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Corporate Governance and Innovation Ability: Empirical Study of Taiwanese Electronics Manufactures

Chun-Yao Tseng[1], Zong-Jhe Wu[1] & Chun-Yi Lin[1]

[1] Department of Business Administration, Tunghai University,Taichung, Taiwan

Correspondence: Chun-Yao Tseng, Department of Business Administration, Tunghai University, Taichung, Taiwan. Tel: 886-4-2359-0121 ext 35109. E-mail: cytseng@thu.edu.tw

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Abstract

Since corporate scandals in the last decade, corporate governance system has been highly focused, besides, now under knowledge-based economy the innovation ability of enterprises is a key factor to enterprise's success. However, how the board of directors effects firms' innovation ability has been rarely explored. Generally, it is thought that corporate governance could provide functions to bring stakeholders the greatest profit and have better operating efficiency. Precious study proved that corporate governance is related to corporate performance. This study discusses the relationship between board of directors and the firm's innovation ability, including size of board directors, proportion of shareholding and traits of board of directors. By using patent counts as an index to measure a firm's innovation ability, this study examined 255 public listed electronic firms in Taiwan by using unbalanced 5 year panel data. This study adopts one way fixed effect model to evaluate parameters of model, and use F-test to examine the explanatory power of a model. Finally, this study shows how the corporate governance system affects firms' innovation ability, and provides suggestion that how corporate governance system, board directors and other traits are effective in firms innovation ability.

Keyword: corporate governance, board director, innovation, patent

1. Introduction

The term of "Corporate Governance" has variously meanings with different scholars, but on the basis concepts of supervision and prevention, it could be say as "corporate supervising" or "corporate controlling", and for the potential enhancing function it would be viewed as "corporate managing" or "corporate governance". Though the meanings are not really the same, the main concept of these is the same that through legislation for controlling and supervising corporate to prevent operation deficiency and to realize it's social responsibility. Since finance scandals emerge in an endless stream, corporate governance simultaneously has become a core issue to prevent miscellaneous falsities and improve the effectiveness of management in recent years. The discussion of corporate governance included agency problem of separation of ownership and management right (Jensen & Meckling, 1976) and of major stockholder and minor stockholder (La Porta, Lopez-de-Silanes, & Shleifer, 1999). Report of International Institute for Management Development (IMD) mentions two indicators about corporate governance, efficiency of board directors supervising ability to management and efficiency of shareholder value. Recently, Taiwan Government work hard on enhancing the efficiency of corporate governance and realize the concept and system of corporate governance.

Under the knowledge-based economy, effective management of knowledge and innovation thus has become important for corporate. Innovation ability of corporate usually is evaluated by input of research and development and new technology form foreign, moreover many studies employed patent count to examine innovation ability of corporate. Connecting with these two issues, corporate governance and innovation ability is the purpose of this study. Whether corporate governance would influence the innovation ability of corporate? For Taiwan, its innovation ability has great competitiveness in the world, and what if the difference influences with the variety type of corporate governance. That is the question this study would discuss.

The early studies had proved that innovation ability has positive influence on the operation performance, and some prior research confirmed that the board effectiveness is significantly related financial performance (Payne, Benson, & Finegold, 2009), therefore, this study wonders about whether board effectiveness would influence innovation ability. For Taiwan, innovation ability is very important, especially for electronic information

industry. In this study, an indicator evaluates the innovation ability of enterprises is patent count. To reveal the market value of the expenses of research and development activities, many studies utility patent count to evaluate the potential growth of technology and innovation. Comparing expenses of research and development activities with patent count, patent count contains more information about research and development activities and could evaluate the market value of innovation well (Deng, Lev, & Narin, 1999). Patent count also could connect the output of research and development activities and further innovation or relative technology. Due to the hided information behind the patent count, patent count reflects the real technology ability more clearly, and it assists to solve the information asymmetry problem. Even in the early innovation stage, investors could understand the innovation ability of an enterprise through patent information. Therefore, this study discuses how the trait of broad directors, size of board directors, the proportion of shareholding, and structure of the board, influences the innovation ability, that is, this study would investigate the relationship between corporate governance and innovation ability.

Above all, there three purposes of this study: (1) Relationship between size of board directors and innovation ability; (2) Relationship between proportion of shareholding and innovation ability; (3) Relationship between trait of board of directors and innovation ability.

2. Theoretical Framework and Research Hypothesis

2.1 Corporate Governance

According to OECD (1999), corporate governance refers to manage the firm, managers, directors and stakeholders, and the firm also can achieve the operation goal through this mechanism. OECD (2004) made more clear definition that corporate governance is guides of management, and it should be promoted. There are many theories to illustrate corporate governance. Aguilera (2005) though that corporate governance could provide functions to ensure stakeholders having the greatest profit and working efficiency. Agency Theory argued that shareholder possesses the right, but unable to have an influence to firm's operation policy. However, managers own the power of operation and their wealth is tied to the financial performance of the firm, and then they become averse to investing in risky projects that could enhances productivity progressive, such as R&D investment (Bulan, Sanyala, & Yanb, 2010), thus it causes agency problems that separated the power of firm and managers and cause the firm fail to achieve the goal of maximizing shareholder's profit (Berle & Means, 1932; Jensen & Meckling, 1976) or promote activities that could positively impact productivity but is inherently risky (Aghion, Van Reenen, & Zingales, 2009).

While a firm with dispersed shareholding and then the manager has less shareholding, what the manger does might be not for increasing firms performance but for their own benefit, and that hurt minor stockholder. Furthermore, La Porta et al. (1999) proved that many public companies control the board of directors through pyramid structure and intersecting holdings, and this might be caused the loss of minor stockholder and the agency cost of moral hazard and adverse selection.

For human resource scholar, in order to maintain competitiveness in knowledge-based economics, a firm has to develop particular innovation or creation of its products and services which is rare, hard to substitute, and could be only transmitted in its own organization. In addition, the labor variety could be more creative for the organization and the ability of solving problem would be better (Van der Zahn, 2004). Under the different concept, scholars could examine the variety of board directors and the connection of corporate performance with different construction, like board directors with internal and external. Recently, the background, gender and race, has already been a special issue for corporate governance (Cadbury, 1992; Higgs, 2003). The early study Van der Zahn (2004) investigated for South Africa had proved that the gender and the race of board of directors would influence the corporate performance of intellectual capital.

2.2 Innovation Ability

It could say that innovation is a new ability produced form existing resource to create profit. Innovation makes the existing resource derive new benefits, and the goal of innovation is push new products, process, or services to the market. Moreover, it is might be a new way for corporate to developing (Schumpeter, 1942). Acs, Anselin, & Varga (2002) commended examination of innovation ability might have two main way, from innovation input and output, separating from the process of innovation investment and produce. Generally, examinations of innovation input include expense of research and development, researchers and their quality. For the examinations of innovation output, it includes patent count, number of new products, the success of new product, and the patent revenues. Lau (1998) commended research and development activities of corporate are the most important investment to continuously improve and enhance the existing products and processes. In early, expense of research and development was first adopted to examine the innovation ability while information of

research and development expense has been recorded on financial reports and easily acquired. Overall, evaluation of research and development, such as expense of research and development, is closed to the evaluation of innovation ability. Expense of research and development is usually viewed as the input of technology ability (Griliches, 1990), since financial resource investing is the first stage to create new products or development new technology. However, there exists some problems, firstly, the uncertainty of research and development is high, and creating new product or new process takes a long time form investment to the market (Hall & Bagchi-Sen, 2002). Secondly, the output of research and development often contains great ambiguous, and it could not be identified and evaluating. Thirdly, the process of innovation is very complicated, it crosses several function from research, prototype development, commercialization, and to the end of market (Hall & Bagchi-Sen, 2002). The benefit might be revealed after several years. Although there are some disadvantages, it stills the most way to evaluate the input of innovation through research and development activities. For patent, patent has been used to estimate innovation ability for a long time, but whether the patent could really reflect the actual condition of innovation ability (Griliches, 1998). Watanabe, Tsuji, and Griffy-Brown (2001) thought only choosing suitable patent office it could make patent be a validity indicator of innovation ability. Grupp and Schmooh (1999) discussed many validity indicators, and then commended "Triple Patent", patent office of United State, European, and Japan where are the three important office for granting patent in the world. Utilize the information behinds the patent to evaluate the innovation ability of corporate has some advantage: firstly, patent is more objective than traditional financial information, and realize the innovation ability of a corporate better. In addition, one patent could compare with other patents among different enterprises. Secondly, all the patent information is provided from inventors voluntarily, and it is more reliable. Thirdly, patent citation provides a clue in technology linkage among patents. Patent citation records record all inventors, invention, and other relative information, and these could help us to understand the technology connection among patents. Fourthly, details of patent application provide plentiful resource for investigating.

2.3 Relationship between Corporate Governance and Innovation Ability

Enterprises work hard at their innovation activities because it would enhance their capabilities (Stopford & Baden-Fuller, 1994), encourage the culture about internal cooperating (Zahra, Sisodia, & Das, 1994), and have new opportunity (Miller, 1983; Zahra, 1994). In fact, innovation activities bring great benefit for enterprise, but the cost of innovation is huge since innovation process is risky. Crawford (1987), took new product development for example, pointed out that the probability of new product success is lower than half even though has a conscientious process. At first, enterprises invest lots of money into innovating, once they fail, they may surfer huge loss innovate or just bankrupt. Montgomery and Kaufman (2003) commended that only the three parts, boar of directors, stockholder, and managers, team up and then have great profit. The way to look on the future is reduce interests conflict caused from information asymmetric problem among the three parts or avoid managerial risk aversion of managers. Goyer (2001) and Lee & O'Neill (2003) thought corporate governance would differ with national culture, legislation, and enterprises characteristic, further it would reflect on innovation activities. Generally, outside board directors with no formal position in the organization have no beneficial relationship with enterprises and they could stand a neutral position to supervise. The higher portion of outside directors the better professional knowledge and advice the board gives (Zahra & Pearce, 1989; Brickley, Coles, & Terry, 1994) Due to the great uncertainty innovation activities have and the responsibility manager take, the view of managers would become more conservative (Zahra et al., 1994).

This study investigates how corporate governance influence cooperate innovation ability, and the structure of this study as figure1.

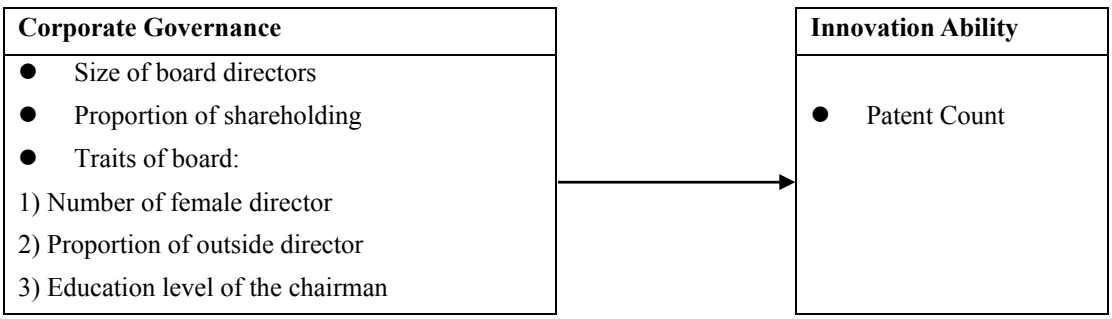

Figure 1. Research model

Most early studies focused on how the proportion of shareholding influences cooperation performance. In this study, the main purpose is to examine how the board of directors, such as size, proportion of shareholding, and the trait of member, influence innovation. In which, the trait of member is classified into four type, number of female director, proportion of outside director, education level of the chairman, and Reward of board. This study also adopts Taiwan electronic information companies to be the research object and utilizes patent count of these companies granted from the three areas, United State, Taiwan, and China to evaluate their innovation ability. Finally, this study examines the relationship between corporate governance between innovation ability.

2.3.1 Size of Board of Directors

What a firm need to do for their growth is keep to innovate and to renew their ability. However, this would need the corporation of managers and board directors or just in vain. Under this changeable environment, the variety could bring enterprises more flexibility, and the variety of directors is good for enterprises to have better decision for innovation investment. Holthausen and Larcker (1993) argued that size of board directors might influence firms' performance. Hermalin and Weisbach (1988) advocated the smaller size of board directors and the higher proportion of outside directors, the higher the probability that change manager to keep better operation performance. Therefore, the larger the size board of directors, the better performance that enterprises would acquire, and this study predict it would have performance on innovation ability. This is the hypotheses H1:

H1: The size of board directors is positive related to innovation ability.

2.3.2 Proportion of Shareholdings

In Asian, many empirical researches found that the family and government owned the most part of shareholdings. Convergence of Interest Hypothesis (Jensen & Meckling, 1976) addressed commanded the higher the proportion of shareholding managers and the board of directors owned the goal would be closer, and it leads the managers and directors make a decision which would maximum the benefit of stockholders. Therefore, while the family and managers owned the most part of shareholdings, a firm would have more investment in innovation and the innovation ability would be stronger. Also, Finkelstein (1992) though board directors own shareholdings might let the board have the power of making decisions about new invention or technology. But some research commanded that directors with more shareholdings would not agree any uncertain investment for their career safety, and this situation is consist with the opinion of entrenchment hypothesis (Jensen & Ruback, 1983).

According to above, while the directors own most proportion of shareholding, the board of directors would not have a motivation to push them to supervise managers, and then a firm would acquire lower performance. This derives hypotheses H2:

H2: The proportion of shareholding of board directors is negative related to innovation ability.

2.3.3 Proportion of Female Directors

For the construction of directors, there have been a lot of studies proved that the variety of board of directors would bring great benefits for a firm (Carter et al., 2003). Van der Zahn (2004) examined the companies of South Africa also had the same results. It pointed out those female directors was positive related to the performance of intelligence capital and made companies pay more attention on the future. This study expects that the higher the proportion of female directors the greater the innovation ability a firm has and addresses the hypothesis H3:

H3: The proportion of female directors is positive related to innovation ability.

2.3.4 Proportion of Outside Directors

Member of board could be separated into two parts, outside directors and inside directors. Inside directors participate in the operation and have formal position in a firm, but outside directors are not hired by a firm. Agency Theory commanded there should have more outside directors for a firm, and that is because outside directors are independent and make the function of supervisions and control more effective. Outside directors would put more emphasis on activities which good for companies, like research and development. Since the most inside directors have formal title in organization, Williams (2000) also thought that these directors would pay more attention on the performance in short term and ignore the future benefit of developing new products or new technology. Generally, the independence of outside directors would force them to focus on the future development and the benefits of shareholders. Therefore, it constructs the research hypothesis H4.

H4: The outside directors' proportion is positive related to innovation ability.

2.3.5 Education Level of Chairman

Based on resource dependence theory the board directors could offer information to managers to forming competitive ability, and the firms with more important information and knowledge can existence in the competitive environment. These information and knowledge are related to the education level of directors. Generally speaking, the higher the education level of directors, the more professional knowledge could be possessed. The directors with higher education level would emphasize on innovation.

H5: The education level of chairman is positive related to innovation ability.

3. Methodology

This study investigates the relationship between corporate governance between innovation ability, and the empirical model in this study is showed as follow (1):

$$Innovation_{i,t} = \beta_0 + \beta_1 Number_{it} + \beta_2 DirOwership_{i,t} + \beta_3 PerGender_{i,t} + \beta_4 PerOutsider + \beta_5 Education_{i,t} \quad (1)$$

Where: βi: coefficient;

$Number_{i,t}$: total number of board;

$DirOwnership_{i,t}$: proportion of shareholding of directors;

$PerGender_{i,t}$: proportion of female directors;

$PerOutsider_{i,t}$: proportion of outside directors;

$Education_{i,t}$: education level of directors;

$Innovation_{i,t}$: innovation ability;

i: i firm;

t: year.

And the estimating method of each indicator about corporate governances in this study is presented in Table 1.

Table 1. Indicator of corporate governances

Indicators	Method of Estimating
Number	= Number of Outside Directors + Number of Inside Directors
DirOwenership	= Shareholdings Directors Owned / Total Shareholdings Company Published
PerGender	= Number of Female Directors / Total Number of Board
PerOutside	= Number of Outside Directors / Total Number of Total Number of Board
Education	= 1, 2, 3, or 4, where 1 is high school and below, 2 is junior college, 3 is university, and 4 is graduate school and above.

The subject of this study is listed Taiwanese electronic manufacturers. The rationale for sample selection was follows. First, this study found 304 firms that be listed into the electronics industry by Taiwan Economic Journal (TEJ) in 2005. Second, because the annual reports during 2001 - 2005 are necessary to report accurately, this study deleted 12 firms which were full-cash delivery stock and go public under two years. Third, this study also deleted 14 firms that unable to obtain material. Finally, the 255 electronics manufactures were selected to meet the above criteria. The data this study collected is a kind of panel data.

The two most frequently adopted for panel data estimation methods are the fixed effect and random effect models. Using a fixed effect solves the problem of unobservable variables in conventional OLS regression estimates, and thus enables efficient estimation of the regression parameters (Greene 2003). Restated, the error term ($\varepsilon_{i,t}$) can be classified into two terms, firm specific effects ($\mu_{i,t}$), and white noise additive random error terms ($\nu_{i,t}$). Time-series cross-section panel data from 255 Taiwanese electronic manufacturers during 2001-2005 are employed for the fixed effect analysis in the model.

4. Empirical Results

In this section, this study would display the results and explanations of statistical analysis. The summary of the data we collected was reported in Table 2. In addition, this study tested if empirical model fits for fixed effect model. In this study, the results of the F-test demonstrate the accuracy of applying a fixed effect model to the proposed data. Restated, inter-individual differences between firms should be considered in the panel estimate.

Table 2. Descriptive data for variables

Variable	Obs.	Mean	Std. Dev.	Min	Max
Year	1275	-	-	2001	2005
1. Corporate Governance					
Number	1275	6.579608	1.833465	3	15
DirOwnership	1275	0.216194	0.119759	0.0277	0.9533
PerGemder	1260	0.095773	0.125188	0	0.75
PerOutsider	1260	0.105953	0.144857	0	0.5
Education	1262	3.058637	0.940608	1	4
2. Innovation Ability					
Patent Count	1275	18.42196	77.1371	0	1048

While employ patent count granted from Taiwan to evaluate innovation ability, the results show that there are some positive relationship between size of board directors and innovation ability (Table 3). It reveals the more directors the more patent granted from Taiwan are, and the better performance that enterprises would acquire. The more directors would lead the innovation ability stronger. The hypothesis H1 is supported, and this result consist with the command that size of board directors might influence firms' performance (Holthausen & Larcker, 1993). However, the empirical results showed there is negative relationship between proportion of shareholding of directors and innovation ability, and this support the hypothesis this study made (H2). It found that the more proportion of shareholding of directors hold the weaker the innovation ability a firm has. This result might be that directors with more shareholdings would not agree any uncertain investment for their career safety, and this situation is consist with the opinion of entrenchment hypothesis (Jensen & Ruback, 1983).

Although the empirical results of this study only could support two hypothesis this study made (H1 and H2), from the empirical results, it also could find that corporate governance is actually related to innovation ability. The system of corporate governance could provide functions to ensure stakeholders having the greatest profit and bring better operating efficiency (Aguilera, 2005).

Table 3. Results of corporate governance and patent

Variable	Coef.	Std. Err.	t Value
Number	4.92060	2.3876	2.06**
DirOwnership	-195.83400	34.4649	-5.68***
PerGemder	16.86830	30.7963	0.55
PerOutsider	-5.19630	17.6339	-0.29
Education	-1.93330	3.8493	-0.50

Notes: 1. The R-Square of this model is 79.66%. 2. The dependent variable is human capital represented by the total number of employees. 3. **Denotes statistical significant at 0.05 level; *** Denotes statistical significant at 0.01 level.

5. Conclusions and Discussions

This study investigates 255 Taiwan electronic information enterprises and examines the relationship between their corporate governance system and their innovation ability. From the results, the board of directors in Taiwan electronic information enterprises is composed by male directors, and the female directors are rare. That shows that it still has less consideration about female directors while designing the management in Taiwan. Recently, for enhancing the supervising effects outside directors proportion is increasing, and the education level of chairman is also increasing. About patent count, the total number of patent granted tends to increasing. This study proves that there exists positive relationship between the size of board directors and innovation ability. It could say that the larger the board the innovation ability is better. The variety could bring enterprises more flexibility and the decision would be more objective (Katzenbach & Associate, 1995), and this is all good for enterprises whether now or future. In addition, the results also found that it is supported the hypotheses H2, and it shows the proportion of shareholding of board of directors is significant negative to innovation ability. From the empirical results, it is proved that the larger size of directors would bring more variety of management and make better strategy which benefit stockholders more, such as innovation investment (Aguilera, 2005). While the proportion of shareholding of directors is high, the ability of acquiring patent is lower. Directors would not tend to applying patent right if the board of directors has strong power of making decisions.

This study discusses the issue about the relationship between corporate governance and innovation ability which

was less discussed before, and provides further researcher for reference. Although this study offers a significant result of the relationship between corporate governance and innovation ability, there still are some limitations. In order to acquire collectable, feasible and simplistic data, this study only facilities the public data to measure corporate governance and innovation output, and they might not reflect real situations. On the other hand, this study only observed five-year data and are long enough to reflect the difference changes of firm. Moreover, as regards the variables of corporate governance issue, this study only employed the composition and traits of the board of directors. Future research would benefit from other variables, such as behavior about employees or managers and so on. Therefore in-depth research is required to offer a better understanding of the idiosyncrasies of the relationship between corporate governance and innovation ability. This study only focuses on firms in Taiwanese electronics manufactures. Further research might investigate the relationship between corporate governance and innovation ability with different industries or countries, and it might be an interesting issue of comparing the type or characteristic of this relationship with different industries or countries. Overall, this study provides several interesting results about corporate governance and innovation. Form the result, we understand innovation ability would differ with different system of corporate governance, and this situation should be paid more attention on if a firm wants to enhance their innovation ability. In addition, this study suggests a firm wants to promote their operation benefit with new technology or innovation should stars at the top management, board of directors.

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