under the coefficients in T-statistics table, *, ** and *** denote significance at 10%, 5% and 1% levels, respectively.

standard. On the other hand, the significance and importance of each intellectual property perspective to performance can be obtained through regression data.

Using verified results, this paragraph answers the proposed hypotheses. Under the moderating effect of intellectual property proxies, will the impact of ownership on corporate performance change alongside different life cycle stages? Will these effects persist over time? Will these effects change across different industries?

(1) The impact of different life cycle stages and intellectual property proxies on corporate performance

In this part, this research establishes the statistical results on the impact of ownership on performance. This study has also considered non-linear relationship proposed by McConnell and Servaes in 1990. The dependent variable is industry- adjusted ROA, abbreviated as IRA, which is the ROA of a firm deducted by the mean ROA of the firms in the same industry. Independent variable is insider ownership rate (OWN), firm size (SIZ), liabilities (LIA), research and development (RS), marketing expenditure (MK) and asset growth (AS). These models are applicable to the entire sample, companies in growth, maturity and decline stages. Columns 1, 3, 5 and 7 in **Table 8** report the relevant results of the respective life cycle stages.

The coefficient of insider ownership concentration (OWN=0.081) is at 1% significance level, and it correlates positively with corporate performance (t=5.560). This result is consistent with the causality interpretations of general literature, conforming with the expectation of H1. One point worth noting, on the other hand, is that intellectual property proxies including RS, CA and MK are becoming more and more important in the value creation process of firms. A positive correlation is expected between intellectual property proxies and performance. However, empirical results show that the coefficients on RS, CA and MK are significant to the entire sample, but the values are different: CA has positive coefficient at 0.011, but both RS and MK have negative coefficients. This is different from the expectation of this research.

To develop the importance of life cycle, this research divides the full samples into growth, maturity and decline companies. There are totally 944 companies with observation values belonging to growth stage, 2,514 belonging to maturity stage, and 855 companies belonging to decline stage. The 3rd, 5th and 7th columns in **Table 8** provide the OLS regression results of the panel data in different life cycle stages. Although the coefficients of insider ownership in maturity and decline stages are positive and significant, at (0.066, t=3.716) and (0.093, t=1.954) respectively, the coefficient in growth stage is only 0.057, showing a positive but not significant relationship with performance. This suggests that the impact of insider ownership on performance gradually increases along with life cycle stages from growth to decline. On intellectual property proxy, MK has a significantly negative coefficient across all life cycle

Table 9. OLS estimates of ownership and intellectual property proxies versus corporate performance in different life cycle stages, and across different industries

Dependent variable: IRA	Full sample		Growth companies		Maturity companies		Decline companies	
Independent variable:	Traditional	High-tech	Traditional	High-tech	Traditional	High-tech	Traditional	High-tech
OWN	0.031*	0.411***	0.0196	0.143**	0.028	0.096***	-0.004	0.229***
	(1.248)	(5.235)	(0.380)	(2.247)	(1.328)	(3.287)	(-0.142)	(3.666)
OWN*RS	-0.018	-0.041*	-0.032	-0.152*	-0.015	-0.090*	-0.216	-0.100
	(-1.313)	(-1.970)	(-0.139)	(-1.790)	(-1.073)	(-1.694)	(-1.570)	(-0.791)
OWN*CA	0.008	0.024**	0.014	0.032	0.011	0.020	0.056**	0.028
	(0.881)	(2.453)	(0.771)	(1.274)	(1.163)	(1.342)	(2.327)	(0.543)
OWN* MK	-0.037*	-0.087***	-0.099***	-0.039	-0.023	-0.108***	-0.049	-0.395***
	(-1.927)	(-2.902)	(-3.211)	(-0.713)	(-1.596)	(-2.737)	(-0.642)	(-3.799)
SIZ	0.002***	0.003***	0.003**	0.002*	0.001*	0.003***	0.002**	0.004***
	(3.661)	(2.711)	(2.074)	(1.702)	(1.863)	(3.604)	(2.278)	(2.807)
LIA	-0.003***	-0.006***	-0.007***	-0.001	-0.001***	-0.025***	-0.008***	-0.021***
	(-7.109)	(-8.777)	(-6.604)	(-1.290)	(-4.006)	(-13.224)	(-4.069)	(-5.955)
AS	0.080***	0.056***	0.098***	0.060***	0.076***	0.071***	0.059***	0.026***
	(21.781)	(19.776)	(11.105)	(10.549)	(15.327)	(19.765)	(7.635)	(5.893)
Observations	2,055	2,258	470	474	1,344	1,170	460	395
Adjusted R-squared	0.329	0.298	0.398	0.334	0.315	0.421	0.254	0.296
F-statistic	73.112	77.442	24.229	18.926	45.427	81.678	11.033	14.477

Note: In the brackets under the coefficients in T-statistics table, *, ** and *** denote significance at 10%, 5% and 1% levels, respectively.

stages; CA has positive coefficient, but its significance is limited to those companies in maturity and decline stages; RS has negative coefficient, although only significant in growth companies.

To assess the impact of insider ownership on performance across life cycle stages, this study develops the interaction between insider ownership and intellectual property proxies in every stage. In the 2nd, 4th, 6th and 8th columns in **Table 9**, it is realized that regardless of the sign and significance of the coefficients, the results of interaction is similar to the aforementioned analysis in this research. Overall, these results suggest that CA is more prominent in the impact on performance, whereas the impact of RS and MK is relatively not important for the full sample and some life cycle stages. This does not conform with the expectation of this study, as well as hypothesis H2. This evidence also suggests that: through the moderating role of the intellectual property proxies, the concept of life cycle stages is quite important in the assessment of the impact of ownership on performance; at least it is so in Taiwan market.

On the other hand, for the control variables, this research expects that liability rate (LIA) shows positive correlation with performance, in line with proxy theory in which proxy conflicts can be alleviated by additional monitoring of creditors. However, the coefficient of liability rate, in fact, shows negative value, conforming the financing pecking order theory but in contradiction to the expectation of this research. The coefficient of company size (SIZ) is a significantly positive correlation, in terms of performance. This shows that larger companies have better performances. Other variables including capital growth rate show positive correlation with performance. On the explanatory power of each model, the adjusted R2 in the full sample, growth companies, maturity companies and decline companies are 30.1%, 33.6%, 33.1% and 25.8% respectively, with all of them at reasonable level. In comparison with similar studies, this adjustment to R2 is acceptable.

(2) The influence of ownership in different life cycle stages and intellectual property proxies on performance for different industries

To examine whether the impact of ownership on performance varies across different industries, this study further sub-divide the sample into two industries: traditional industries and high-tech industries. There are totally 2,055 and 2,258 observation values over the period from 2002 to 2011. To examine whether the impact of ownership on performance varies across different industries, **Table 9** shows the impact of the product of ownership and intellectual property proxies on performance. The results of traditional industries and high-tech industries in different life cycle stages show that, for traditional industries, the coefficients of ownership structure and intellectual property proxies are mostly not significant, including all life cycle stages. On the contrary, most of the coefficients of high-tech industries are more significant. So, for Taiwan market, the effects of ownership and intellectual property proxies seem to be more prominent in the high-tech industries, especially MK, conforming with hypothesis H3.

Table 10. Different life cycle stages, different period: the effect of ownership and intellectual property proxies to corporate performance (traditional industries)

Dependent variable: IRA Independent variable:	Full sample		Growth companies		Maturity companies		Decline companies	
	2002-2006	2007-2011	2002-2006	2007-2011	2002-2006	2007-2011	2002-2006	2007-2011
OWN	0.015	0.031	0.000	0.056	0.031	0.007	-0.043	0.016
	(0.801)	(0.937)	(0.003)	(0.808)	(1.038)	(0.250)	(-1.015)	(0.323)
OWN*RS	0.121	-0.020	-0.216	0.101	0. 166	-0.017	-0.134	-0.266*
	(1.165)	(-1.140)	(-0.702)	(0.288)	(1.138)	(-1.160)	(-0.673)	(-1.702)
OWN*CA	0. 017*	0.004	-0.003	0.032	0.031**	0.002	0. 015	0.042
	(1.702)	(0.322)	(-0.179)	(1.144)	(2.003)	(0.166)	(0.479)	(1.232)
OWN* MK	-0.102***	-.0.021	-0.085***	-0.139**	-0.114***	-0.008	-0.001	-0.147
	(-4.435)	(-1.511)	(-2.858)	(-2.550)	(-3.465)	(-0.528)	(-0.829)	(-1.298)
SIZ	0.002**	0.003***	0.001	0.003	0.002**	0.001	0.001	0.003**
	(2.311)	(2.658)	(0.346)	(1.612)	(2.247)	(1.249)	(1.178)	(2.587)
LIA	-0.007***	-0.002***	-0.011***	-0.007***	-0.007***	-0.001**	-0.020***	.-0.004
	(-8.446)	(-4.665)	(-5.317)	(-5.090)	(-6.259)	(-2.082)	(-5.967))	(-1.569)
AS	0.069***	0.086***	0.053***	0.113***	0.078***	0.073***	0.039***	0.070***
	(9.711)	(11.129)	(4.024)	(9.392)	(9.541)	(11.528)	(3.809)	(6.497)
Adjusted R-squared	0.271	0.214	0.251	0.324	0.295	0.193	0.223	0.195
F-statistic	39.733	35.538	8.518	16.422	28.921	23.662	7.567	8.727

Note: In the brackets under the coefficients in T-statistics table, *, ** and *** denote significance at 10%, 5% and 1% levels, respectively.

Table 11. Different life cycle stages, different period: the effect of ownership and intellectual property proxies on corporate performance (high-tech industries)

Dependent variable: IRA Independent variable:	Full sample		Growth companies		Maturity companies		Decline companies	
	2002-2006	2007-2011	2002-2006	2007-2011	2002-2006	2007-2011	2002-2006	2007-2011
OWN	0.079***	0.171***	0.032	0.185**	0.058*	0.110***	0.215**	0.199**
	(2.733)	(4.911)	(0.435)	(2.161)	(1.690)	(2.712)	(2.341)	(2.524)
OWN*RS	-0.012*	-0.057	-0.186*	-0.127	0.029	-0.155**	0.387	-0.077
	(-2.018)	(-0.763)	(-1.783)	(-1.063)	(0.446)	(-2.149)	(1.170)	(-0.570)
OWN*CA	0.007	0.013	-0.025	0.049	0.011	0.024	0.018	0.050
	(0.688)	(0.833)	(-0.814)	(1.405)	(0.654)	(1.048)	(0.246)	(0.703)
OWN* MK	-0.176***	-0.007	-0.102	0.008	-0.285***	-0.018	-0.328*	-0.304**
	(-4.445)	(-0.282)	(-1.321)	(0.121)	(-5.263)	(-0.362)	(-1.951)	(-2.403)
SIZ	0.003**	0.003***	0.002	0.002	0.002***	0.003***	0.002	0.002*
	(2.445)	(3.123)	(1.354)	(1.358)	(2.782)	(2.862)	(0.924)	(1.806)
LIA	-0.021***	-0.006***	-0.033***	-0.001	-0.021***	-0.026***	-0.018***	-0.024***
	(-7.381)	(-4.585)	(-4.981)	(-0.595)	(-7.786)	(-10.696)	(-3.597)	(-5.510)
AS	0.033***	0.079***	0.038***	0.085***	0.045***	0.088***	0.016***	0.101***
	(9..349)	(12.432)	(7.064)	(8.479)	(11.122)	(16..324)	(3.634)	(8.484)
Adjusted R-squared	0.266	0.229	0.314	0.250	0.346	0.323	0.205	0.397
F-statistic	33.547	43.872	10.874	13.305	31.310	54.972	5.976	16.921

Note: In the brackets under the coefficients in T-statistics table, *, ** and *** denote significance at 10%, 5% and 1% levels, respectively.

(3) The effect of ownership and intellectual property proxies in different life cycle stages on performance at different time: the dynamic design for different industries.

To broaden the scope of research, this study adopts a dynamic approach to test the persistence of relationship between ownership & intellectual property proxy variables and corporate performance. This study divides the entire research area into: the first period (2002-2006) and the second period (2007-2011), to examine the persistence of relationship between dispersed ownership and corporate performance in different life cycle stages and over different periods. **Tables 10** and **11** examine the impact in different life cycle stages and over different periods, by considering traditional industries and high-tech industries separately, and also examine whether the effect of the same company in certain life cycle stage in the first period is different from that in the same stage in the second period.

For traditional industries (**Table 10**) in all life cycle stages, although the estimated values of ownership to performance, either in the first period or second period, are relatively less important, the coefficients of intellectual property proxies (CA and MK) for the full sample in maturity stage are more important in the first period, regardless of the size and significance. In the full sample, for example, the coefficients of CA and MK in the first period are more significant. On the other hand, for high-tech industries (**Table 11**), the estimated values of ownership to performance, either in the first period or second period, are significantly positively related; the coefficients of intellectual property proxies (RS and MK) are more important in the first stage. Therefore, for Taiwan market, the effect of ownership to performance is not only a function of corporate life cycle stage, but also a function of period effect, apparently not conforming with hypothesis H5.

Robustness of Results

In this part, the sensitivity of the aforementioned results to different designs is examined, including the effect of lagged period design in examining industries in different life cycle stages and the fixed effects model of panel data, etc.

(1) Test of fixed or random effects model of panel data

In statistical point of view, two major regression models can be used to match panel data: fixed effects and random effects. Each one has its own strengths and weaknesses. So, a test is established in this study to decide whether the random effects model, fixed effects model in panel data, or ordinary least regression model, is the more suitable model. In actual application, there are 3 tests to measure the suitability of these models. They are F test, LM test and Hausman test. The formulas in this study show that fixed effect is more significant and effective. So, this study adopts the fixed effects model of panel data to undergo robustness analysis.

(2) Different life cycle stages, different industries: the impact of lagged period design of ownership and intellectual property proxies on performance

Some studies suggest that insider ownership can affect corporate value, according to causality relationship (McConnell et al., 2008), while others believe that this will neglect the problem of endogeneity, especially in the OLS model. This kind of relationship can easily lead to simultaneity bias. Thus, this study uses Granger causality test as a reference. Results show that the test results of Granger causality test in different life cycle stages have not reached a certain consensus. For robustness, this research makes ownership and intellectual property proxies lag by a period so that ownership and performance will not interact simultaneously, in order to alleviate potential simultaneity problem. Because of using lagged specifications such that ownership and some control variables are lagged by a period, and using fixed effects regression framework of panel data, 817 observation vales are lost. Therefore this table is unbalanced panel data, with only 3,496 firm-year observation values in the sample. Life cycles stages are further sub-divided into traditional industries and high-tech industries. There are totally 1,821 and 1,675 observation values respectively over the period between 2002 and 2011. The first and second rows in **Table 12** show the results of the full sample; the third to eighth rows show the results of different life cycle stages of traditional industries and high-tech industries respectively. For high-tech industries, all coefficients with ownership lagged by a period are more significant, especially in the full sample and firms in maturity stage. The intellectual property proxy, research and development (RS), is more important to the estimated value of performance, both in magnitude and significance, to high-tech industries in different life cycle stages. Capital expenditure (CA) show significant positive correlation to both high-tech industries and traditional industries. Overall, the impact of ownership and intellectual property proxies on performance is not essentially and significantly changed due to the use of different designs and measurement methods in this study. As for its explanatory power, evidence shows that adjusted R2 of the fixed effects model are at a relatively high level (around 0.3-0.5).

Table 12. Different life cycle stages, different industries: fixed effects regression estimates of lagged ownership and intellectual property proxies to performance

Dependent variable: IRA	Full sample		Growth companies		Maturity companies		Decline companies	
Independent variable:	Traditional	High-tech	Traditional	High-tech	Traditional	High-tech	Traditional	High-tech
OWN(-1)	-0.011	-0.111***	0.295*	-0.012	-0.132***	-0.148***	-0.072	0.181
	(-0.355)	(-2.748)	(1.970)	(-0.102)	(-2.967)	(-2.878)	(-1.081)	(1.522)
OWN(-1)^2	-0.030	0.119***	-0.323***	-0.042	0.087*	0.179***	0.032	-0.181
	(-0.898)	(2.704)	(-2.743)	(-0.320)	(1.731)	(2.969)	(0.441)	(-1.397)
OWN(-1)*RS(-1)	0.091	-0.238***	-0.234	-0.331**	0.037	-0.214*	0.094	0.170
	(0.592)	(-2.863)	(-0.294)	(-2.189)	(0.208)	(-1.765)	(0.337)	(0.432)
OWN(-1)*CA(-1)	0.060***	0.083***	0.001	0.039	0.065*	0.112**	0.101*	0.264**
	(2.642)	(2.664)	(0.019)	(0.440)	(1.841)	(2.374)	(1.815)	(2.200)
OWN(-1)*MK(-1)	0.016	0.056	0.074	0.233**	0.015	0.149	0.321	0.020
	(0.851)	(0.954)	(1.304)	(2.205)	(0.695)	(1.553)	(1.592)	(0.050)
SIA	-0.004	0.006**	0.006	0.003	-0.002	0.007	-0.002	0.026***
	(-1.394)	(2.205)	(0.436)	(0.356)	(-0.457)	(1.720)	(-0.277)	(2.765)
LIA	-0.003***	-0.009***	-0.004	0.007*	-0.003***	-0.026***	-0.019***	-0.026***
	(-4.544)	(-4.572)	(-1.346)	(1.982)	(-4.229)	(-7.774)	(-2.903)	(-3.214)
AS	0.077***	0.041***	0.089***	0.082***	0.084***	0.059***	0.051***	0.013**
	(14.403)	(12..910)	(5.454)	(6.237)	(11.608)	(11.912)	(4.404)	(2.467)
Adjusted R-squared	0.375	0.402	0.341	0.367	0.472	0.505	0.289	0.265
F-statistic	4.327	4.976	2.651	2.875	4.854	5.635	2.511	2.439

Note: In the brackets under the coefficients in T-statistics table, *, ** and *** denote significance at 10%, 5% and 1% levels, respectively.

CONCLUSION

Based on corporate life cycle perspective, this study examines the relationship between intellectual property, corporate ownership and corporate performance, and attempts to understand the impact of ownership on corporate performance under the moderating effect of intellectual property proxies. This research uses unbalanced panel data sample, totally 4,313 observation values from Taiwan listed companies, and uses dynamic perspective to develop the persistence of relationship between ownership structure and corporate performance. In the analysis of major results, ordinary least regression model of panel data is first used; for robustness, this research uses fixed effects model of panel data. The discoveries of this study are as follows:

Firstly, it is worth noting that intellectual proxies including RS, CA and MK are becoming progressively more important in the value creation process of corporate value. The correlation between intellectual property proxies and performance is expected to be positive; however, empirical results show that the coefficients of RS, CA and MK are significant to the full sample, but with different signs: CA has positive coefficient but RS and MK have negative coefficients. In order to assess the impact of insider ownership on performance in different life cycle stages, this study develops the interaction between insider ownership and intellectual property proxies in different stages. Overall, these discoveries suggest that CA is more prominent in the effect on performance, while the impact of RS and MK are relatively less important in the full sample and part of the life cycle stages. This evidence also suggests that through the moderating role of intellectual property proxies, the concept of life cycle is rather important in the assessment of the impact of ownership on performance, at least it is so in the case of Taiwan market. On the other hand, the impact of ownership and intellectual property proxies on performance, for Taiwan market, is relatively more prominent in high-tech industries. Secondly, in order to extend the scope of research, this study adopts a dynamic approach to test the persistence of relationship between ownership and intellectual property proxies in different stages and across different industries. For traditional industries in different life cycle stages, although the estimated values of ownership to performance are relatively less important in both the first period and the second period, intellectual property proxies (CA and MK) are more important to the full sample in maturity stage, both in size and significance. On the other hand, the estimated values of ownership to performance for high-tech industries are apparently positively correlated in both the first period and the second period, with intellectual property proxies (RS and MK) more important in the first period. Thus, for Taiwan market, the effect of ownership on performance is not only a function of corporate life cycle stages, but also a function of period effects. Thirdly, on the adoption of different designs and measurement techniques, the discoveries of this study are robust. Under the fixed effects regression model, this study makes the measurement values of ownership structure and intellectual property proxies lag by a period to alleviate potential endogeneity problem.

The results of this study can be concluded as follows:

(1) This study reviews the literature on the relationship between ownership structure and corporate performance or corporate value, and intellectual property and operation performance. Discussion based on conceptual theory and analysis methods can provide subsequent researches with further understanding in the concept of this field.

(2) To broaden the research, this study tries to develop the importance of intellectual property and the relevant value creation information it provides, in order to test the basic relationship and persistence of relationship between ownership structure and corporate performance.

(3) This study applies AHP technique to provide a more reasonable basis of analysis for the selection of value driving factors of intellectual property, and so it helps to simplify the analysis model of intellectual property.

(4) This study develops the importance of corporate life cycle. The interaction between ownership structure, intellectual property proxies and corporate performance are studied in different corporate life cycle stages. Research results can be offered to corporate management for improving operational performance, and as a basis of management decisions.

(5) This study provides a more reasonable and suitable direction of categorization for future related researches by analyzing and discussing on categorizing the sample observation values into three corporate life cycle stages.

(6) Traditional corporations in Taiwan market is usually dominated by controlling shareholder. However, high-tech industries reveal a higher demand in separating ownership and control. So, can research on ownership structure directly affect corporate performance, or indirectly affect corporate value through the mediating role of intellectual property? Are the effects consistent in traditional and high-tech industries? Research results can provide a basis for adjusting management decisions for the management across different industries.

There are also some limitations to this research, such as emphasizing on relatively neglected start-up stage of life cycle, possible use of different approaches and measurement techniques like simultaneous equation model and two stage least square methods that can more effectively tackle simultaneity problem in empirical studies. Because of the restrictions on obtaining data, many intellectual property proxies are not included. That could possibly lead to the situation that existing proxies cannot entirely represent different intellectual propertys. However, due to the rather diversified use of proxies in previous literature, it can be concluded that not all uses of proxies are correct. Thus, perhaps using too many proxies to present intellectual property cannot lead to more appropriate research results. Moreover, corporate life cycle indicators adopt modified Anthony and Ramesh (1992) method. Individual indicator, however, does not necessarily represent corporate life cycle. Also, the integrated indicator does not necessarily measure corporate life cycle stages correctly. Finally, there is little literature in exploring the relationship between corporate life cycle, intellectual property and corporate value. Thus, the theoretical basis of this study may appear to be weak. These limitations can also act as directions for further research.

REFERENCES

Berle, A. A., G. G. C. Means (1932) The modern corporation and private property. Transaction Books.

Black, E. L. (1998) Life-cycle Impacts on the Incremental Value-relevance of Earnings and Cash Flow Measures. The Journal of Financial Statement Analysis, 4(1), 40-56.

Bukh, P. N., H. T. Larsen, J. Mouritsen (2001) Constructing Intellectual Capital Statements. Journal of Management, 17(1), 87-108.

Chan, S. H., J. D. Martin, J. W. Kensinger (1990) Corporate Research and Development Expenditures and Share Value. Journal of Financial Economics, 26(2), 255-276.

Cho, M. H. (1998) Ownership Structure, Investment, and the Corporate Value: An Empirical Analysis. Journal of Financial Economics, 47(1), 103-121.

Demsetz, H., B. Villalonga (2001) Ownership Structure and Corporate Performance. Journal of Corporate Finance, 7(3), 209-233.

Faccio, M., M. A. Lasfer (2000) Do Occupational Pension Funds Monitor Companies in which They Hold Large Stakes? Journal of Corporate Finance, 6(1), 71-110.

Fan, J. P., T. J. Wong (2002) Corporate ownership structure and the informativeness of accounting earnings in East Asia. Journal of accounting and economics, 33(3), 401-425.

Himmelberg, C. P., R. G. Hubbard, D. Palia (1999) Understanding the Determinants of Managerial Ownership and the Link between Ownership and Performance. Journal of Financial Economics, 53(3), 353-384.

Hurwitz, J., S. Lines, B. Montgomery, J. Schmidt (2002) The Linkage Between Management Practices, Intangibles Performance and Stock Returns. Journal of Intellectual Capital, 3(1), 51-61.

Jensen, G. R., D. P. Solberg, T. S. Zorn (1992) Simultaneous Determination of Insider Ownership, Debt, and Dividend Policies. Journal of Financial and Quantitative Analysis, 27(02), 247-263.

Jensen, M. C., R. S. Ruback (1983) The Market for Corporate Control: The Scientific Evidence. Journal of Financial economics, 11(1), 5-50.

Jensen, M. C., W. H.Meckling (1976) Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure. Journal of Financial Economics, 3(4), 305-360.

Johanson, U., M. Märtensson, M. Skoog (2001) Measuring to Understand Intangible Performance Drivers. European Accounting Review, 10(3), 407-437.

Kamath, G. B. (2008) Intellectual capital and corporate performance in Indian pharmaceutical industry. Journal of Intellectual Capital, 9(4), 684-704.

Kapopoulos, P., S. Lazaretou (2007) Corporate Ownership Structure and Firm Performance: Evidence From Greek Firms. Corporate Governance: An International Review, 15(2), 144-158.

Lewis, V. L., N. C. Churchill (1983) The Five Stages of Small Business Growth. Harvard Business Review, 61(3), 30-50.

Lichtenberg, F. R., G. M. Pushner (1994) Ownership Structure and Corporate Performance in Japan. Japan and the World Economy, 6(3), 239-261.

Mavridis, D. G. (2005) Intellectual Capital Performance Determinants and Globalization Status of Greek Listed Firms. Journal of Intellectual Capital, 6(1), 127-140.

McConnell, J. J., H. Servaes, K. V. Lins (2008) Changes in Insider Ownership and Changes in the Market Value of the Firm. Journal of Corporate Finance, 14(2), 92-106.

Moh'd, M. A., L. G. Perry, J. N. Rimbey (1998) The Impact of Ownership Structure On Corporate Debt Policy: a Time-Series Cross-Sectional Analysis. Financial Review, 33(3), 85-98.

Morck, R., A. Shleifer, R. W. Vishny (1988) Management Ownership and Market Valuation: An Empirical Analysis. Journal of Financial Economics, 20, 293-315.

Myers, S. C. (1977). Determinants of Corporate Borrowing. Journal of Financial Economics, 5(2), 147-175.

Pound, J. (1988) Proxy Contests and the Efficiency of Shareholder Oversight. Journal of Financial Economics, 20, 237-265.

Ramaswamy, V., C. J. Ueng, L. Carl (2008) Corporate Governance Characteristics of Growth Companies: An Empirical Study. Academy of Strategic Management Journal, 7(1), 21-23.

Saaty, T. L. (2005) The Analytic Hierarchy and Analytic Network Processes for the Measurement of Intangible Criteria and for Decision-Making. In Multiple Criteria Decision Analysis: State of the Art Surveys,345-405.

Tseng, C. Y., Y. J. James Goo (2005) Intellectual Capital and Corporate Value in an Emerging Economy: Empirical Study of Taiwanese Manufacturers. R&D Management, 35(2), 187-201.