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# An Analysis of Mediating Effect of Intellectual Capital Linking Board of Director and Firm Performance: Empirical Evidence from Thai Listed Companies

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**Abstract:** This study examines how the characteristics of the board of directors can influence the performance of companies through the efficiency of intellectual capital. The study analyzes data gathered from 403 listed companies on the Stock Exchange of Thailand (SET) with the exception of those involved in the financial sector. Results indicated that the efficiency of intellectual capital has a significant effect upon company performance, audit committee meetings and the size of the board. With regard to the frequency of audit committee meetings it was found that a partial effect was exerted by the efficiency of intellectual capital upon firm performance. In contrast, the extent of board independence, audit committee meeting frequency, CEO duality and the percentage of the board composed of women did not appear to have any effect upon the performance of companies through the efficiency of intellectual capital.

**Key words:** Efficiency of intellectual capital, board of director characteristics, firm performance, CEO, companies, Thailand

## INTRODUCTION

In today's knowledge economy, companies thrive through the use of communication technology, digital technology, organizational networks and a constant process of innovation. In order to compete successfully on a global stage, value creation must be driven by intellectual capital (Li *et al*., 2008), since, this is vital in sustaining a competitive advantage and consequently, creating value for shareholders (Tayles *et al*., 2007). This can explain the trend for greater investment in those intangible factors such as Information Technology (IT), Research and Development (R&D), Human Resources (HR) and marketing (Orens *et al*., 2009). As a consequence, intellectual capital is becoming the subject of an increasing number of academic studies. For businesses to thrive in the competitive global environment it is essential that they continually seek to improve their performance. The best way to remain competitive and efficient is widely held to be through corporate governance, since, this can support production and profits as well as sustainability, allowing success in the absence of quotas. Effective corporate governance in the knowledge economy involves maximizing the benefits which can be derived from intellectual capital and prioritizing the company's knowledge base by recognizing its potential role in sustaining competitiveness in world markets (Makki and Lodhi, 2014). The need to maximize the returns on intellectual assets is the key challenge facing companies in today's economy with the recognition that corporate knowledge can be the difference between success and failure. This also represents a significant shift away from the norms of the age of manufacturing because the knowledge economy demands that value creation stems from human resources rather than physical capital. Maximizing the benefits to be derived from intellectual assets requires companies to place increased emphasis upon knowledge management, professionalism and skill development, client relationships and organizational structure. The wisdom acquired from years of experience can also be a key difference maker as companies seek to improve their profitability and maintain their advantages through knowledge utilization and effective management (Nimtrakoon, 2015).

Corporate governance can be heavily influenced by the board of directors. The board is not part of the company's management but answers to the shareholders. However, in recent years a number of corporate failures have been blamed upon directors and they have been held responsible for lower overall returns to shareholders. They have been involved in several high profile fraud cases which have brought about the downfall of their companies with Enron just one example (Abidin *et al*., 2014). It has been argued that these failures have been the result of poor oversight from the board, caused by

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unsuitable board structure, poor work from committees, managers acting in the interests of themselves rather than the firm and boards failing to take care of the interests of the shareholders. As a consequence, reforms of corporate governance have typically focused on altering the structure and composition of the board of directors as well as improving the ownership arrangements.

The Stock Exchange of Thailand (SET, 2012), advises that the board of directors ought to provide vision and leadership and should also offer independence in its decision making in order to best serve the business and the shareholders. The responsibilities of the board should be distinctly separated from those of the company's managers while one key role of the board is to monitor the activities of the company to ensure that it is operated in such a manner as to meet all its legal and moral obligations. The board members should comprise directors whose skills, experience, qualifications and backgrounds offer sufficient variety to maximize their usefulness to the company as it faces different challenges. Commitment from the directors is important because their role requires their full attention if the board is to be effective. Directors should be selected through a nomination process which is both transparent and not subject to manipulation from shareholders or the company's managers. This will ensure that external observers can trust the board to carry out its duties impartially.

The modern knowledge economy demands intellectual capital to sustain competitiveness no matter which particular industry is involved. It is possible therefore, that the intellectual capital of a company will influence its market value and lead to improved financial performance (Chen *et al*., 2005) while a study by Murale *et al*. (2010), reported finding significant positive links between book value and market value and the company's intellectual capital. As a result it can be claimed that intellectual capital is a vital intangible resource which can take a company from a domestic trading environment and propel it to international success. Another key factor behind the worldwide rise in importance of intellectual capital has been the economic shift towards a dominant services sector at the expense of manufacturing and to thrive in services, intellectual capital and the way it is managed become absolute priorities.

This research study examines one important area of corporate governance which has hitherto attracted limited attention. The characteristics of the board of directors can be expected to have an influence upon the development and management of intellectual capital and the way in which the benefits are maximized from its exploitation. This study also evaluates the typical structure of the relationships which are used to measure corporate governance, corporate performance and the efficiency of intellectual capital.

Structural equation modeling is used to determine how intellectual capital can be influenced by the board of directors and thus affect the performance of companies listed on the SET. The variables assessed with regard to the board of directors characteristics included audit committee size, independent directors, CEO duality, board size, number of female directors, board meeting frequency and audit committee meeting frequency. The calculation of the efficiency of intellectual capital is accomplished through the use of VAIC™ (Pulic, 2000) and the financial performance measurements are based upon Return on Equity (ROE). The data used for all of these variables comes from the companies annual reports which are available through SETSMART.

The evaluation of the structural model which links the roles played by the board of directors in developing intellectual capital to fuel firm performance represents a valuable addition to the literature. The primary aims of this research study are to determine precisely how intellectual capital serves to connect the characteristics of the board of directors and the performance of the company through analysis of the data collected from the reports detailing the performance of Thai companies listed on the SET.

## Literature review

### Board of directors characteristics and efficiency of intellectual capital

**Board size:** Cerbioni and Parbonetti (2007) reported that the size of the board negatively influences the quantity of intellectual capital but in contrast a positive relationship was found by Zamani *et al*. (2012) who applied VAIC™ for a study of companies listed on the Tehran Stock Exchange. A study conducted in Malaysia by Abidin *et al*. (2014), revealed positive correlation between increased board size and efficiency of intellectual capital, along with a similar positive link between the efficiency of intellectual capital and the number of non-executive directors. However, the findings by Yermack (1996) were quite different as a negative relationship was revealed linking efficiency of intellectual capital and board size when the data from 452 US companies were analyzed. One further study, from Appuhami and Bhuyan (2015) did not find any effect from board size upon intellectual capital efficiency. These previous findings permit the formulation of the following hypothesis:

- $H_{1a}$ : the size of the board of directors has a positive influence upon the intellectual capital efficiency of a company

**Proportion of independent directors:** When directors are independent, they have traditionally been more inclined

to encourage long-term managerial thinking and ideas which are in the best interests of the business (Ibrahim *et al*., 2003). The research by Al-Musalli and Ismail (2012) confirmed that there is a significant link between intellectual capital performance and the number of independent directors serving on the board. Similarly, it is confirmed by Mahmudi and Nurhayati (2015), that the proportion of independent directors exerts a significant influence upon the efficiency of intellectual capital, so, it can be anticipated that the presence of independent directors will have a positive outcome in terms of intellectual capital, leading to greater investment in research, human resources and IT. These previous findings permit the formulation of the following hypothesis:

- $H_{1b}$: the proportion of independent directors positive influences the efficiency of intellectual capital efficiency of a company

**Participation of female board members:** A study of listed companies in South Africa by Williams (2001) showed that a when boards comprise a balance of members in terms of ethnic and gender backgrounds, there is an improvement in their efficiency of intellectual capital. In further support, the research by Khumalo (2011) revealed that no material difference is created when the proportion of female directors is low. A positive relationship between the proportion of female directors and the intellectual capital performance of companies was reported by Zahn (2006). These previous findings permit the formulation of the following hypothesis:

- $H_{1c}$: participation of female board members positively affects the efficiency of intellectual capital of a company

**Combined role of chairman and CEO:** If a single person takes the roles of both CEO and chairman of the board, the situation of duality arises (Butt, 2012). Since, both are powerful posts, duality can concentrate a significant amount of power in one person, who then controls both the board and the management. This can lead to excessive support for the actions and interests of the management at the expense of the shareholders. It also reduces the board's capacity for monitoring and oversight. Ho and Williams (2003) found that duality was linked to negative outcomes for intellectual capital in a study focusing on listed companies in the UK, Sweden and South Africa but no link was established between duality and VAIC™. In contrast, it was suggested by Abidin *et al.* (2014) that duality may lead to better performance because the structure creates clarity in establishing responsibility for the various internal and external processes of the company. These previous findings permit the formulation of the following hypothesis:

- $H_{1d}$: separation of the roles of chairman and CEO positively affects the efficiency of intellectual capital of a company

**Frequency of board meetings:** Meetings of the board of directors are not always considered by the participants to be a wholly serious and practical matter by either executive or non-executive directors (Makki and Lodhi, 2014). However, the findings by Al Mamun and Badir, that intellectual capital tends to rise when more board meetings are held. Mahmudi and Nurhayati (2015) argued that an increase in the frequency of board meetings does not necessarily improve intellectual capital performance, since, the effectiveness of meetings plays a more significant role than the mere number of meetings held. These previous findings permit the formulation of the following hypothesis:

- $H_{1e}$: the frequency of board meetings positively influences the efficiency of intellectual capital of a company

**Frequency of audit committee meetings:** The purpose of an audit committee meeting is to assess the performance and the strategic approaches of a company through examination of the financial statements, the internal control structures and the corporate governance standards. No connection was found between the frequency of these meetings and the company's performance in terms of intellectual capital (Mahmudi and Nurhayati, 2015). However, according to Li *et al.* (2008), there is a positive relationship between the frequency of audit meetings and the efficiency of intellectual capital. These previous findings permit the formulation of the following hypothesis:

- $H_{1f}$: the frequency of audit committee meetings positively influences the efficiency of intellectual capital of a company

**Audit committee size:** It was demonstrated by Mahmudi and Nurhayati (2015), that audit committees serve as a useful means of controlling the management of a company, so, it could be argued that a committee with more members would be better able to monitor the activities of the company. A large audit committee would thus be anticipated to support the efficiency of

intellectual capital more effectively (Li *et al*., 2012). In contrast, however, Cerbioni and Parbonetti (2007) discovered that the effect of audit committee size upon the quality of intellectual capital was negative while the findings by Ting and Lean (2009) on the same relationship indicated no influence at all. These previous findings permit the formulation of the following hypothesis:

- $H_{1g}$: audit committee size positively influences the efficiency of intellectual capital of a company

**Efficiency of intellectual capital and firm performance:** Three elements of intellectual capital efficiency can be found consistently in the literature: human capital efficiency; capital employed efficiency and structural capital efficiency. These can be applied in accordance with the extended VAIC™ Model (Pulic, 2000). Links between company value and intellectual capital were examined by Berzkalne and Zelgalve (2014) with the conclusion that a rise in the latter should lead to an increase in the former. Similarly, Nimtrakoon (2015) discovered that the relationship between intellectual capital and the stock market value of a company was also positive which indicates that strong performance in the area of intellectual capital usually results in improved ROA. However, Morariu (2014) revealed that the relationship between VAIC™ and market-to-book value was negative and found no significant links between VAIC™ and ROE. The research by Muhammad and Ismail (2009) showed significant positive links between intellectual capital and both ROA and profits while Tan *et al*. (2007), revealed that present and future firm performance was positively linked to intellectual capital performance in a study of 150 Singaporean companies. A further study by Chen *et al*. (2005), investigated the influence of intellectual capital efficiency upon the traditional corporate performance measures using data from companies listed on the Hong Kong Stock Exchange during the period 2001-2005. These previous findings permit the formulation of the following hypothesis:

- $H_2$: intellectual capital efficiency positively influences a company's performance.

**Board of directors characteristics and firm performance**
**Board size:** It has been shown that a larger board is positively related to a company's performance (Jackling and Johl, 2009) whereas evidence has also shown that the size of the board can exert a significant negative effect upon profits, returns to shareholders and Tobin's Q (Guest, 2009). Furthermore, Cheng (2008) point out that the larger the board, the greater the incidence of difficulties pertaining to inefficient directors. A significant negative correlation was discovered between board size and ROE in a study of the Thai banking sector (Pathan *et al*., 2007) while the research by Kiel and Nicholson (2003) examined firm performance in the light of board composition and discovered a positive link between performance and the size of the board. These previous findings permit the formulation of the following hypothesis:

- $H_{3a}$: the board size positively influences firm performance

**Proportion of independent directors:** It has been argued that the percentage of independent directors who make up the board of directors can affect the performance with Pathan *et al*. (2007) confirming this view by finding a positive and significant link between ROE and the proportion of directors who were independent. In addition, the composition of the board was found to positively influence ROE and profits in a study by Connelly *et al*. (2012). For non-family businesses, Leung *et al*. (2014), reported that the independence of the board is positively correlated with firm performance while the research by Khan and Awan (2012) found positive links between the returns on assets and equity and the presence of non-executive directors on corporate boards. However, Ghosh was unable to link board and corporate performance when examining India's manufacturing sector. These previous findings permit the formulation of the following hypothesis:

- $H_{3b}$: the proportion of independent directors positively influences firm performance

**Participation of female board members:** A number of research studies have examined the issue of female participation on the board of directors. Abdullah *et al*. (2012) conducted a study in Malaysia to assess the effects upon market performance of including female members on the boards and found that a female presence was associated with a significant positive influence upon ROE. Carter *et al*. (2003) were also able to show that an increase in the proportion of female directors could improve firm performance while Dobbin and Jung (2012) addressed the question of whether female directors could enhance profitability and stock market value. The findings indicated that that a higher proportion of females is not linked to any increase or decrease in profitability. In the

US Adams *et al.* (2010) found that the overall influence of female directors on corporate performance was negative and therefore, the summary of these findings would be that companies which have a higher percentage of female directors cannot expect to see any correlated effect upon profitability. These previous findings permit the formulation of the following hypothesis:

- $H_{3c}$: the participation of women on a board of directors positively influences firm performance

**Combined role of chairman and CEO:** Ramdani and Witteloostuijn (2010) studied the effects of duality in Malaysia, Indonesia, Thailand and South Korea and Thailand and discovered positive links between duality and corporate performance. In contrast Judge *et al.* (2003) found the links to be negative between duality and performance in a study of Russian companies. Fooladi and Chaleshtori (2011) confirmed this negative relationship using ROE and ROA as the indicators for financial performance. A study of UK listed companies found similar results whereby duality is associated with poor financial performance. These previous findings permit the formulation of the following hypothesis:

- $H_{3d}$: separating chairman and CEO roles positively influences firm performance

**Frequency of board meetings:** The findings by Vafeas (1999) hold that a positive relationship exists between the frequency of board meetings and firm performance and therefore, the researcher suggests that the activities of the board play an important role in guiding the company. This is further supported by Brick and Chidambaram (2010) who revealed that the actions of the board have a positive impact on firm performance. However, the findings by Jackling and Johl (2009), indicated no links between the frequency of board meetings and the financial performance of companies in India. These previous findings permit the formulation of the following hypothesis:

- $H_{3e}$: the frequency of board meetings positively influences firm performance

**Audit committee meeting frequency:** It was suggested by Stewart and Munro (2007) that ROE is positively influenced by the frequency of audit committee meetings while Anderson *et al.* (2004) add that the audit committee plays a key role in supervising the internal controls of a company, thereby allowing vital information to be transmitted to the shareholders. The internal audit system is thus strengthened and the appropriate oversight of management can lead to lower business risks. Azam *et al.* (2010) studied companies in Australia and found that equity returns were positively affected by the frequency of audit committee meetings. Therefore, it can be argued that the frequency of audit committee meetings has a role to play in determining how effective an audit committee will be in performing its supervisory role (DeZoort *et al.*, 2002). These previous findings permit the formulation of the following hypothesis:

- $H_{3f}$: the frequency of audit committee meetings positively influences firm performance

**Size of the audit committee:** It is possible for an audit committee to become too big, whereupon its processes become ineffective and the responsibilities of members become too widely diffused for the committee to work effectively (Karamanou and Vafeas, 2005). Similarly Al-Matari *et al.* (2012) discovered significant negative links between the size of the audit committee and the performance of companies. In contrast, Ranjith and Mohammad is no evidence that audit committee size have an effect on intellectual capital efficiency in top service firms in Australia. These previous findings permit the formulation of the following hypothesis:

- $H_{3g}$: the size of audit committee positively influences firm performance

**Mediation of the efficiency of intellectual capital:** The mediation process comprises four steps (Baron and Kenny, 1986). The following description explains why the efficiency of intellectual capital is a relevant mediator in each of the four steps.

All relationships between dependent and independent variables have to be significant. A significant relationship is evidenced in the literature for firm performance and the characteristics of the board of directors (Connelly *et al.*, 2012; Karamanou and Vafeas, 2005; Cheng *et al.*, 2008; Jackling and Johl, 2009; Azam *et al.*, 2010; Dobbin and Jung, 2012; Fooladi and Chaleshtori, 2011; Abdullah *et al.*, 2012).

All relationships between independent and mediator variables have to be significant. A significant relationship is evidenced in the literature for the efficiency of intellectual capital and the characteristics of the board of directors (Ho and Williams, 2003; Carter *et al.*, 2003; Cerbioni and Parbonetti, 2007; Abidin *et al.*, 2014; Makki and Lodhi, 2014; Khumalo, 2011; Butt, 2012; Al-Musalli and Ismail, 2012; Mahmudi and Nurhayati, 2015).

All relationships between dependent and mediator variables have to be significant. A significant relationship is evidenced in the literature for the efficiency of intellectual capital and firm performance (Mondal and Ghosh, 2012; Chen *et al.*, 2005). In the case where it is possible to reduce the direct link between the

characteristics of the board of directors and firm performance to zero when the efficiency of intellectual capital is included such that the indirect relationship involving the mediator becomes significant, then full mediation is confirmed. However, if the link is reduced significantly then partial mediation is demonstrated while a significant direct link indicated no mediation.

- $H_{4a}$: efficiency of intellectual capital mediates the relationship between Board Size (BSIZE) and firm performance
- $H_{4b}$: efficiency of intellectual capital mediates the relationship between the proportion of Board Independence (BIND) and firm performance
- $H_{4c}$: efficiency of intellectual capital mediates the relationship between the proportion of Women on Board (BWOM) and firm performance
- $H_{4d}$: efficiency of intellectual capital mediates the relationship between the separate chairman and CEO (BCEO) and firm performance
- $H_{4e}$: efficiency of intellectual capital mediates the relationship between the Board Meeting (BMEET) and firm performance
- $H_{4f}$: efficiency of intellectual capital mediates the relationship between the Audit Committee Meeting (ACMEET) and firm performance
- $H_{4g}$: efficiency of intellectual capital mediates the relationship Audit Committee Size (ACSIZE) and firm performance

## MATERIALS AND METHODS

### Sample selection

**Population and samples:** This study employs a quantitative approach using data collected from the SET and Reporting Tool in 2014 (SETSMART) and also from the annual reports for 2014 of the companies involved in the research. The year 2014 provides the latest available data. According to the SETSMART data, the population comprises 545 companies. However, a number of these are not to be included: those with unusual fiscal year results (34 companies); those undergoing rehabilitation (32 companies); those involved in property funds and real estate investment trusts (31 companies); those involved in finance, banking or insurance (26 companies); those for which SETSMART could not provide data (10 companies) and those whose ROE ratio was not available (9 companies).

### Measurement of the characteristics of the board of directors and control variables

**Firm performance; Return on Equity (ROE):** The calculation of ROE is conducted as shown in the equation in accordance with Dadashinasab *et al*. (2012) and can be used to establish financial performance:

Table 1: Measurement and measurement of study variables

| Variables | Definitions | Measurements |
|---|---|---|
| BSIZE | Board of directors size | Natural logarithm of the number of directors on the board at year end |
| BIND | Independent directors proportion | Proportion of independent directors to board size at year end |
| BWOM | Board participation of women | Proportion of female directors to board size at year end |
| BCEO | Role of CEO and chairman combined | Indicator variable is "1" to show a separate chairman and CEO or "0" if the roles are combined |
| BMEET | Board Meeting frequency | Natural logarithm of the number of board meetings annually |
| ACMEET | Audit Committee Meeting frequency | Natural logarithm of the number of audit committee meetings annually |
| ACSIZE | Audit Committee Size | Natural logarithm of the number of audit committee members at year end |

$$\text{ROE} = \frac{\text{Net income}}{\text{Shareholder equity}}$$

**Measurement of intellectual capital efficiency:** This research uses the Value Added Intellectual Coefficient (VAIC™) in accordance with Pulic (2000) as a means to measure the efficiency of intellectual capital. There are three elements involved in the calculation of VAIC™ (Muhammad and Ismail, 2014). These are Structural Capital Efficiency (SCE), Human Capital Efficiency (HCE) and Capital Employed Efficiency (CEE). The calculation is carried out as follows:

$$\text{Capital Employed Efficiency (CEE)} = \frac{\text{Value Added (VA)}}{\text{Capital Employed (CE)}}$$

$$\text{Human Capital Efficiency (HCE)} = \frac{\text{Value Added (VA)}}{\text{Human Capital (HC)}}$$

$$\text{Structural Capital Efficiency (SCE)} = \frac{\text{Structural Capital (SC)}}{\text{Value Added (VA)}}$$

$$\text{Value Added Intellectual Capital Efficiency (VAIC}^{\text{TM}}\text{)} = \text{HCE+SCE+CEE}$$

**Board of directors characteristics:** This study examines a number of characteristics of the board of directors and each can be thought of as an independent variable. Table 1 shows how each can be measured in accordance with its definition.

## RESULTS AND DISCUSSION

When assessed using the structural model, the relationship variables fall between endogenous and exogenous. The process of analysis therefore, shows both direct and structural links between variables along with latent constructs and mediation.

Table 2: Descriptive statistics

| Variables | N | Minimum | Maximum | Mean | SD |
|---|---|---|---|---|---|
| BSIZE | 403 | 0.778 | 1.255 | 1.001 | 0.099 |
| BIND | 403 | 0.200 | 0.714 | 0.396 | 0.086 |
| BWOM | 403 | 0.000 | 0.667 | 0.174 | 0.149 |
| BCEO | 403 | 0.000 | 1.000 | 0.632 | 0.482 |
| BMEET | 403 | 0.600 | 1.380 | 0.829 | 0.192 |
| ACMEET | 403 | 0.602 | 1.380 | 0.747 | 0.178 |
| ACSIZE | 403 | 0.301 | 0.699 | 0.492 | 0.047 |
| VAIC | 403 | -21.522 | 15.460 | 2.493 | 4.537 |
| ROE | 403 | -61.700 | 77.910 | 8.381 | 15.949 |
| BIG4 | 403 | 0.000 | 1.000 | 0.692 | 0.462 |
| INDUS | 403 | 0.000 | 1.000 | 0.677 | 0.468 |
| AGE | 403 | 1.000 | 39.000 | 17.603 | 0.778 |

**Descriptive analysis:** A set of descriptive statistics for the variables can be seen in Table 2. For Board Size (BSIZE) the mean natural logarithm is 1.001 with a minimum of 0.778 and maximum of 1.255. For Audit Committee Size (ACSIZE) the mean natural logarithm is 0.492 with a minimum of 0.301 and maximum of 0.699. For proportion of Board Independence (BIND) the mean is 0.396 with a minimum of 0.200 and maximum of 0.714. For participation of Women on the Board (BWOM) the mean is 0.174 with a minimum of 0.000 and maximum of 0.667. For Board Meeting frequency (BMEET) the mean natural logarithm is 0.829 with a minimum of 0.600 and maximum of 1.380. For Audit Committee Meeting Frequency (ACMEET) the mean is 0.747 with a minimum of 0.602 and maximum of 1.380. For duality (BCEO) the mean is 0.632 with a minimum of 0.000 and maximum of 1.000. For Intellectual Capital efficiency (VAIC) the mean is 2.493 with a minimum of -21.522 and maximum of 15.460. ROE shows a mean value of 8.381 with minimum of -61.700 and maximum of 77.910. The minimum BIG4 of the companies is 0 while the maximum stands at 1. The mean is 0.692. The minimum INDUS of the companies is 0 while the maximum stands at 1. The mean is 0.677. The oldest company in the sample has been operating for 39 years while the youngest has been in existence for one year. The mean age of the companies is 17.603 years.

**Correlation analysis:** Table 3 indicates that the correlations which exist are typically smaller than 0.80 which suggests there may be no significant problems with multicollinearity in this research. It is therefore, the case that multicollinearity between independent variables is not a serious issue for concern.

**Structural equation model:** This research study constructs a model to assess the relationships involving the variables which indicate the characteristics of the board of directors. These variables are BSIZE, ACSIZE, BIND, BWOM, BMEET, ACMEET and BCEO. The mediator role is played by the Intellectual Capital efficiency Variable (VAIC) with ROE playing the role of the dependent variable to indicate firm performance. Furthermore, an evaluation of the model fit of path analysis was achieved using the Goodness of Fit Index (GFI), Comparative Fit Index (CFI), Adjusted Goodness of Fit Index (AGFI) and Root Mean Square Error of Approximation (RMSEA). These goodness of fit indices are shown in Table 4 with all values clearly above 0.90 with one exception, indicating that all are acceptable for the context of the model and are statistically significant. The RMSEA is the most important index and has a score of 0.045 which indicates an adequate fit for the model. The values obtained are indicative of an improved fit for the model when compared to the null model (Hayes, 2013).

The research study therefore, examines a total of 22 hypothesis. A Maximum Likelihood (ML) approach was used to test the hypothesized research model and Table 5 presents the outcomes in terms of standard regression weights mediation and the direct and indirect models to test the research hypothesis.

**Hypothesis and discussion:** This research study set out to determine which characteristics of the board of directors affect efficiency of intellectual capital which characteristics of the board of directors affect firm performance and the way in which efficiency of intellectual capital can be influenced by the characteristics of boards of directors in listed companies in Thailand. The findings revealed that board size influences the efficiency of intellectual capital in full mediation, indicating that an increasing number of board directors will result in better quality decision making with regard to resource allocation and the use of strategic information. These findings are in accordance with the research by Abidin *et al.* (2014) and Zamani *et al.* (2012) with confirmation that intellectual capital plays a vital role in modern organizations and can improve the operational aspects of a company (Cheng, 2008). However, the result of an increased proportion of independent directors serves to negatively affect corporate operations but the effect upon intellectual capital is not negative. The outcome in Thailand is that directors are rarely independent and this allows companies to operate effectively as is confirmed by the finding by Haniffa and Hudaib who found that operating results improve as the proportion of independent directors falls. A highly independent board of directors theoretically acts as a counterbalance to the managers and will supervise to ensure good decision making. It prevents internal processes from falling under the influence of managers pursuing their own interests and

Table 3: Results of Pearson correlation analysis

| Variables | BSIZE | BIND | BWOM | BCEO | BMEET | ACMEET | ACSIZE | VAIC | ROE | BIG4 | INDUS | AGE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BSIZE | 1 | | | | | | | | | | | |
| BIND | -0.249** | 1 | | | | | | | | | | |
| BWOM | -0.117* | -0.040 | 1 | | | | | | | | | |
| BCEO | 0.029 | 0.000 | -0.051 | 1 | | | | | | | | |
| BMEET | 0.094 | 0.130** | 0.013 | -0.014 | 1 | | | | | | | |
| ACMEET | 0.139** | 0.145** | -0.035 | -0.053 | 0.540** | 1 | | | | | | |
| ACSIZE | 0.291** | 0.047 | 0.045 | -0.078 | 0.002 | 0.072 | 1 | | | | | |
| VAIC | 0.086 | 0.010 | -0.050 | -0.034 | 0.032 | 0.113* | -0.068 | 1 | | | | |
| ROE | 0.037 | -0.108* | 0.051 | -0.113* | -0.117* | 0.049 | -0.029 | 0.419** | 1 | | | |
| BIG4 | 0.148** | -0.096 | -0.142** | -0.006 | -0.013 | 0.064 | 0.004 | 0.063 | 0.163** | 1 | | |
| INDUS | -0.151** | 0.143** | -0.074 | -0.063 | 0.006 | 0.036 | -0.056 | 0.068 | 0.034 | 0.023 | 1 | |
| AGE | 0.220** | -0.103* | -0.012 | -0.073 | 0.103* | 0.013 | 0.057 | -0.007 | -0.027 | 0.018 | -0.150** | 1 |

*p<0.10, **p<0.05, ***p<0.01

Table 4: Parameters of the models of characteristics of the board of directors, efficiency of intellectual capital efficiency and firm performance

| Models | CMIN | df | CMIN/df | p-values | GFI | AGFI | CFI | NFI | RMSEA |
|---|---|---|---|---|---|---|---|---|---|
| Mediation | 29.285 | 19 | 1.541 | 0.062 | 0.988 | 0.952 | 0.973 | 0.933 | 0.037 |
| Independence | 440.026 | 66 | 6.667 | 0.000 | 0.855 | 0.829 | 0.000 | 0.000 | 0.119 |

Table 5: Parameters of the models of characteristics of the board of directors, efficiency of intellectual capital efficiency and firm performance

| Variables | Estimate | SE | CR | p-values | Standardized regression weights |
|---|---|---|---|---|---|
| VAIC<---BSIZE | 5.646 | 2.551 | 2.213 | 0.027 | 0.122* |
| VAIC<---BIND | 1.495 | 2.723 | 0.549 | 0.583 | 0.028 |
| VAIC<---BWOM | -0.466 | 1.518 | -0.307 | 0.759 | -0.015 |
| VAIC<---BCEO | -0.333 | 0.461 | -0.724 | 0.469 | -0.035 |
| VAIC<---BMEET | -1.063 | 1.352 | -0.786 | 0.432 | -0.045 |
| VAIC<---ACMEET | 0.162 | 0.076 | 2.140 | 0.032 | 0.123* |
| VAIC<---ACSIZE | -10.839 | 4.945 | -2.192 | 0.028 | -0.114* |
| VAIC<---BIG4 | 0.391 | 0.488 | 0.800 | 0.424 | 0.040 |
| VAIC<---INDUS | 0.659 | 0.486 | 1.357 | 0.175 | 0.068 |
| VAIC<---AGE | -0.009 | 0.026 | -0.348 | 0.728 | -0.017 |
| ROE<---VAIC | 1.407 | 0.154 | 9.109 | 0.000 | 0.401*** |
| ROE<---BSIZE | -2.999 | 7.948 | -0.377 | 0.706 | -0.019 |
| ROE<---BIND | -18.078 | 8.438 | -2.142 | 0.032 | -0.098* |
| ROE<---BWOM | 9.493 | 4.701 | 2.019 | 0.043 | 0.089* |
| ROE<---BCEO | -2.854 | 1.428 | -1.998 | 0.046 | -0.087* |
| ROE<---BMEET | -16.388 | 4.191 | -3.910 | 0.000 | -0.198*** |
| ROE<---ACMEET | 0.763 | 0.236 | 3.229 | 0.001 | 0.165** |
| ROE<---ACSIZE | -5.164 | 15.407 | -0.335 | 0.737 | -0.015 |
| ROE<---BIG4 | 4.715 | 1.514 | 3.114 | 0.002 | 0.137** |
| ROE<---INDUS | 0.373 | 1.508 | 0.247 | 0.805 | 0.011 |

*p<0.10, **p<0.05, ***p<0.01

thus in theory independent directors should lead to greater operating efficiency. Meanwhile, the percentage of female members of the board of directors negatively affects operations but does not interfere with the efficiency of intellectual capital. This finding contradicts the results by Zahn (2006) whose work revealed that an increase in the number of females present on the board would boost intellectual capital. While women have generally seen benefits from their value to intellectual capital, a significant proportion of companies have no female directors (over 21%), so this may lead to difficulties in accurately assessing the effects of female board members. Companies which have separated the roles of CEO and chairman can expect a positive effect upon intellectual capital value but little effect upon the intellectual capital itself. The results in this study concur with those by Abidin *et al*. (2014) who found that a lack of duality fails to influence intellectual capital value. Broadly when the directors do not own or manage the business, there is an inequality created in the information received by the agent and the principal which can affect the strategy creation of the company as shown by Ho and Williams (2003) who found this link between intellectual capital and CEO duality. When directors are independent they may seek to use the resources of the company for their own personal gain. This provides no benefit to the company and does not support intellectual capital. Meanwhile, an increased number of board meetings can improve the operating performance but still have no effect on intellectual capital. This finding matches that by Al-Musali and Ismail (2012) who added that a diverse board of directors had a tendency to make changes to the company's strategies which would inadvertently have an adverse influence upon the

intellectual capital, also making it very hard to measure intellectual capital effectively in these circumstances. Vafeas (1999) reported a negative link between board meeting frequencies and operating outcomes, although, an increased number of audit committee meetings was found to be beneficial in terms of firm performance and efficiency of intellectual capital. Li *et al*. (2008) concur, revealing that a high frequency of audit committee meetings leads to improved performance. The size of the audit committee does not however, lead to positive outcomes, since, it negatively affects operations in full mediation. A large number of audit committee members results in a committee which is too rigorous and can inhibit the development of intellectual capital. The examination of intellectual capital efficiency can lead to better performance but when a committee is too big, the intellectual capital is decreased in Thai companies, leading to less effective governance.

## CONCLUSION

**Contributions of the study:** This study analyzed the links between intellectual capital, the performance of companies and the characteristics of their boards of directors. The study therefore, provides a valuable foundation for any future studies which seek to examine the role of intellectual capital in a business setting. The structural equation model which this study applied for the purpose of path analysis had not previously been applied in the context of corporate governance and its influence upon firm performance and intellectual capital. The study showed the positive effects upon intellectual capital resulting from the board of director characteristics such as the number of directors, the number of audit committee members and the frequency of the audit committee meetings. It can therefore, serve as a useful guideline to corporate governance strategies, since, it shows that companies are able to achieve their goals in line with the concepts established in agency theory. The findings suggest that the board of directors play a significant part in controlling intellectual capital and the deployment of resources to achieve a level of efficiency which leads to strong firm performance. The results would therefore, provide information to support the idea of the significance of intellectual capital. The information provided could also be useful in guiding administrators to more efficient practices and in guiding investors to increase their investment in the SET through taking into account the potential value of a company on the basis of its strong record in corporate governance. The size of the board of directors and the audit committee have a significant effect upon the development of intellectual capital as does the frequency of audit committee meetings and thus this information can serve as an indication to investors that the performance of certain companies might be expected to improve. Additional factors such as the proportion of independent directors, the proportion of female board members, the frequency of board meetings and the existence of CEO duality were all found to affect firm performance and should therefore, be of interest to investors.

## LIMITATIONS

The principal limitation in the study was the fact that only seven characteristics were identified to represent the board of directors while in reality there may be more variables which could have been selected. It is therefore, suggested that, the reliability of the study could be improved by deeper study of the factors related to the board of directors which might influence intellectual capital efficiency and firm performance.

## SUGGESTIONS

Future studies in this field should investigate corporate governance and interesting elements of the characteristics of the board of directors such as the structure of the ownership, financial returns to managers and board composition. It should also be possible to consider using the intellectual capital disclosure index as a tool to more accurately assess intellectual capital. In this study, the performance of the company was measured through the use of ROE as a financial indicator. Alternative indicators could be applied and may result in a different outcome. Indicators such as ROA, EPS and Tobin's Q were used in this study but alternatives exist which could be used in future investigations for a different perspective.

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