Aims and Scope
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DETERMINANTS OF CAPITAL STRUCTURE: A CASE STUDY IN THAI STEEL INDUSTRY

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ABSTRACT

This study examines the determinants of capital structure for Thai steel industry. The research selects growth opportunity, distance to bankruptcy, non-debt tax shield, and liquidity as research determinants and explores the relationship among determinants of leverage ratio. It also investigates which capital structure theory best explains the capital structure in the steel industry in Thailand. This study finds that growth opportunity and non-debt tax shield have positive relationships to leverage; whereas the distance to bankruptcy and liquidity of the firm have negative relationships to debt. The research’s results suggest that steel firms should use internal financing as priority before going for external financing which is relevant to Pecking Order Theory. Furthermore, when going for external financing, the optimal leverage ratio of 48% for Thai steel industry is appropriate and can be applied as a guideline for steel firms’ managers in determining the capital structure for a firm. Therefore, the benefit of this study could assist managers in the steel industry in selecting the right mix of debt and equity for their firms.

Keywords: Capital structure; growth opportunity; distance to bankruptcy; non-debt tax shield, liquidity

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Introduction
A major financial decision for all firms deals with raising capital or funding. Firms have two ways to raise capital-through debt or equity. While equity financing is often thought in terms of issuing common stocks, it could actually take a variety of forms depending partly on the type of the firm, and partly on the firm’s growth and risk characteristics. Equity financing could take form of internal equity financing (such as retained earnings) and external equity financing (such as owner’s equity, common stocks, venture capital and warrants-Damodaran, 1999).

Debt financing consists of short-term debt and long-term debt; it can vary from a simple bank debt to issuing bond to borrow from public. Debt is a fixed obligation to make cash flow payments (both interest and principal payments), provides tax-deductible advantage, has fixed life, and has priority claims on cash flows in both operating periods and in times of financial trouble. There is little management cover after meeting all other fixed obligations, and it provides management control to the owners. However, equity provides no tax advantage from its dividends payments, and equity holders do not have priority in times of financial trouble (Damodaran, 1999).

Theory suggests that managers must choose a right financing mix of debt and equity that maximizes firm value (known as optimal capital structure.) The most common approach is to set leverage close to that of the industry to which the firm belongs. If the firms in the industry are similar to fundamental and healthy characteristics, it can be argued that this approach provides a short-cut in arriving at optimal capital structure. However, if the firms differ from these characteristics, this approach is likely to fail. Characteristics of capital structure have been subject of many research studies. Many researchers have attempted to find out the determinants of the right mix between debt and equity. Most empirical studies in determinants of capital structure have focused on developed countries. Rajan and Zingales (1995) studied capital structure in G-7 countries; Burgman (1996) studies determinants of capital structure in the US; Hall et al. (2004) did a case study of capital structure of SMEs in European zone. Some studies focused on emerging and developing countries. Booth et al. (2001) studied capital structure of ten developing countries; Deesomsak et al. (2004) study capital structure of selected countries in Asia-Pacific region and they selected Thailand, Malaysia, Singapore, and Australia. Narrowing down the geographic to only one country, Buferna et al. (2005) researched the capital structure of some industries in Libya. Huang and Song (2006) researched capital structure in China across various industry sectors. Rafiq et al. (2008) conducted their research in Pakistan in chemical industry sector. Banchuenvijit (2011) researched 81 listed firms in Thailand. Since most researches in this area have been done on regional basis, which includes many countries, or many industries in a specific country, the conclusions do not provide in-depth understanding for a specific industry or country. To avoid this problem, this research specifically examines determinants of capital structure of steel industry in in Thailand. More specifically, this research attempts to find the relationship among determinants of leverage ratio. It also investigates which capital-structure theory can best explain the mix of debt and equity proportion in the steel industry in Thailand.

This research attempted to address the following research questions:
1. What are the possible determinants of capital structure for the Steel Industry in Thailand?
2. What are relationships among these determinants and the leverage ratio? And,
3. Which capital structure theory, among the three, best explains the capital structure of the Steel Industry in Thailand?

The objectives of this research; therefore, are:
1. To identify and to gain a better understanding of the determinants of the capital structure for the Steel Industry in Thailand.
2. To suggest an optimal level of debt and equity financing in the Steel Industry, which could be used as a model for firms when making financing decision. And,
3. To identify the capital structure theory that best explains the characters of the Steel Industry in Thailand.
Thailand is the largest steel exporter in ASEAN countries. The need for steel products for domestic consumption has also been rising due to the growth in construction, infrastructures, and automotive industries. This study could assist managers in the steel industry in selecting the optimal financing mix for their firms.

**Literature Review**

**Overview of Steel Industry in Thailand**

Thailand is the largest steel consuming country in ASEAN group. It consumed approximately 16.4 million tons in 2012, which made it a major importer of iron and steel products in ASEAN group (Tan, 2013). Since 2010, within the country, the need of steel products has grown approximately 7.3 percent annually, and the import of steel to the country has risen approximately to 4.3 percent (Iron & Steel Institute of Thailand, 2012). Steel industry is an essential sector to Thailand’s development. Steel products are vital as raw materials in many important industries and also are used in daily lives. Fifty four percent of the steel products in Thailand are mainly used in construction, in infrastructure projects, and 16 percent are used in automotive industry, 13 percent in machinery and industrial sectors, 12 percent in appliance, and the rest are used in canned packaging (Iron and Steel Institute of Thailand, 2012). In the construction industry, which has the most impacts for steel consumptions, the consumption of steel has grown continuously each year at the approximate rate of 5 percent per year (Office of the Permanent Secretary, 2012). The needs of steel in the automotive industry have also been expanding by 11 percent per year (Iron & Steel Institute of Thailand, 2012). In January 2011, there were 27 firms listed in the Stock Exchange of Thailand, valued in equivalent of 103 billion Thai baht, or approximately 1.32 percent of Stock Exchange of Thailand market capitalization (SET News, 2010).

**The Capital Structure Theories**

Three theories explain capital structure; MM theory, Static Trade-off theory, and Pecking order theory. These three theories are briefly summarized as follows:

**Modigliani-Miller Theory**

The first capital structure theory was proposed in 1958 by Franco Modigliani and Merton H. Miller and was later referred to as the MM Theory. This MM theory contained certain unrealistic assumptions, such as, perfect and frictionless markets, no taxes, no bankruptcy costs, and no brokerage costs. Due to these assumptions, this theory concluded that capital structure did not affect the companies’ value (Modigliani & Miller, 1958). Later in 1963, Modigliani and Miller revised their MM Model by including the effect of the corporate taxes. Their revised theory concluded that when the corporate taxes were considered, increase in leverage raised the value of company due to the fact that the interest is a tax-deductible expense. This meant that companies would have more cash available. On the other hand, if companies financed by equity, they did not get tax-shield benefits when the dividends were paid to the shareholders. Thus, the revised MM Model suggested that the optimal structure occurred when companies financed by 100 percent debts (Modigliani & Miller, 1963). An empirical study on the Modigliani and Miller tax model (1963) done by Fama and French (1998) argued that the major determinant of leverages had positive correlation with profitability. This conclusion suggested that profitable companies tended to hold high level of debt.

Miller also presented a paper that integrated both corporate tax and personal tax into the model. He found that as personal tax decreased, but not fully eliminated, the tax-shield was beneficial. Thus, the Miller Model also supported the use of 100 percent leverage (Miller, 1977). Various countries have different tax systems which cause various levels of debt tax benefits. Countries that permit companies to take advantages of both carry-forward and carry-back losses, like in the US, may encourage the companies to take more debts. This is because the companies can get cash refund from previous taxes paid or future tax deductions (Ashton, 1989). In Thailand, the companies are permitted tax benefits for carry-forward losses for only five accounting periods (PwC Thailand, 2013). This makes Thai companies unwilling to hold very high debt levels in their capital structure because
they do not want to increase the bankruptcy risk. There are many criticisms on both the MM and the revised Miller Model about their assumptions. For example, both models do not consider bankruptcy costs, agency costs, and brokerage costs, which is unrealistic.

The MM and revised Miller theories also influenced the development of other theories such as the Static Trade-off Theory and the Pecking Order Theory.

**Static Trade-off Theory**

The Static Trade-off theory was based on works of Baxter (1967), Stiglitz (1969), Kraus and Litzenberger (1973), and Kim (1978). The Static Trade-off Theory claimed that companies could reach the optimal capital structure as a trade-off between tax benefits and financial distress. The Static Trade-off Theory attempted to correct several imperfections of the MM and revised M theories by including bankruptcy costs, corporate taxes, and personal taxes. It kept the assumptions about market efficiency and symmetric information. Later, this theory also added the agency cost. Agency costs refer to costs associated with resolving conflicts among manager, bondholders as well as shareholders. More debt could lead to conflict between managers and bondholders, while more equity could lead to conflict between shareholders and management (because of the high level of free cash flow- Jensen and Meckling, 1976). Jensen and Meckling (1976) claimed that the conflicts between management control and owners' interest could give a negative impression to stockholders. For instance risk taking managers may invest in risky projects which shareholders may consider too risky for value of their investment.

The inclusion of bankruptcy and agency costs may reduce the benefits from tax-shield which limits use of debt. This is called the target or optimal level of capital structure. When a company issues more debts, the value of the company will raise to a certain point. Continued borrowing will lead to a fall in the firm’s value. This is because when a company finances with high level of debt, the bankruptcy and agency costs tend to increase, which lowers the company’s value (Jensen & Meckling, 1976).

According to the Static Trade-off Theory, a company has a target debt ratio which it tries to reach. The target is composed of the trade-off between the tax benefits and bankruptcy related costs (Jong et al., 2008). Historically, some determinants that affect the target debt ratio are as follows.

Growth opportunity is one element. If there is little growth opportunity, the firm may not need to use much debt. This is due to the fact that the firm may already have sufficient free cash flow reserves. The purpose of this strategy is to limit the potential of investing in unprofitable projects. In a company facing high growth opportunities, which usually has a small free cash flow, raising more capital by debt financing may prove beneficial. However, the intensive use of debts may cause the agency conflicts among managers and bondholders which could end up to high financial distress and increased cost of debt. A strong growth company that wants to decrease these conflicts can offset the benefit of debt by equity funding (Jensen & Meckling, 1976). Healthy companies with high distance from bankruptcy are likely to have low level of debt (Kayo & Kimura, 2011). This is because the intensive use of debts leads to the increasing in bankruptcy risks that may reduce the value of the companies (Jensen & Meckling, 1976). Therefore, companies can stay away from bankruptcy if the companies maintain low level of debts.

Tax-shield benefits from holding debts can be substituted by other tax deduction called Non-debt tax shield which consist of investment tax credit and depreciation (DeAngelo & Masulis, 1980). Companies with a large section of non-debt tax shield do not need to pay much attention to the benefits from interest expenses. Thus, these companies tend to keep small portions of debts.

Companies that have high liquidity ratio have more potential to use debt financing. This is because the companies feel confident that they have enough cash on hand which they can use to support for the short-term obligation (Akinlo, 2011). Thereby, companies have higher chances to employ short-term debt financing.

**Pecking Order Theory**

In 1961 Donaldson introduced the Pecking Order
Theory from a survey among American companies. Later, Myers did further studies in this theory and concluded that according to this theory the optimal capital structure does not exist (Myers, 1984). Pecking order theory is based on the assumption of information asymmetry while MM theory assumes a perfect market. Information asymmetry assumes that since manager has more accurate information than outside investors, he/she notices earlier that the company is overvalued. Therefore, he/she may raise capital by issuing stocks. However, when the company issues more equity, especially before reaching the maximum limit of its debt, investors may perceive it as a signal that the company is stepping into a bad financial position. In such a case, investors’ actions could lower the company’s stock price. In order to prevent the decline in stock price, the managers may be forced to avoid issuing needed equity (Myers & Majluf, 1984).

The Pecking Order Theory states that a company follows a hierarchy of financing choices ranging from internal to external sources and from those with cheaper to more expensive transaction costs. When a company needs more capital, usually at the beginning, it normally uses internal funds. If the internal financing is insufficient, it moves to acquire the external funding. The company will select the cheapest sources of financing to minimize the total cost of capital. This usually makes the debt financing preferable. Issuing preferred stocks is the next step, and is then followed by issuance of common stock (Myers & Majluf, 1984; Pinegar & Wilbricht, 1989).

Adedeji (1998) criticized that Pecking Order Theory did not clearly explain some concepts, such as the effects of government intervention and level of interest. When the economy is down, the government intervenes by lowering the level of interest in order to stimulate the economy. In such a case, the cost of debt will be lower than the cost of internal funds (Cull & Xu, 2005). Pecking Order Theory suggests that companies follow suggested financing hierarchy and does not allow for any exceptions.

According to the Pecking Order Theory, the market-to-book ratio is regularly used to measure company’s growth opportunities. Studies have revealed that during period of high growth opportunity, companies usually hold high debt level (Myers, 1984; Fama & French, 1998), therefore suggest a positive relationship between growth opportunity and leverage. Pecking Order Theory claims that companies prefer to use internally generated funds, in form of profits and retained earnings, to finance the company activities before consider other sources of financing (Myers, 1984). This theory suggests that the greater the distance from bankruptcy, the lower level of debt a company should use. A company with positive income, stable sales revenue, and good operating performance is normally considered to be far from bankruptcy.

Empirical evidence has found that the Non-Debt Tax Shield had high positive correlation with asset tangibility (Bradley et al. 1984; Huang & Song, 2006). Pecking Order Theory proposes that tangible assets are used as an assurance for borrowing money from banks and issuing debts because of the asymmetric information since creditors prefer some collateral assets to guarantee for the defaults (Myers & Majluf, 1984). This leads to a positive relationship between the Non-Debt Tax Shield and leverage. Moreover, Pecking Order Theory states that companies with high liquidity have fewer debts because the companies already have sufficient internally generated funds and free cash flow to use for their operation (Niu, 2008; Akinlo, 2011).

Previous Studies on Capital Structure and its Determinants

The following section briefly discusses previous research on capital structure as well as its determinants. Four determinants of the capital structure (leverage ratio) are growth opportunity, distance from bankruptcy, non-debt tax shield, and liquidity.

**Leverage Ratio (Dependent variable)**

Studies by Titman and Wessels (1998); Buferna et al. (2005); used three main ratios to measure the firms’ ability to meet financial obligation and to identify methods of financing. These three leverage ratios were total debt to total assets (TD/TA), short-term debt to total assets (STD/TA), and long-term debt to
total assets (LTD/TA). Buferna, et al. (2005) analyzed each of these leverage ratios with similar set of data in explanatory variables. From their research, they found that total debt to total assets (TD/TA) gained the highest adjusted R² of 0.95. Myers and Majluf (1984) found the composition of the duration of debt ratios: short-term debt to total assets, and long-term debt to total assets, - would be a better method to measure leverage. They also stated that the book value of assets should be used since assets-in-place are used to as collateral to support debt, while market value of assets relies on growth opportunity of the firms and is not closely related to the level of debt used. Research in Thailand by Udomsirikul et al. (2011), and Banchuenvijit (2011), found that it was more precise to use total debt to total assets (TD/TA) as a proxy for leverage ratio. In this research, we chose book value of total debt to book value of total assets (TD/TA), as the proxy for leverage ratio.

**Growth Opportunity (Independent variable)**

Steel industry is highly capital intensive and to seek growth potentials a firm needs a large capital investment which often involves a large amount of debt financing. Researchers use variety of methods to measure growth opportunity. Titman and Wessels (1988) used three ratios to measure growth opportunity: capital expenditures to total assets; research and development to sales, and percentage of change in total assets. Huang and Song, (2006) used growth rate in sales to represent growth opportunity. Many researches study growth rate using percentage increases in total assets (Buferna et al., 2005; Saeed, 2007; Rafiq et al., 2008; Banchuenvijit, 2011). Other researchers argue that a more reliable growth opportunity measure is Tobin’s Q ratio, the market value-to-book value ratio of common equity, since it incorporates the future expectation and confidence of investors (Rajan & Zingales, 1995; Booth et al., 2001; Udomsirikul et al., 2011). In our research, we used market value-to-book value ratio of common equity as a proxy for growth opportunity. This was due to the fact that our study did not include research and development expenses or capital expenditures (seldom used in steel industry.)

**Distance from Bankruptcy (Independent variable)**

Altman (1968) developed a model called Altman’s Z-score to test companies’ distance to bankruptcy. Altman’s Z-score indicates the potential of the firm to go bankrupt; the higher the z-score, the less likely is the firm would go bankrupt. In the original work, the Altman’s Z-score model was composed of five ratios; 1) earnings before interest and taxes to total assets, 2) retained earnings to total assets, 3) sales to total assets, 4) working capital over total assets, and 5) market value of equity to book value of total debts. MacKie-Mason (1990) modified Altman’s Z-score by excluding market value of equity to book value of total debts, because such factor contains a close relationship with other equity measurements such as growth opportunity or Tobin’s Q ratio. Graham et al. (1998) applied the modified Altman’s model in their research and modified Altman’s Z scores, are as the following:

\[
Z = 3.3 \left( \frac{EBIT}{Total\; Assets} \right) + 1.0 \left( \frac{Sale}{Total\; Assets} \right) + 1.4 \left( \frac{Retained\; Earnings}{Total\; Assets} \right) + 1.2 \left( \frac{Working\; Capital}{Total\; Assets} \right)
\]

Static Trade-off Theory and Pecking order Theory claimed that distance from bankruptcy had a significance negative relationship with leverage; i.e., a firm with low leverage has a high distance from bankruptcy. Some empirical evidence supported this claim (Byoun, 2008; Lee et al., 2010; Lewis & Jais, 2013; Fathi et al., 2014). However, Kayo and Kimura (2011) found that the distance from bankruptcy was not a significant influence on leverage ratio. According to the Static Trade-off Theory, the firm’s financial decisions are influenced by costs and benefits of using debts. Therefore the measure of how far the firm is from bankruptcy helps measure the risk of debt financing. There are a limited numbers of studies in relationship between distance from bankruptcy and leverage; therefore,
it is studied in our research. In this research, we use the modified Altman’s Z-score as a proxy for distance of bankruptcy.

**Non-debt Tax Shield (Independent variable)**

Non-debt tax shield consists of investment tax credits and depreciation that can be used for tax deduction at the year-end. Firms with many non-debt tax shield items could hold fewer or lower debts, due to the fact that these non-debt tax shield items could be used as substitutes for interest expenses (DeAngelo & Masulis, 1980). In their study, Deesomsak et al. (2004) found a negative relationship between non-debt tax shield and leverage. On the contrary, Bradley, Jarrell, and Kim (1984), Saeed (2007), and Rafiq et al. (2008) found a positive relationship between non-debt tax shield and leverage. A research by Titman and Wessels (1988) found no significant relation between the two variables. Due to conflicting findings of previous researches, in our study of the Thai steel industry, we decided to further study the relationship between non-debt tax shield and leverage. A common ratio used in previous studies to measure non-debt tax shield is the ratio of depreciation expenses to total assets. In our research, we used the ratio of annual depreciation expense to total assets as proxy for non-debt tax shield in Steel industry in Thailand.

**Liquidity (Independent variable)**

The purpose of liquidity in a firm is to provide sufficient current assets to cover daily operations and to meet short-term liabilities. Researchers have used cash conversion cycle model (composed of three ratios) or a simpler current ratio (current assets divided by current liabilities) to represent liquidity of a firm (Akinlo, 2011; Jong et al., 2008). Cash conversion cycle model focuses on the length of time between when the company makes payments and when it receives cash inflows (Richards & Laughlin, 1980). The firm’s goal should be to shorten the cash conversion cycle as much as possible without hurting its operations. The reduction in the cash conversion cycle, the lower the required net operating working capital, and the higher the free cash flow. Current ratio shows the firm’s ability to cover its current liabilities with its current assets; usually should be more than one with a larger the number representing higher ability of the firm to pay off its short-term obligations. However, a very high current ratio could imply that the firm sacrifices profitability for liquidity. In this research, we use current ratio to represent liquidity of the company. The relationship of liquidity and leverage in capital structure theories are still questionable. According to Static trade-off theory, there is a significantly positive relationship between liquidity and the level of debt used. The higher liquidity a firm has, the more it can use debt (Akinlo, 2011). On the other hand, Pecking Order Theory states that a firm prefers to use internal source of financing due to its lower cost compared to the cost of external financing. As a consequence, a firm that maintains adequate liquidity accumulates more internal financial resources and usually seeks lower external financing. Niu’s study (2008) showed a negative relationship between liquidity and debt financing supporting the prediction of the Pecking Order Theory.

**Research Model**

From the stated research questions and research objectives proposed in Section 1, we suggested the following regression equation to test the model:

\[
LEV_i = b_0 + b_1 (GT_{i-1}) + b_2 (DBR_{i-1}) + b_3 (NDTS_{i-1}) + b_4 (LIQ_{i-1}) + e_i
\]

Where,

- LEV = Leverage
- GT = Growth opportunity
- DBR = Distance from bankruptcy
- NDTSt = Non-debt tax shield
- LIQ = Liquidity
- ei = error term
Research Method
This study used a cross-sectional data, which was tested with a multiple regressions method. First, this study tested the correlation between independent variables to check for multicollinearity. Second, the regression was applied and results were obtained. Third, a t-test was used to check for significance of each variable in order to explain the importance and its relationship with the leverage. Fourth an ANOVA was applied to get an F-statistic for supporting the significance of the model. Finally, a robustness test was performed a reliability test.

Hypotheses
Four hypotheses were used to test the relationships. Null hypotheses were rejected when the result showed statistically significance of 1%, and 5%.
Ha: There is a relationship between Growth opportunity and Leverage.
Hb: There is a relationship between Distance from Bankruptcy and Leverage.
Hc: There is a relationship between Non-Debt Tax Shield and Leverage.
Hd: There is a relationship between Liquidity and Leverage.

Scope of the research
As mentioned earlier, most research studied on capital structure has covered many industries or were done in many countries. Although the existing empirical results from these studies have broadened the knowledge in the area, they have provided few results with high applicability in determining the right mixture of debt and equity which could be used by managers of a specific industry in a specific country. This research attempted to cover this gap by investigating the optimal capital structure in the steel industry in Thailand.

The purpose of this research was to study the determinants of capital structure, and the relationships among these determinants and the leverage ratio in the specified industry. Furthermore, this research study examined existing capital structure theories to find out which theory best explained debt and equity mixture in the selected industry. We select steel industry in Thailand to study due to the fact that this industry has grown continuously since year 2010. We believe that the results of our research should benefit Thai managers in the chosen industry in determining the optimal level of capital financing.

Research Sample
In 2009 there were approximately 3,815 steel companies registered in Thailand with only 27 listed in the Stock Exchange of Thailand (The Thailand Company Directory, 2009). Early in year 2011, Stock Exchange of Thailand added “Steel Sector” into the “Industrials” Industry group. This indicates the growing importance of the steel sector in Thailand. In 2011, firms listed under Steel sectors were composed of the producers, processors, and sellers of steel and its related products (The Stock Exchange of Thailand, 2011).

In this study we used the companies listed in the Stock Exchange of Thailand under the Steel Sector (27 companies.) The reason for this selection was the availability of information for public companies.

Sources of Data
The research collected published information from various places. Financial statements of 27 listed companies under Steel Industry sector were collected mainly from Securities and Exchange Commission of Thailand, the firms’ annual reports and, the firms’ websites (Securities & Exchange Commission Thailand, 2014.) The study obtained data during 2007 to 2012, six years in total. However, one listed company had less than six years of financial information (financial statements for the year 2012 were not available.) There were 160 cases from 27 companies used as data for this research.

The Results of Hypotheses Testing
Descriptive Statistics
Shown in Table 1 below, most companies in Thai Steel industry had the average debt ratio of 46.36 percent. More specifically, about 40 percent of the aggregate debt was short-term, while about 6 percent was long-term. One explanation of this mixture could be that managers believe that short-term debt provided more flexibility in term of repayment period than long-term debt. This might be due to
the fact that the firms in the industry face unstable earnings due to the changes of world steel price and demand. Furthermore, this may be due to the financial policy of some companies that prefer equity financing and avoid long-term debt. Low short term rate in recent years may also have contributed to this strategy. Further research is needed to determine the reason behind this short term borrowing preference. The maximum rate of growth opportunity (39.21 times) could indicate a bright future for Thai Steel Companies. However, some companies have negative total equity values which could lead to their negative growth opportunity. The average of distance from bankruptcy for Thai Steel Companies was a positive value. Lastly, the maximum number of liquidity, 31.87 times, illustrated that some companies had very liquidity and internal funding.

Table 1 Descriptive Statistics of Research Variables

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Median</th>
<th>Minimum</th>
<th>Maximum</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leverage</td>
<td>0.4636</td>
<td>0.4570</td>
<td>0.0181</td>
<td>1.7068</td>
<td>0.2288</td>
</tr>
<tr>
<td>Growth Opportunity</td>
<td>1.6119</td>
<td>0.7101</td>
<td>-0.6852</td>
<td>39.2120</td>
<td>4.0289</td>
</tr>
<tr>
<td>Distance from Bankruptcy</td>
<td>1.6805</td>
<td>1.7436</td>
<td>-3.8365</td>
<td>6.0380</td>
<td>1.1794</td>
</tr>
<tr>
<td>Non-debt tax shield</td>
<td>0.0252</td>
<td>0.0237</td>
<td>0.0012</td>
<td>0.0787</td>
<td>0.0140</td>
</tr>
<tr>
<td>Liquidity</td>
<td>2.6390</td>
<td>1.4760</td>
<td>0.1263</td>
<td>31.8668</td>
<td>3.6782</td>
</tr>
</tbody>
</table>

Correlation analysis among independent variables found the lowest correlation between independent variables was -0.4259 and the highest was 0.2190 (Table 2). Therefore, the multicollinearity was not a problem. The distance from bankruptcy was positively related to growth opportunity and liquidity, whereas it was negatively related to non-debt tax shield.

Table 2 Correlation Matrix of Independent Variables

<table>
<thead>
<tr>
<th></th>
<th>Growth Opportunity</th>
<th>Distance from Bankruptcy</th>
<th>Non-debt tax shield</th>
<th>Liquidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth Opportunity</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance from Bankruptcy</td>
<td>0.0630</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-debt tax shield</td>
<td>-0.0462</td>
<td>-0.4259</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Liquidity</td>
<td>-0.0954</td>
<td>0.2190</td>
<td>-0.0890</td>
<td>1</td>
</tr>
</tbody>
</table>

Regression Results and Analysis

Table 3 illustrates the ANOVA which tests the goodness of fit between the data and the model. The total number of observation is 160 sets. The F-test shows that there are relationships among independent variables (growth opportunity, distance to bankruptcy, non-debt tax shield, and liquidity) and the dependent variable (leverage ratio). The last column in Table 3 indicates a significance level of 1%, suggesting good predictability of the model.

Table 3 ANOVA Table of Multiple Regressions

<table>
<thead>
<tr>
<th></th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>Significance F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>4</td>
<td>4.36371</td>
<td>1.09093</td>
<td>42.70573</td>
<td>0.00000</td>
</tr>
<tr>
<td>Residual</td>
<td>155</td>
<td>3.95951</td>
<td>0.02555</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>159</td>
<td>8.32323</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
R-square ($R^2$) was equal to 0.52428 and Adjusted $R^2$ was equal to 0.512 (Table 4). This meant that the variation of all four independent variables could explain the variation in the dependent variable. Approximately 52.4 percentile of the proportion of the variance in dependent variable can be explained by the variations in the independent variables by 51.2 percent. The standard error of estimation was 15.98 percent, which was relatively low, so there was less dispersion of dependent variable around its mean.

The regression results that study the determinants of leverage are also presented in Table 4 below. This comprises of the expected sign of coefficients and the statistical significance of each independent variable. The results infer that all independent variables have statistically significant relationship to the leverage ratio at 1% and 5%.

<table>
<thead>
<tr>
<th>Table 4 Regression Coefficients and Significance Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coefficients</strong></td>
</tr>
<tr>
<td>Intercept</td>
</tr>
<tr>
<td>Growth Opportunity</td>
</tr>
<tr>
<td>Distance from Bankruptcy</td>
</tr>
<tr>
<td>Non-debt tax shield</td>
</tr>
<tr>
<td>Liquidity</td>
</tr>
</tbody>
</table>

Multiple $R = 0.72407$; $R^2 = 0.52428$; Adjusted $R^2 = 0.51200$

The regression equation for this research can be rewritten based on the coefficients in Table 4 as follows:

$$LEV_t = 0.47985 + 0.02543(\text{GT}_{t-1}) - 0.02572(\text{DBR}_{t-1}) + 2.38668(\text{NDTS}_{t-1}) - 0.02811(\text{LIQ}_{t-1}) + \epsilon_t$$

Based on this analysis, growth opportunity has a positive relationship with leverage. The coefficient is 0.02543 with a significant level of 1% (Table 4). This means that firms with growth opportunity maintain a high level of debt financing instead of issuing new equity. This is in line with the Pecking Order Theory, whereas the results contradict the Static Trade-Off Theory. The finding revealed that firms with high growth opportunity in Thai Steel Industry tended to have high debt due to the fact that the low interest rate policy of the Thai government aimed at stimulating the economy and supporting industries with high growth potentials. This finding was consistent with findings of the study by Saeed (2007) and Rafiq et al. (2008) which also observed a positive relationship of growth opportunity and leverage. However, it was worthy of noting that some prior researchers found a negative correlation between growth opportunities and leverage while other studies found no significant relationship (Deesomsak et al., 2004; Buferna et al., 2005; Supanvanji, 2006; Banchuenvijit, 2011). Distance from bankruptcy had a negative relationship with the leverage ratio in studied companies, with coefficient of -0.2572, at significant level of 5% (Table 4). This means that the steel companies in Thailand generally have sufficient internal funding, such as retained earnings for investments; therefore, they used lower level of debt financing to reduce the chance of bankruptcy. This finding was in line with suggestions made by both the Static Trade-off and Pecking Order Theories that the companies try to avoid using intensive debt desire to select the cheapest source of capital, usually from internal capital sources such as retained earnings. Byoun, 2008; Fathi et al., 2014 also found similar evidence in their research. Companies in Thai steel industry consider themselves to be far from bankruptcy (or to have low bankruptcy risk) and usually have low leverage ratio.
In this research, we found that the non-debt tax shield was positively related to the level of leverage used by firms with a coefficient equal to 2.38668, at significance level of 5%. This positive relationship is in line with the Pecking Order Theory. We found that when firms had more tangible assets and normally used these assets as collaterals to get more debt. The depreciation expenses increases with the increasing of tangible assets due to their closely positive relationship (Bradley et al., 1984). Our findings were in agreement with other previous research which found a positive relationship between non-debt tax shield and leverage used (Bradley et al., 1984; Saeed, 2007; Rafiq et al., 2008; Lewis & Jais, 2013). It is noteworthy to mention that in contrast, Titman and Wessels (1988) had found that non-debt tax shield was not a significant determinant of debt proportion.

In our study, liquidity was negatively related to the leverage ratio. The coefficient for liquidity in our model was -0.02811 with significance at 1%. This makes our findings consistent with the Pecking Order Theory stating that the firms with higher liquidity usually use lower debt proportion. Firms with sufficient internal funds usually need lower level of debt financing. Previous empirical evidences had also suggested a negative relationship between leverage and liquidity (Jong et al., 2008; Lewis & Jais, 2013).

In conclusion, our research indicated that the Peking Order Theory may provide a good explanation of the financing decision made by the managers of the Thai steel companies. Results from our research suggested a positive relationship between leverage and two independent variables (growth opportunity and non-debt tax shield.) The study also found a negative relationship between leverage and two independent variables (distance from bankruptcy and liquidity (see Table 4 and regression equation).

**Hypotheses Testing**

About four hypotheses stated in Section 4.1, along with results shown in Table 4, we conclude the following:

**Ha**: There is a relationship between Growth opportunity and Leverage.

Our findings supported this hypothesis. The null hypothesis (Ha) was rejected. We concluded that there was a positive relationship between growth opportunity and leverage. This relationship was significant at 1%.

**Hb**: There is a relationship between Distance from Bankruptcy and Leverage.

The study supported this hypothesis. The null hypothesis (Hb) was rejected. We concluded that there was a negative relationship between distance from bankruptcy and leverage and this relationship was significant level at 5%.

**Hc**: There is a relationship between Non-Debt Tax Shield and Leverage.

The study supported this hypothesis and the null hypothesis (Hc) was rejected. We conclude that there was a positive relationship between non-debt tax shield and leverage and this relationship was significant level at5%.

**Hd**: There is a relationship between Liquidity and Leverage.

The study supported this hypothesis and the null hypothesis (Hd) was rejected. We concluded that there was a negative relationship between liquidity of the firm and leverage and this relationship was significant level at 1%.

**Summary and Concluding Remarks**

**Summary of the Findings**

The choice of the capital structure is a major financial decision for manager of firms. The right mix of debt and equity used affects a firm's cost of the capital, the risk and return to shareholders, and the value of the firm. Several capital structure theories have attempted to explain the behavior of companies in regards to making this financial decision. Research in capital structure has been burdened by mixing industries, countries, etc. which has limited its applicability for specific managerial decisions. The main objective of our research was to identify key determinants of the capital structure for the steel industry in Thailand. The findings could provide not only a better understanding of the
industry but also a guideline for future financial decisions. Two well-known capital structure theories were used to explain the optimal level of capital structure. The Static Trade-off Theory claims that there is an optimal level of capital structure. The Pecking Order Theory proposes that firms tend to use internal resources before external resources for financing in order to lower the cost and to avoid asymmetric information.

In Thailand, the steel industry has become more important due to its growth opportunities and its contribution to the overall economy. Our research used a sample of 27 listed firms in Steel Industry group in the Stock Exchange of Thailand. Data collection period was from 2007 to 2012. Multiple regressions of cross-sectional data were used as an analytical method. Four determinants of capital structure studied were growth opportunity, distance from bankruptcy, non-debt tax shield, and liquidity. The results indicated that all four determinants had significance relationships with the firm’s leverage. Growth opportunity and non-debt tax shield had positive relationships to leverage; whereas the distance to bankruptcy and liquidity of the firm has negative relationship to debt. The research discovered that the Pecking Order Theory was an appropriate theory to explain the leverage characteristic of firms in Thai steel industry. The studied firms tended to use internal financing as their priority before they applied for external financing. We also concluded that growth firms tended to hold higher levels of debt financing since they may have more investment projects and insufficient internal funds. Firms that generate high level of operating earnings were more likely to use lower debt financing to reduce the risk of bankruptcy. Firms with more tangible assets can use their assets as collaterals when applying for debt can benefit from non-debt tax shield advantage. Finally, firms with high liquidity usually hold lower debt due to sufficient internal capital resources. From the conclusion of our findings, these four specific factors significantly influenced on the capital structure and their relationships are consistent with the application Pecking Order Theory. We believe that our research findings about these four determinants could be applied to other industrial sectors in Thailand, which may have similarity in the nature of these determinants or firm-specific factors. However, this would leave the gap for further research before making such conclusion.

### Managerial Implication

The leverage model derived in this research can be used for managerial decisions on determining appropriate capital structure for steel companies in Thailand. A steel firm can use the debt level of the industry to determine its proper capital mixture. Table 5 illustrates the average numbers of all determinants calculated for the researched companies in the study in 2012. The recommended leverage ratio (debt ratio) for year 2012 is determined by the model.

### Table 5 The Average Financial Information of Thai Steel Industry in 2012

<table>
<thead>
<tr>
<th>Growth Opportunity (Market value/book value of equity)</th>
<th>Distance from Bankruptcy (Modified Altman’s Z Score)</th>
<th>Non-Debt Tax Shield (Annual depreciation expenses/ total assets)</th>
<th>Liquidity (Current assets/current liabilities)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.8318</td>
<td>1.4702</td>
<td>0.0270</td>
<td>2.5826</td>
</tr>
</tbody>
</table>

\[
LEV_t = 0.47985 + 0.02543(GT_{t-1}) - 0.02572(DBR_{t-1}) + 2.38668(NDTS_{t-1}) - 0.02811(LIQ_{t-1})
\]

\[
LEV_{2012} = 0.47985 + 0.02543(1.8318) - 0.02572(1.4702) + 2.38668(0.0270) - 0.02811(2.5826)
\]

Therefore, \(LEV_{2012} = 48.03\%\)
The research model suggested a debt ratio of 48% for the Thai Steel Industry. Although this model can be used as a guideline for determining the capital structure for a firm, specifics of various companies would allow for deviations from this average. The bar chart in Figure 1 shows the comparison between the actual leverage and the leverage suggested by the model for each of the 27 firms in our study in 2012. More than half of 27 listed firms had similar leverage levels as the model recommended. Only a few firms have major deviations due to their unique business preferences for equity financing. The investors can also use the findings of this study to assist them in making investment decisions to determine a firm’s riskiness when purchasing stocks. Risk-averse investors can apply the leverage model along with other valuation techniques in order to avoid investing in the risky companies.

**Figure 1** Comparison the Actual Leverage to the Suggested Leverage

**Limitations of the Study**
Since the focus of this research was to examine the characteristics and the determinants of capital structure of the Thai steel industry, its conclusions may not be applied to other industries in Thailand without further research. Moreover, the characteristics of Steel Industry may be different across countries, so the research results may not represent such an industry in other countries.

**Recommendations for Further Research**
This research focused on four determinants of the capital structure. Other determinants, such as volatility of income and structure of ownership and influencing leverage decision could be included or could be the subjects of future studies.

**References**


IT COMPETENCES FOR PROFESSIONAL ACCOUNTANTS: 
CASE STUDIES IN THAILAND

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Maha Sarakham, 44150, Thailand

ABSTRACT

Today, Information Technology (IT) is already having a major impact on business whilst the traditional roles of accountants is transforming. IT elements have been appearing to be crucial in triggering changes of accountants’ roles. Thus, this study aims to investigate IT competencies among professional accountants to enhance firm performance. This research was conducted with 53 respondents from ten organisations in Thailand. This qualitative research employed interpretive evidence. The results indicate that 19 IT competency factors within the organizational issues were defined. Specifically, these new factors were based on the research findings and the literature and uniqueness to IT competencies for professional accountants, including ERP software skills, BI software skills as well as accounting law and legal skills. The evidence in this study suggests that ERP software, spreadsheets, BI software and accounting software were ranked as much-needed skills to be acquired by accountants while communication skills were ranked as the most required skills and delegation skills as the least required. The findings of the research’s empirical evidence suggest that organizations should understand the appropriateness to develop information technology-related competencies for workers in general and for professional accountants in particular and to provide assistance in all processes of decision making.

Keywords: IT competencies, IT competences for professional accountants, IT skills for accounting

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Introduction

IT has changed the way information to be collected, processed, stored, and collected for the arrangement of bookkeeping as well as back related data required by the management to control and manage business activities, therefore bookkeepers were firmly influenced by this change (Bahador & Haider 2013). The importance of IT skills to the accounting profession is additionally highlighted by numerous gatherings, including accounting specialists, academics and professional bodies (IFAC 2003; Chang & Hwang 2003). According to IFAC (2006), the accountancy profession calling confronts various difficulties identifying with IT. Information technologies are changing the nature and financial aspects of accounting action. The career plans of professional accountants, and their cognate training needs, need to be predicated on an authentic view of the transmuting nature of accounting and the profession’s role, and the cognizance and skills required for prosperity as a professional accountant. In this way, every professional accountant is relied upon to go about as a user, designer, manager, organizer or evaluator of information systems; or a blend of these parts (Wessel, 2008). It must be recognized that these rules require reasonable IT learning, handy IT aptitudes, association abilities, interpersonal abilities, and other social abilities (IFAC, 2006). Although professional accountants’ IT competencies are required by the expert guidelines set by IFAC, very little is known about professional accountants’ IT competencies levels, especially in developing economies such as Thailand (Chaikanalukkoon, 2011; Thongdeerawisuraket, 2011). There are very few studies available that have investigated IT competencies for professional accountants in developing economies. Those studies; however, have used only one dimension i.e. IT skills to measure accounting practitioners’ competence in using IT. Thongdeerawisuraket found in the perspective of accounting managers working in enterprises located in the industrial estate authority of Thailand, competencies of professional accountants are composed of 11 elements. The five most important competencies are knowledge of information technology (.87), intellectual skills (.77), organizational and management skills (.70), knowledge of organizations and business (.68), and knowledge of accounting and finance (.66)(Thongdeerawisuraket, 2011).

This paper is structured as follows. The first section provides research methodology and research design. The second section is research framework and the third is the main focal point in presenting case findings in IT competencies within the organisational issues. Finally the paper draws conclusions from the case study.

Research Questions and Design

The research framework outlined in Figure 1 shows the foundation for this research which demonstrated the multi-layer multi-tied framework of IT related competencies for professional accountants. In terms of achieving this objective, the following questions will be investigated:

“How do competent professional accountants work in accounting practices using IT?”

The participating organizations that provided accounting and business consultation services were the main sources for the data collection. The reason is that these organizations involved with the highly complex nature of accounting tasks, such as preparing financial reporting, taxation and auditing. Semi-structured interviews were conducted through a one-to-one interview which averaged approximately one hour for each interviewee. A total of eight interviews were conducted with accounting practitioners from the organizations. Managers including company secretarial manager and senior accountants (senior finance accounting, senior company secretarial, senior in business consultation and senior accountant) who are involved in delivering accounting-related and business services in this organization were interviewed.

This research study used a qualitative approach by using an interpretive paradigm whereby the interactions between the phenomenon and context are analysed and interpreted. The qualitative data analysis methods employed pattern-matching, content analysis, and cross-case synthesis. Overall, 10 case studies (semi-structured interviews) were conducted as listed below:
Table 1  Case Study Organisations

<table>
<thead>
<tr>
<th>Case</th>
<th>Organization Type</th>
<th>Organization Size</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Industrial</td>
<td>Large</td>
<td>Company manufactures and distributes 5 major product lines, which are protective coating, timber coating, decorative paints, industrial coating and automotive refinish.</td>
</tr>
<tr>
<td>B</td>
<td>Education</td>
<td>Large</td>
<td>Government organization with the purpose to extend higher education.</td>
</tr>
<tr>
<td>C</td>
<td>Government</td>
<td>Large</td>
<td>Government organization, involved in the maintenance of highway assets and management and operation of a transport system and related infrastructure.</td>
</tr>
<tr>
<td>D</td>
<td>Agricultural</td>
<td>Large</td>
<td>Rice milling company engaged in business associated with agricultural products such as jasmine rice, white rice, and glutinous rice.</td>
</tr>
<tr>
<td>E</td>
<td>Financial</td>
<td>Large</td>
<td>Banking organization; the bank provides a broad range of consumer, commercial, and corporate banking services, including lending, deposit-taking, credit card services, international trade financing, custodian services, asset management and investment banking services.</td>
</tr>
<tr>
<td>F</td>
<td>Industrial</td>
<td>SMEs</td>
<td>Organization of the conventional paper industry. As a leading manufacturer in pulp and paper production, Company F operates altogether three sophisticated paper mills which produce quality products with excellent performance including coated and uncoated paper delivered across domestic and international markets.</td>
</tr>
<tr>
<td>G</td>
<td>Education</td>
<td>SMEs</td>
<td>Government organization with the purpose to extend higher education in Thailand.</td>
</tr>
<tr>
<td>H</td>
<td>Government</td>
<td>SMEs</td>
<td>Government organization involved in the maintenance of assets and management and operation of Maha Sarakham Province.</td>
</tr>
<tr>
<td>I</td>
<td>Agricultural</td>
<td>SMEs</td>
<td>Rice milling company engaged in business associated with agricultural products such as jasmine rice, white rice, and glutinous rice.</td>
</tr>
<tr>
<td>J</td>
<td>Financial</td>
<td>SMEs</td>
<td>Banking organization; the bank provides a broad range of consumer, commercial, and corporate banking services, including lending, deposit-taking, credit card services, international trade financing, custodian services, asset management, and investment banking services.</td>
</tr>
</tbody>
</table>

In order to obtain insightful understanding, a number of interviews were conducted for each case study with participants who have relevant roles to participating organisation that provided accounting and business consultation services. For example,
The Changing Roles of Accountants

Today, is now majorly affecting business, and the conventional part of the accountant is changing (Bahador & Haider, 2013). In addition, IT assumes a basic part in current business, particularly in regards to the accounting function. Utilisation of data innovation to perform accounting functions has conveyed a chance for organisations to advance toward paperless workplaces. Organisations applying a generation system should apply it all the more viable on the off chance that they utilise computerised systems (Ghasemi et al., 2011). According to Sajady, Dastgir and Hashem (2008) information technologies in accounting generally provide financial reports on a daily or weekly and basis useful information for the decision-making process as well as performance of the organisation. Therefore, information technology has become important for the achievement of the modern day. It is vital to monitor, update and pay greater attention to improving the quality management of information to create and add value so that organisations become trustworthy and reliable (Lee et al., 2002). The progress of innovation likewise can enhance quality and reduce the costs of products or services, encourage productivity by being all around composed, and can make operations more proficient by giving all the more auspicious data, sharing learning, enhancing the productivity and viability of the inventory network, creating inner

<table>
<thead>
<tr>
<th>Case</th>
<th>Organization Type</th>
<th>Organization Size</th>
<th>Business Nature</th>
<th>Interviewee(s)’s Roles in the Organization</th>
</tr>
</thead>
</table>
| A    | Private           | Large             | Private national manufacturing enterprise | CEO  
Company Secretarial Manager  
Senior Finance Accounting  
Accounting Manager  
Senior IT project  
Programmer  
Director of IT audit division  
Project manager |
| B    | Public            | Large             | Government organisation in the maintenance of assets | Acting Director of Finance and Division office  
Accountant  
Senior Accountant  
Project manager  
Director of IT  
Accountant  
Programmer  
Director of IT audit division |
control structures and enhancing decision making (Romney & Steinbart, 2006). Moreover, several authors (Nicolaou, 2000; Phonnikornkij et al., 2008; Ussahawanitchakit & Phonnikornkij, 2006; Xu, Horn Nord, Daryl Nord and Lin, 2003) argue that an accounting system can provide assistance in all phases of decision making. Furthermore, information about the results of previous decisions provides valuable feedback that can be used to improve future decisions. In addition, an accounting system can improve decision making by providing accurate information in a timely manner. Xu (2003) mentioned that business needs to be seen as employing quality accounting systems, and require accounting information quality to manage and operate processes in all sections.

Information has turned into an undeniably essential business asset in supporting organisational decisions. Since innovation making the accounting assignment that would take a gathering of individuals to perform can be expert by one person. It has constrained accountants to overcome difficulties and has taken the chance to climb the company pecking order and to join the administration group. This obliges accountants to have different abilities, i.e. leadership skills, project management and communication skills in analysing organisation’s processes and functions for organisations’ decision making and risk management (Bahador & Haider, 2012).

**IT competences and accounting**

IT competencies can be identified as a set of IT skills and soft skills that accountants must possess to use IT effectively (Bahador & Haider, 2013). These competencies are basic for accountants with a specific end goal to play out their tasks (Wessel, 2008). A particular information system which computerises the manual accounting procedures and assignments is frequently known as an AIS. An AIS can gather and store information about exercises and exchanges, and procedures this information into data that is valuable for choices; it likewise gives satisfactory controls to protect the association’s advantages (Phonnikornkij et al., 2008; Romney & Steinbart, 2006; Ussahawanitchakit & Phonnikornkij, 2006). Along these lines, the AIS can increase the value of an association through productively doing those tasks that can be performed through automated systems. Accounting information can improve decision making in several ways: it recognizes circumstances requiring management activity for picking between option activities by decreasing vulnerability. Moreover, information about the aftereffects of past decisions gives profitable criticism that can be utilized to enhance future decisions. Also, an AIS can enhance basic leadership by giving exact information in a timely manner.

Moreover, Basselier, Benbasat and Reich (2003) define IT competencies as the arrangement of IT-related knowledge and experience that a business manager and knowledge worker should possess. The authors propose two measurements; IT-related knowledge and IT experience. IT knowledge refers to specific learning controlled by people i.e., how well they understand fundamental IT concepts, how well informed they are about the utilization of IT in their associations. Carnaghan (2004) views IT competencies as what might be exhibited by exercises, such as having the capacity to make a spreadsheet or database for a specific reason, or the capacity to utilize software. In considering the definition of IT competencies of professional accountants, it is vital to stress the requirement for both IT skills and relevant knowledge such as management skills, interpersonal skills, and experience of IT (IFAC 2003). Thus, integrating the above-mentioned definitions and discussion, IT competencies in this paper are defined as: “a set of IT skill and soft skills that professional accountants must possess to use IT effectively”
Table 4  Definition of IT competencies

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Definition of IT Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold and Malhotra (2001)</td>
<td>“the shared IT capability that enables the flow of knowledge in organization to be supported”</td>
</tr>
<tr>
<td>Tippin and Sohi (2003)</td>
<td>“consist of three important components, namely IT knowledge, IT operation, and IT object”</td>
</tr>
<tr>
<td>Basselier, Reich &amp; Benbasat (2003)</td>
<td>“the set of IT-related knowledge and experience that a business manager possesses”</td>
</tr>
<tr>
<td>Carnaghan (2004)</td>
<td>“what would be demonstrated by activities, like being able to create a spread sheet or database for a particular purpose, or the ability to use tax planning software”</td>
</tr>
<tr>
<td>Croteau and Raymond (2004)</td>
<td>“to support the effective use and management of IT”</td>
</tr>
<tr>
<td>Wessel (2008)</td>
<td>“considered imperative for accountants in order to perform their tasks”</td>
</tr>
<tr>
<td>Bahador and Haider (2013)</td>
<td>“the set of IT skills and soft skills that accountants must possess to use IT effectively”</td>
</tr>
</tbody>
</table>

Source: Compiled from various authors

These skills provide such necessary support for IT skills that professional accountants can play out their employments adequately the broad utilization of IS good to go has made the expression “knowledge – worker” in order to describe the worker that operates within an IT environment as well as the competencies possessed. This ownership of suitable skills will permit the formation of a domain where the IS technology will work at an ideal coming about to the upside of the whole business operation (Bahador & Haider, 2012). IT competencies considered basic for accountants so as to play out their errands (Wessel, 2008). The determination of these competencies is vital for accountants but this includes, to start with, the determination of the parts of a present day accountants in business and second, the meaning of term competencies.

The determination of the part of the present day accountant in business is vital as it sets the system inside an accountant works and subsequently this influence the IT/IS tools it is required.

**IT Competencies for Accountants**

Professional accountants’ skills for achievement are exceptionally required to respond rapidly and viable in associations. Bahador and Haider (2012) admit their examination, distinguished that with the exception of specialized IT skills, various different skills are of equivalent significance to be acquired by accountants keeping in mind the end goal to play out their employment adequately, for example, organizational, conceptual, social and various other skills. These skills are viewed as supplementary to technical IT skills and given backing to them. List of the identified skills can be seen in Table5.
A framework for IT Competences for professional accountants

Figure 1 shows a summary of case studies findings related to IT competencies for professional accountants. Findings from the pilot case studies – using different types of organization (one large public organization, and one large private organization) informed this summary. The developed model provides guidance on how are the IT related competencies that help professional accountants to perform their job better.

The study indicates that information technology-based competencies framework for professional accountants define 19 stages. Specifically, these new factors based on the research findings and unique to professional accountants were identified by two pilot case studies and are not specifically addressed as important factors in the relevant literature. There are three new factors that have been identified by this research that has not been reported in previous studies. These are:

- Technical Skills
- Conceptual Skills
- People Skills
- Organizational Skills

Table 5 Classification of IS abilities/knowledge/skills (Bahador & Haider, 2012)

<table>
<thead>
<tr>
<th>Skills</th>
<th>Categories / Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Skills</td>
<td>Analysis and design, programming language, specific application and general IS knowledge, information system product, database and data communication, advanced applications, computer applications systems, systems theory and concepts, business functional knowledge, technology management knowledge, operating systems, network, personal computer tools</td>
</tr>
<tr>
<td>Organizational Skills</td>
<td>Time management, priority, information organization</td>
</tr>
<tr>
<td>People skills</td>
<td>Organizational skills, organizational unit, interpersonal, communication, interpersonal relationships, management, professionalism, business, management, social, society, personal trait, professional skills, business knowledge.</td>
</tr>
<tr>
<td>Conceptual Skills</td>
<td>Problem solving, abstraction, strategic planning</td>
</tr>
</tbody>
</table>

Figure 1 A framework for IT Competences for professional accountants
The ‘new’ factors identified by this study Factors in Red denote the news factors that are identified from the pilot case study findings.

1. ERP software skills, which demonstrates that an ERP system, the accounting software modules deal with the recording and accounting transactions within functional areas such as accounts payable, accounts receivable and payroll. These functional areas and their relating sub-records will encourage exchanges into the general record where monetary reports are produced for management and external stakeholders. Notwithstanding the transaction or function, it will at last lead back to the general ledger for final review and analysis. Thusly, selecting an ERP solution with functionality rich accounting software functionality is vital to the project’s overall success. Thusly, the accountant ought to think about ERP procedures and how to utilize ERP software into the capacity to work with it is imperative in numerous areas in the organization.

2. BI software skills is a new factor that has been identified by this research but not been reported in previous studies. BI may threaten some traditional accounting roles in delivering management information; however, it presents new opportunities to stimulate stalled finance transformation projects and release management accountants’ ability to take on decision support roles and improve decision-making. Moreover, large companies in Thailand require professional accountants who know about BI software to analyze company data and help to make an important decision.

3. Accounting law and legal skills, which indicates that professional accountants must constantly learn new information such as tax law, international standard law, business law and legal for business to support and help their organization.

Findings and Discussion

<table>
<thead>
<tr>
<th>Technical Skills</th>
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<tbody>
<tr>
<td>1. Enterprise Resources Planning Software</td>
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<td>3. Business Intelligence Software</td>
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<td>5. Tax Return Preparation software</td>
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Accounting and finance occupations and technology skills regularly go as an inseparable unit. Capability utilising finance-specific software programs, for example, SAP and Microsoft AX, is a prerequisite in most cases. Cloud computing is also becoming increasingly popular at many companies. It was found that an organisation needs ERP software skills from accountants and professional accountants. This is because ERP package handles the entire range of business functions of an organisation so that can help professional accountants to improve workforce productivity with anytime, anywhere access. As one accounting manager stated:

We used SAP software to help manage information by checking problems and we can get reports from this tool with anytime and anywhere access. So we know the service problems and how to solve them. SAP is the centralization of information, decision-making, and control leads to increase in efficiencies of operation and productivity.

Accounting manager (Case A)

The accountant should know about ERP processes and how to use ERP and the ability to work with it is vital in many areas of the job market.

I think, skills in using ERP are necessary to improve the quality of accounting service and their service as well.

CEO (Case A)
However, SMEs still have problems with an expert person in ERP software – a problem that is related to the lack of knowledge and vision for decision making they may not know what is the accounting information or know of appropriate accounting information, or do not understand or recognize the advantages it brings, and think there is no need to introduce financial software to replace manual accounting, making them largely reluctant to spend too much money on it. In the technology infrastructure and software application suited to the AIS, related to improving the accounting system.

...we don’t have people around that know about AIS software and hardware. I think, it is best to purchase the accounting software and hardware from a vendor because the vendor can help to review the specifications and confirm its adequacy as an accounting system for my company.

CEO (Case I)

Another organization noted that the lack of expertise in using ERP software within the accounting area is related to a lack of information quality in the accounting system.

I used XXX (ERP software) to keep track of my money, every month. For example, the accounts, invoicing and billing were pretty good, but it was the VAT and corporation tax which caused my concern. I think we needed an expert person to help...

Accounting manager (Case F)

**Accounting software skills**

An organization may utilize an off-the-rack accounting software package to record its financial transactions. Programs such as QuickBooks, Peachtree, and Express allow clerical personnel to prepare invoices for customers, enter invoices received from vendors and print checks. Many accounting jobs involve the technical duties of processing accounting transactions. The skills to play out these obligations have known as specialized technical accounting skills. One CFO stated:

We use ACCPAC to help manage information by checking problems and we can get reports from this tool. So we know the service problems and how to solve them. Skills in using ACCPAC can help accountants to complete the task quickly and accurately.

CFO (Case B)

Notwithstanding to software packages that are designed for the accounting field, jobs typically require proficiency in basic computer operations. Overseeing email records, sharing and printing documents and performing information reinforcements are common tasks.

We have to check our Cash Book fairly closely by Express application and it is definitely one of the highest priorities. We have forecasts that need to be met, so we need to give ourselves early warning signals if a part of the business looks like it is not performing. The numbers will hopefully tell us that, so we can address the issue.

Accounting manager (Case C)

However, Case B has some problems based on using different systems to collect information related to IQ in the AIS. For example, there were various systems used for AIS including Excel, Express, and SAP; as they were not integrated, more effort and resources was sometimes needed in manually duplicating data inputs. Timely data access across different systems was also difficult. The data stakeholders expressed their concerns:

There are different systems to collect information, they are not linked, we manually enter different numbers from the screen to SAP so that we can cross reference.

Accounting manager (Case C)

**Another interviewee stated:**

We also have GFMIS but it’s just not dynamically linked. We don’t go from GFMIS front end to Express®, but the consultant has recommended this path.

Project manager (Case B)

In case I, accounting software is not available in line with business requirements; this adds to the workers’ problems.

The EasyCut software [Production software] cannot automatically be extracted to WinSpeed [accounting software], e.g. Sales receive the order confirmation documents from vendor’s distribution
center once the product is being dispatched, however, this confirmation needs to be manually entered into the system for billing. So a lot of part-time staff are required to do the data entry job, which is time consuming and costly. What they aim to do in the next stage is to use WinSpeed to automate this laborious intensive task.

Accounting manager (Case F)
This could be clarified by the fact that most advanced technology or software used today is extremely advanced and gigantic. This is the reasons why advanced technology skills were not demonstrated by academics as among important skills need to perform the greater part of the work that accountants need to do.

Business Intelligence Software Skills
Employers are looking for skills beyond standard accounting competency. Even junior level employees are expected to do more consulting and assist in strategic thinking. Business Intelligence Software provides a powerful tool to analyze company data and thus helps to make important decisions. business intelligence takes the multitude of transactions generated by an organization and summarizes them into monthly totals that can be delivered on the screen to help managers get an immediate view of business performance. One of the CFO stated:

I use BI software to continuous management of financial and operational functions, with views of past performance, the current state of business, and opportunities for the future

CFO (Case E)

BI is becoming an essential tool in helping finance professionals add value in their organizations. Another accounting manager explained:

I need to get accounting manager who knows about BI software to empower me with information to make better strategic, tactical and operational decisions.

CEO (Case E)
Moreover, large companies in Thailand require professional accounting who knows about BI software to analyze company data and helps to make important decision.

I need to get accounting manager who knows about BI software to empower me with information to make better strategic, tactical and operational decisions.

CEO (Case A)

Spreadsheet skills
The accounting manager indicated that, if computers are available, it could be easier to have a computerized system, rather than a paper system. This would also make it more convenient for staff to read information informally and gain a clearer understanding of requirements.

To simplify discussions organizations should have software and tools such as Excel, PowerPoint, Word, Vision and Outlook and so on, for use in accounting system.

Accounting manager (Case C)

Spreadsheet skill is very useful in the accounting industry. Spreadsheet software is to an accountant what a hammer is to a carpenter. Used correctly, both tools perform effectively and efficiently.

At the end of the day people do financial analysis by extracting data from SAP software back-end systems and shoving it around in Excel spreadsheets to make specifically report.

CFO (Case B)

About all accounting work is computerized, and spreadsheet commonality is essential for technical accounting workers. While an essential comprehension of spreadsheet usefulness is required, the most capable technical accountants can utilize propelled skills for gathering, sort and filter data from accounting systems. In bigger organizations, these skills allow accountants to sort through the large number of accounting transactions that occur each day and acclimatize this information into formats that are useful for decision-makers.
Utilized erroneously, they can botch a job—or at least make it a tedious project. For many CPAs, the data in this article will delineate a portion of the less-known spreadsheet software works that can hone your abilities—and even take you past basic calculating. In case you’re an accomplished spreadsheet client, don’t accept you’re acquainted with all the tips in this article. Look at every; you might be shocked by a capacity that will propel your spreadsheet work.

This article concentrates on Excel 97 in light of the fact that it is by a wide margin the calling’s most broadly utilized spreadsheet application; in any cases, its utilization does not infer our underwriting of the item. Know, likewise, those earlier versions of Excel may lack some of the functions described here.

Accounting manager (Case H)

* More examples are available upon request

Table 5 summarises all case studies findings

<table>
<thead>
<tr>
<th>IT Competences for professional accountants</th>
<th>Large Organisations</th>
<th>SME Organisations</th>
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<tbody>
<tr>
<td><strong>Technical Skills</strong></td>
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<tr>
<td>1. Enterprise Resources Planning Software</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td></td>
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<tr>
<td>2. Accounting Software Package</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td></td>
</tr>
<tr>
<td>3. Business Intelligence Software</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td></td>
</tr>
<tr>
<td>4. Spreadsheet Software</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td></td>
</tr>
<tr>
<td>5. Tax Return Preparation Software</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td></td>
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<tr>
<td>6. Presentation Software</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td></td>
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<tr>
<td>7. Web Site Design</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td></td>
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<tr>
<td>8. Word Processor Software</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td></td>
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<tr>
<td>9. Database</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td></td>
</tr>
<tr>
<td>10. Communication Software</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
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<td><strong>Organisation Skills</strong></td>
<td></td>
<td></td>
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<tr>
<td>1. Time Management skills</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
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<tr>
<td><strong>Conceptual Skills</strong></td>
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<tr>
<td>1. Problem Solving Skills</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
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<tr>
<td>2. Critical Thinking Skills</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
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<td>3. Analytical Skill</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
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<td><strong>People Skills</strong></td>
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<tr>
<td>1. Teamwork Skills</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
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<td>2. Delegation Skills</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
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<td>3. Communication Skills</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
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<tr>
<td>4. Leadership Skills</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
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<tr>
<td>5. Accounting Law and Legal Skills</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
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Remarks: ✓ = factors that are supported by the specific case study
Overall, this study found that IT competences for professional accountings are presented and found relevant in organisation’s IT competency dimensions regardless the actual organisation size. However, in terms of where and how the organisations targeted IT competences efforts, there is a difference between large organisations and SMEs as summarised below:

Table 6 Differences in IT competences for professional accountants’ efforts, Large VS. SMEs

<table>
<thead>
<tr>
<th>IT Competences</th>
<th>Large Organisations</th>
<th>SME Organisations</th>
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<tbody>
<tr>
<td>Technical Skills</td>
<td>- within an ERP system, the accounting software modules deal with the recording and handling of accounting transactions within functional areas such as accounts payable, accounts receivable and payroll (CFO, Case B)</td>
<td>- skills in using ERP are necessary to improve the quality of their service (Accounting manager, Case I)</td>
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<td></td>
<td>- ERP package handles the entire range of business functions of an organisation so that it can help professional accountants to improve workforce productivity with anytime, anywhere access (CEO, Case A)</td>
<td>- some organisations lack of skills in using ERP software, so organisation used outsource to help (CEO, Case F)</td>
</tr>
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<td></td>
<td>- ERP skills are very useful in the accounting industry. This software can drive work better, faster decision-making with real-time data and report (CFO, Case C)</td>
<td>- lack of knowledge and vision, they may not know what is the accounting information or know of appropriate accounting information (CEO, Case J)</td>
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<td></td>
<td>- accountants ought to think about ERP processes and how to utilize ERP and the capacity to work with it is crucial in numerous regions of the job market (CFO, Case B)</td>
<td>- not clear understanding of what the real circumstance of this organization was before usage, for example, the level of management, the level of PC equipment and software, technical level, etc., but they have indiscriminately picked a financial software package which is not appropriate for the situation of the enterprise (Accounting manager, Case F)</td>
</tr>
<tr>
<td></td>
<td>- skills to use ERP software can help accountants to finish the undertaking rapidly and accurately (Senior Accountant, E)</td>
<td>- you can make utilization of instruments like timetables, ordered envelopes, day organizers, shading coded post-it notes and highlighters, and applications and projects intended to help you stay exceedingly sorted out and in the short-and-long haul (CEO, Case C)</td>
</tr>
</tbody>
</table>
2. Accounting software package

- It's a resource management system that besides checking the business' financials, likewise tracks the accompanying: tangible and intangible assets, human resources, and materials. Intangible parameters incorporate working hours, item life cycles, key execution pointers, and client relations. These are not financials as such, but rather they affect on the organization's finances; subsequently, they are fundamental to your accounting (CFO, Case B)

- The technology advancement also significantly influenced the process of decision making and information systems by expanding utilization of accounting software (Accounting chief, Case C)

- There have been changes in skills requirement to adapt to the requests of customers' assortment who utilize the different sort of business and information system applications (CEO, Case D)

- An organization may utilize an off-the-rack accounting software package to record its financial transactions. Programs such as Quickbooks, Peachtree, and Account Ability allow clerical personnel to prepare invoices for customers, enter invoices received from vendors, and print checks. Depending on the package purchased, a payroll, fixed asset or inventory module may be included. At month-end, financial statements can be printed quickly. Feeling comfortable with one or a greater amount of the regular accounting software programs can be advantageous (Accounting director, Case E).

- Accounting package handles just individual business elements of accounts (Accounting administrator, Case F)

- Most business associations are modernized. They use in any event the Thai local accounting software for creating their financial information (CFO, Case H)

- The term is utilized to entirely to allude to the financial aspect of your business operations. These include accounts receivable, accounts payable, payroll, and trial balances. Many vendors bundle accounting software with modules for pertinent business exercises like billing, sales order, purchase order, general ledger, timesheet, expense, and electronic payment (CEO, Case I)

- Some organizations lack of skill in using accounting software, so organizations used outsource to help (Accounting manager, Case G)
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<tr>
<th>IT Competences</th>
<th>Large Organisations</th>
<th>SME Organisations</th>
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| 3. Business Intelligence Software | - BI may debilitate some customary accounting roles in delivering management information yet it exhibits new chances to invigorate slow finance transformation projects and release management accountants’ capacity to take on decision support roles and enhance decision-making (CFO, Case E)  
- BI gives a powerful tool to analyse company data, thus helps to make important decisions(CEO, Case E)  
- lack of formal concept definitions and decisions makes it hard to create a pragmatic information unwavering quality appraisal system(Accounting supervisor, Case A)  
- lack of knowledge and vision, they may not recognize what is the accounting information or | None |
| 4. Spreadsheet software | - spreadsheet skills are very useful in the accounting industry(Accounting manager, Case C)  
- at the end of the day, people do financial analysis by extracting data from SAP software back-end systems and shoving it around in Excel spreadsheets to make specifically report(CFO, Case B)  
- spreadsheet software is extremely useful, particularly in managing business information and to analyse the information. Skills in utilizing spreadsheets can help accountants to finish the assignment rapidly and precisely (Project manager, Case E) | - spreadsheet skills are very useful in the accounting industry in SMEs in Thailand (Senior Finance, Case C)  
- skills in using spreadsheets can help records to finish the assignment rapidly and accurately (Accounting director, Case H)  
- accountants can perform bank reconciliations; calculate job costs, taxes, payment schedules, profit forecasts and stock control. All in all, these undertakings the spreadsheet demonstrates an imperative instrument in encouraging the procedure of estimation and generation decisions(CFO, Case J) |
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<th>IT Competences</th>
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<tr>
<td>5. Tax Return Preparations Software</td>
<td>- Tax preparation software modules can give your accounting or tax firm with a cost-effective, convenient, and secure method for developing and filing state and federal client tax returns. Tax preparation modules can help you enhance office efficiency, spare time, expand benefits, and offer enhanced customer administration (CEO, Case A)</td>
<td>- Tax preparation packages also include workflow tools to help make the process of documenting customer returns as productive as would be prudent. In my company, we have document scanning technologies to better manage and input data. The ability to electronically file tax returns is critical for tax professionals. Electronically documenting frames gives reserve funds in both time and cash (Accounting director, H)</td>
</tr>
<tr>
<td>6. Presentation Software</td>
<td>- need to be able to present your work and your ideas clearly (CEO, Case E)</td>
<td>- presentation software skills are very useful in the accounting industry (accounting manager, H)</td>
</tr>
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<td></td>
<td>- skills in using presentation software can help accounts to present their work completely (CEO, Case A)</td>
<td>- skills in using presentation (CFO, Case C) software can help accounts to present their work completely (CFO, Case J)</td>
</tr>
<tr>
<td>7. Web site Design</td>
<td>- in accounting, computer skills in website design is vital in light of the fact that the utilization of programming projects to deliver and record accounting information is increasing (CFO, Case C)</td>
<td>- with the lack of knowledge and vision, they may not realize what is the accounting information or know of proper accounting information (CFO, Case J)</td>
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</table>
8. Word processor Software

- word processing empowers word processing to compose their reports, edit and retrieve data or text (CFO, Case B)
- if accountants don’t have a decent comprehension of IT skills, for instance in an auditor’s role, it will make an issue on the grounds that the vast majority of the proof/records are delicate duplicates. Along these lines, how might auditors have the capacity to review organizations in the event that he/she is not acquainted with the audit/accounting programming, which will empower them to extricate the data (CFO, Case C)

9. Database

- businesses are looking for accounting professionals who are proficient in the most recent database applications and enterprise resource planning programs. Additionally, many organizations are moving to more advanced systems and analytical tools, so they’ll need accounting and finance professionals with solid specialized expertise to adjust rapidly (Acting Director of Finance and Division office, Case B)
- information and ability set in outlining and building up a relational accounting database (Senior Accountant, Case C)
- understanding of relational database will be advantageous (CFO, Case C)
- need experience working with SQL, Oracle (Director of IT review and division, Case B)
- database skills are valuable for accountants, but they are not as critical as spreadsheet and database skills, which are straightforwardly required in the accounting processes (Accounting administrator, Case G)
- accounting ought to concentrate on the most proficient method to produce yield from these software processes (spreadsheet, database) instead of focusing on cutting edge technology skills, (for example, ERP, EDI, and network). Besides, there are advanced IT services/people available in the business sector (CFO, Case J)
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<th>IT Competences</th>
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</table>
| 10. Communication Software | - provide remote access to systems and exchange files and messages in content, sound and/or video formats between various PCs or users (CFO, Case C)  
- communication software is an application or project intended to pass data from one system to another (CEO, Case E)  
- people in different sections within the organization lack sufficient communication skills to work as a whole team; rather they only work on their own tasks/areas related to information quality problems (CEO, Case A)  
- the company talks to other people via email and apply XXX software (communication software) to talk with other people. However, some people don’t use XXX software this is because it is hard to understand all functions and all details (Acting Director of Finance and Division office, Case B)  
- the capacity to distil complex financial information into everyday language is a must. Financial reporting, treasury management and tax law sway on all territories of business and must be disclosed to differ audiences (accounting manager, Case A) | - communicate information to people or gatherings; convey presentations suited to the attributes and needs of the group of onlookers. Unmistakably and succinctly pass on data orally or in keeping in touch with people or gatherings to guarantee that they comprehend the data and the message. Listen and react fittingly to others. Capacity to build up viable working connections that foster organisational success (Accountant, Case I)  
- communicate with other in the composed arrangement, for example, utilizing reminder, letters and reports are essential in accounting. Written skills provide the per user with compact, brief and clear information (Accounting director, Case F) |
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<tr>
<td>Organisation Skills</td>
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<tr>
<td>1. Time management skill</td>
<td><em>there are many aspects of the undertaking that should be sorted out or recorded including all documentation, contracts, e-mails, memo’s, reviews, meetings, specialist documents, requirements and determinations, reports, changes, issues, dangers, and so on.</em> (CFO, Case C)</td>
<td><em>apply general learning of relevant applicable information technology to meet work needs</em> (CFO, Case J)</td>
</tr>
<tr>
<td></td>
<td><em>a system for managing your workload is just successful on the off chance that you additionally know how to spend plan your time. As an accountant, you’ll have to manage contending needs and juggle horde errands – while finishing everything on time. The ability to work inside due dates and to constantly re-organize your schedule will take you far. Not just will it awe your supervisor, colleagues, and customers, it will likewise help you to keep up a solid work/life adjust and keep your everyday profitable</em> (Accounting administrator, Case A)</td>
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<tr>
<th>Conceptual Skills</th>
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<tr>
<td>1. Problem Solving Skills</td>
<td><em>the ability to distinguish key parts of issues, to identify the reason for issues, to orchestrate helpful data from other data and to suspect and resolve issues in managing important tasks by professional accountants</em> (CEO, Case A)</td>
<td><em>professional accountants assess and may resolve remarkable issues that require research and review of policy and procedures and regulations. Apply judgment for issue resolutions or project necessities taking into account appointed authority</em> (Senior Finance, Case H)</td>
</tr>
</tbody>
</table>
2. Critical Thinking Skills
- the capacity to think past customary thinking and take care of an issue with thoughts and techniques that had not been attempted before (CEO, Case A)
- the accounting industry is exceptionally rapid, so accountants who can adjust rapidly and effectively are at an unmistakable point of preference.
- having the capacity to give better services to their customers, versatile people will probably learn and develop in their professions since they see each new test as a chance to learn and test their abilities
- strategic thinking also requires insight into industry trends and innovative thinking. These days, it’s not unusual for financial dynamos to understand what’s happening in business and be able to successfully apply to their company or clients
- exhibit a capable level of professional skill and/or knowledge in accounting and keep current with advancements and trends (CFO, Case J)
- knowledge and ability to utilize appropriate information technology and systems to meet work needs (Accounting supervisor, Case G)

3. Analytical Skill
- analytical skills ability to visualize, and take care of confused issues and make an accurate and informed decision (CFO, Case E)
- an accountant's ability to see the master plan, understanding the relationship between financial performance and the more extensive business sector, implies they assume a vital part in mergers, acquisitions and another key, financial activities (CFO, Case A)
- analytical skills are helpful in associations’ business function since it incorporates both the ability to utilize great thinking in analysing a situation furthermore the ability to solve problems (CFO, Case G)
- many academics, the attention on analytical skills has had influence in controlling the inward environment of organisations (CFO, Case J)

4. Accounting law and Legal Skills
- professional accountants must constantly learn new information such as tax, tax law, international standard law, business law and legal for the business to support and help their organisation (CFO, Case D)
- organisation requires professional accountants know about the international standard law, business law and legal for the business to support and help their organisation (Senior Finance, Case I)
People Skills

1. Teamwork Skills
- people with different abilities and skills work in gatherings keeping in mind the end goal to fulfill a comparative objective (CEO, Case D)
- teamwork is utilized a great deal as a part of the field of accounting with a specific end goal to complete tasks, assess customers, and report/analyze financial statements (Accenting director, Case C)
- today’s accounting professionals must be cooperative individuals, practicing tact and strife determination attitudes to encourage and advance the achievements of their associates (CEO, Case A).

2. Delegation Skills
- professional accountants can help the ability to collaborate, cooperate with fellow employees so as to enhance the decision-making process using IT (CFO, Case C)
- Delegation is one of the most important management skills (CEO, Case A)
- organizations require good delegation skills (CFO, Case F)
- effective delegation is crucial for management and leadership succession (CFO, Case J)

3. Communication Skills
- accounting and finance staff should have the capacity to recount the story behind the numbers, especially for associates in different offices less acquainted with accounting standards and language. Both composed and verbal relational skills are basic for achievement in an accounting role (CEO, Case E)
- plan composed and/or specialized items which pass on compact, extensive and precise discoveries and fit in with rules; give fitting documentation to bolster conclusions; may survey and may review and edit the work of others (CFO, Case J)
- communication software was recorded as the minimum vital IT abilities necessity required by accountants (project chief, Case I)
- accountants are relied upon to speak with customers and additionally their work associates so data is unmistakably comprehended and viable scattered. Respondents were likewise requested that demonstrate their significance level of communication skills (CFO, Case F)
## 4. Leadership Skills

- Supervisors have an eye on the future and need experts who have solid strong leadership qualities who can venture into more senior parts when the time is correct. They search for people who can maintain a strategic distance from or resolve clashes, adjust well to change, coach others and grasp persistent learning (CFO, Case C)
- Capacity to rouse and lead individuals to finish certain objectives and destinations (CEO, Case A)
- Being a good leader means knowing how to guide and instruct, and making yourself congenial and accessible to the general population you’re in charge of. You need to adjust being a good example and the individual in control while as yet being a piece of the group. It likewise takes certainty, persistence, and capacity to assign – qualities which don’t come effortlessly to a great many people.
- Leadership skills also incorporate vital thinking and long haul arranging. Many accountants give counselling services, which implies that they offer guidance and business answers for help organizations enhance their operations, so the capacity to look ahead is critical.
- The top players in accounting are for the most part known for being visionary – for making logical decisions that additionally include a touch of imagination. To be an effective accountant, you should have the capacity to demonstrate your customers that you’re attempting to enhance their present and future (CEO, Case F)
- In accounting it is vital in light of the fact that a considerable measure of work is done in groups and with a specific end goal to meet due dates you need to be able to lead the colleagues into accomplishing their goals (CFO, Case J)
- To be an effective consultant, you have to help guide people and sometimes that includes making difficult recommendations. It could even mean making tough decisions. Smaller companies may especially need that assistance.

<table>
<thead>
<tr>
<th>IT Competences</th>
<th>Large Organisations</th>
<th>SME Organisations</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Leadership Skills</td>
<td>- Supervisors have an eye on the future and need experts who have solid strong leadership qualities who can venture into more senior parts when the time is correct. They search for people who can maintain a strategic distance from or resolve clashes, adjust well to change, coach others and grasp persistent learning (CFO, Case C)</td>
<td>- In accounting it is vital in light of the fact that a considerable measure of work is done in groups and with a specific end goal to meet due dates you need to be able to lead the colleagues into accomplishing their goals (CFO, Case J)</td>
</tr>
<tr>
<td></td>
<td>- Capacity to rouse and lead individuals to finish certain objectives and destinations (CEO, Case A)</td>
<td>- To be an effective consultant, you have to help guide people and sometimes that includes making difficult recommendations. It could even mean making tough decisions. Smaller companies may especially need that assistance</td>
</tr>
<tr>
<td></td>
<td>- Being a good leader means knowing how to guide and instruct, and making yourself congenial and accessible to the general population you’re in charge of. You need to adjust being a good example and the individual in control while as yet being a piece of the group. It likewise takes certainty, persistence, and capacity to assign – qualities which don’t come effortlessly to a great many people.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Leadership skills also incorporate vital thinking and long haul arranging. Many accountants give counselling services, which implies that they offer guidance and business answers for help organizations enhance their operations, so the capacity to look ahead is critical.</td>
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<td>- The top players in accounting are for the most part known for being visionary – for making logical decisions that additionally include a touch of imagination. To be an effective accountant, you should have the capacity to demonstrate your customers that you’re attempting to enhance their present and future (CEO, Case F)</td>
<td></td>
</tr>
</tbody>
</table>

In this research, the results of skills in using IT necessary to improve the quality of services (all variables in this study), were measured by in-depth interviews. Furthermore, the research summarizes the scores given by different stakeholders in Case A to Case J (the ten organizations).
Information Technology Skills

![Diagram showing IT skills required by accountants.](Source: Developed for this research)

What Are the Necessary IT Skills Required by Accountants?

Figure 2 shows the results of IT Skills required by accountants from ten among the 53 respondents from 10 organisations. The majority of the respondents agreed that skills in using IT are necessary to improve the quality of their work. Fig. 2 shows the ranks and types of IT skills sought by accountants and IT society in ascending order of response. They identified all IT skills which are important. However, Accounting software package (mean score 4.80) and spreadsheet software (mean score 4.60) were ranked as the top skills needing to be acquired by accountants. These outcomes additionally have been supported by the findings obtained from the interview sessions. The statements are:

Respondents were asked to indicate on a scale of five choices consisting of not important agree, little important agree, average important agree, very important agree, and extremely agree. Thai listed organisation firms have average scores of 5 (extremely agree) referred to the most critical factor which soft skills required by accountants is teamwork skill; an average score of 4 (very important agree) was achieved for soft skills including analytical skills, problem-solving skills, critical thinking skills, and time management skills. And firms with an average score of 3 (average important agree) addressed factors including communication skills, leadership skills, accounting law and legal skills and delegation skills. A score of less than 2.00 for any factors were not revealed by the results.

What Are the Soft Skills Required by Accountants?

Soft skills can ensure that employees or workers plan and perform activities as efficiently as possible. Respondents were asked to indicate on a scale of five choices consisting of not important agree, little important agree, average important agree, very important agree, and extremely agree. Respondents were asked to indicate on a scale of five choices consisting of not important agree, little important agree, average important agree, very important agree, and extremely agree. Thai listed organisation firms have average scores of 5 (extremely agree) referred to the most critical factor which soft skills required by accountants is teamwork skill; an average score of 4 (very important agree) was achieved for soft skills including analytical skills, problem-solving skills, critical thinking skills, and time management skills. And firms with an average score of 3 (average important agree) addressed factors including communication skills, leadership skills, accounting law and legal skills and delegation skills. A score of less than 2.00 for any factors were not revealed by the results.
Conclusion
It must be acknowledged that some differences were introduced by the actual organisation size and beget of accounting information systems and the industry that each organisation belongs to. However, some observations are listed below:

1. In large organisations, ERP software skills effort is more process-driven, regarded as an integrated part of an existing project. In SMEs, some organisations lack of skill in using ERP software, so organisation used outsource to help.
2. In large organisations, BI provides a powerful tool to analyse company data and thus helps to make important decisions. In SMEs, organisations lack of skill in using ERP software.
3. In large organisations, professional accountants must constantly learn new information such as tax law, international standard law, business law and legal for the business to support and help their organisation. In SMEs, the organisation is not attending for.

Besides, IT competence for professional accountants has received increasing attention by organisations worldwide. Accountants ought to comprehend and perceive the particular issues with respect to clients and elements of IT skills. This conduct will permit them to determine which elements of IT skills and competencies are appropriate to the issue and to guarantee the level of services are at a satisfactory level. As obligations increment in the accounting world, additional software skills might be needed. There are software programs to manage projects, conduct reviews, track depreciation on fixed assets and prepare tax returns. What’s more, the organisation should understand appropriate into developing information technology-related competencies for knowledge workers in all processes of decision making.

References


CURRENCY COINTEGRATION AND GLOBAL FINANCIAL CRISIS:
THE CASE OF ASEAN CURRENCIES

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ABSTRACT

This study examines the short-run causality and the long-run cointegrating relationships among ASEAN national currencies prior to and after the 2008 Global Financial Crisis (GFC) with the aim to assess the ASEAN’s readiness to form an Optimal Currency Area (OCA). We support the notion that ASEAN is not ready to become an OCA, as the linkages among national currencies appear to vanish due to varying responses to an asymmetric external economic or monetary shock toward the region. In addition, there are only weak and scatter (ing) ties among the currencies. In contrary to the findings in the extant literature, we find that a financial crisis does not always lead to a more cointegrated currency group as there is a strong evidence of cointegrating relationships among ASEAN currencies prior to the 2008 Global Financial Crisis, but there is only a minimal pairwise relationship and no long-term linkage among the currencies after the crisis. We observe that nature of the crisis could take part in explaining the effect of a financial crisis on currency cointegration.

Keywords: ASEAN, global financial crisis, currency cointegration, optimal currency area

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Introduction
Since an inception of the Association of Southeast Asian Nations (ASEAN) in 1967, one of the key aims of ASEAN has been to promote the economic growth of its members through the expansion of trade and investment across the region. Despite the significance of ASEAN's trade and investment volumes with counterparts outside of Southeast Asia, intra-regional trade and investment have surprisingly accounted for the highest proportions of the total trade and investment volumes and have been increasing at a staggering pace in recent years. The facts further highlight the needs for more attention on the development toward intra-ASEAN economic and financial integration.

A recent development in the region is the plan to establish the ASEAN Economic Community (AEC) by 2015 with a view to transform Southeast Asia into a single market and production base, a highly competitive economic region with free movements of goods, services, investment, skilled labour, and capital, and a region which is highly integrated to the global economy (The ASEAN Secretariat, 2014). To achieve the objective, the existence of long-run linkages among national currencies of the ASEAN members, indicating a synchronization of their business cycles and economic policies, is a precondition required to facilitate the ever-increasing intra-regional trade and investment transactions and a prerequisite for ASEAN to become an Optimal Currency Area (OCA). Coherence in the movement of the ASEAN national currencies would lead to a higher market stability and a greater intra-regional trade and investment. Understanding the nature and the dynamics of short- and long-run relationships among its members' currencies would benefit policy makers in assessing ASEAN's readiness toward reaching the AEC goal.

Despite an increasing importance of intra-regional economic and monetary integration in Southeast Asia, most of the related studies have concentrated on finding linkages among national currencies and an OCA potential of ASEAN+3 countries. In addition, empirical results concerning cointegrating relationships among ASEAN currencies in the extant literature have been mixed in terms of the currencies involved in the linkages and the effect of an economic shock on the currency linkages. Furthermore, only a few studies with regard to currency cointegration have been conducted over the period spanning through the Global Financial Crisis (GFC) in 2008 (Ahmad, Rhee, & Wong, 2012; Gharleghi, Shafighi, & Fah, 2015; Kawasaki, 2012). In this regard, the extent and the nature of the impacts of the 2008 GFC on the relationships among ASEAN currencies may be different from those of the Asian Financial Crisis (AFC), one started right at the heart of Southeast Asia in 1997. The main objective of this study is, thus, to evaluate ASEAN's readiness toward becoming an OCA and a highly financially integrated region by re-examining currency linkages among the national currencies of ASEAN economies during 2004-2013, the period, which spans through the 2008 GFC, employing cointegration techniques.

According to the theory of Optimal Currency Area (OCA) developed by Mundell (1961) and McKinnon (1963), a group of economies having close economic ties and sharing common stochastic economic trends, would see the stability of the bilateral exchange rates involving their national currencies. The rationale is that countries with strong economic relationships can share factor mobility in their national income processes and, consequently, the real exchange rates of the economies as the functions of national income processes should be highly correlated and cohesively stable. A strong linkage among the national currencies would allow the countries in the group to abandon their own

1 According to the ASEAN Statistics Database, intra-regional ASEAN trade had increased by seven times from USD 82 billion to USD 609 billion during 1993-2013 and accounts for almost 30% of the ASEAN's total trade volumes in 2013. The foreign direct investment (FDI) flows originated and received from ASEAN members also accounts for a significant 20% of the total FDI flows in 2013 (The ASEAN Secretariat, 2015).

2 ASEAN+3 refers to ASEAN members, China, South Korea and Japan also known as East Asian countries.
currencies and adopt a common currency to facilitate intra-group trades and investments. In the context of the current study, the existence of a significant long-term linkage among national currencies of ASEAN members would imply that there is a convergence of monetary policies and a synchronization of economic cycles among the ASEAN members. The conditions allow for an exchange rate stability which in turn leads to a lower transaction cost and an increase in intra-regional trade and investment (Chang, 2008; De Grauwe, 1994). An evidence of a cointegrating relationship among ASEAN currencies would also indicate that Southeast Asia would be a prime candidate to become an OCA, either through a creation of a new common currency or through a joint adoption of a major global currency or a basket of major currencies (Ng, 2002).

During the past three decades, much effort has been put into the assessment of whether and how ASEAN+3 economies could form an OCA. Most of the related studies suggested that only a subset of the ASEAN+3 economies are ready to become an OCA. Using traditional cointegration techniques, Aggarwal and Mougoue (1996) examined the possibility that Japan and two groups of East Asian countries (Hong Kong, South Korea, Singapore and Taiwan as the “Tigers” group and Myanmar, Philippines, Thailand and Singapore as the “ASEANs” group) can become a Yen bloc. They found the evidence of a long-run relationship among the currencies for both groups, suggesting that the Tigers and the ASEANs could form an OCA by adopting Japanese Yen as the standard currency. Zhang, Sato, and McAleer (2004) set up an economic model containing output, exchange rate and price level and employed the Structural Vector Auto Regression (S-VAR) approach developed by Bayoumi, Eichengreen and Mauro (2000) to examine the symmetry of underlying shocks affecting East Asian economies. They found that only some Asian Newly Industrialized Economies (NIEs) and some ASEAN countries are better candidates for a common currency arrangement and that the speed of adjustment to shocks in East Asia is much faster than in Europe. In a similar avenue, Sun and Simons (2011) examined monetary integration in East Asia using Real Exchange Rate (RER) data but found no support for monetary integration in the entire region except in the group of four ASEAN members and South Korea. In addition, Kawasaki (2012) investigated ASEAN-5 plus some combinations of China, Korea and Japan as a suitable candidate for an OCA and found that the whole group could become an OCA in the near future.

Due to the increasing importance of the regional economic and monetary integration in Southeast Asia, more studies have emphasized on assessing the region’s readiness to form an OCA. The empirical results, however, have been rather mixed. Ng (2002) examined the possibility of the formation of a currency union in ASEAN, in comparison with EU and NAFTA countries and found that only Indonesia, Singapore, and Malaysia could be ready for a currency union. Cortinhas (2007) tested whether an increase in intra-ASEAN trade and business cycle synchronization would lead to a greater economic integration, which in turn would prepare member countries for a common currency adoption. The author found that only the group of Malaysia, Thailand, Singapore, and Philippines has potential to become an OCA. Along the same line, Thong, Santhapparaj, and Hossain (2010) assessed the asymmetry of the demand and supply shocks experienced by ASEAN-5 countries and found that the ASEAN-5 countries as a whole were not ready to form an OCA. However, the authors found that Malaysia, Singapore, and Thailand, could spearhead the formation of a single currency. Added to the list of studies with mixed results, Gharleghi et al. (2015) found that Indonesia, Singapore and Thailand could form an OCA.

Many studies in the extant literature took into account the effects that the 1997 Asian Financial Crisis (AFC) may have on the degree of economic

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3 ASEAN-5 refers to five largest economies in Southeast Asia including Indonesia, Malaysia, the Philippines, Singapore and Thailand.
and monetary integration and on the possibility to form an OCA by ASEAN members. Despite being different in term of the outside currencies chosen, most of these revealed a similar result that the linkages among ASEAN currencies strengthened after the 1997 AFC compared to those pre-crisis, possibly due to foreign exchange market interventions, the contagion effect, and coordinated macroeconomic policies under the IMF’s mandate (Jeon & Seo, 2003). For instance, Choudhry (2005) investigated the effects of 1997 AFC on the Generalized Purchasing Power Parity (G-PPP), the approach developed by Enders and Hurn (1994), and found that the possibility for Thailand, Indonesia, Malaysia, Philippines, and South Korea to form an OCA existed only after the crisis. Chin and Azali (2010) examined potential linkages among ASEAN-5 currencies pre- and post-1997 AFC and found that ASEAN countries were financially more integrated after the crisis, with an increasingly role of Singapore dollar in ASEAN. In a recent and similar study, Gharleghi et al. (2015) found that ASEAN currencies became more tightly integrated in the post-crisis period.

Recently, only a few studies explored the impacts of the 2008 Global Financial Crisis (GFC) on ASEAN currency cointegration. Ahmad et al. (2012) observed that the 1997 AFC was more disturbing event to the Asia-Pacific currency cointegration than the 2008 GFC, which may be partly due to the policy failure of Asian countries. Kawasaki (2012) adopted the G-PPP approach to examine East Asian currencies and suggested that ASEAN-5, China, Korea, and Japan were more ready to become an OCA only after the 2008 GFC.

### Data and Methodology

#### Sample construction

The sample in this study is constructed using weekly bilateral exchange rate data during the period 2003 to 2014, involving national currencies of six ASEAN economies against the US dollar as the outside currency. The six currencies include the Indonesian Rupiah (IDR), the Malaysian Ringgit (MYR), the Philippine Peso (PHP), the Singapore Dollar (SGD), the Thai Baht (THB) and the Vietnamese Dong (VND). The data are extracted from DataStream and are natural logarithmic transformed for unit root and cointegration tests and subsequent analyses. To examine the effect of the GFC started in 2008 on the short- and long-run linkages among the ASEAN currencies, the data set is divided into two subsamples. The pre-crisis subsample contains the data from January 2003 to December 2007, while the post-crisis subsample includes the data from January 2010 to December 2014. The two-year period from January 2008 to December 2009 is intentionally omitted to avoid a potential bias in cointegration test results which may occur due to an extremely turbulent nature of financial markets during the period around a financial crisis. The resulting number of observations is 262 for pre-crisis and post-crisis samples.

#### Unit root, bivariate and multivariate cointegration tests

Our investigation of the cointegrating relationships among the six ASEAN currencies began by performing unit root tests to examine the stationarity of the data and to ensure that the cointegration technique, rather than the traditional multivariate regression, was appropriate for the investigation of

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4 See Baak (2004); Bowman (2005); Brailsford, Penn, and Terrell (2005); Click (2009) for further evidence on a stronger post-crisis cointegration among the ASEAN currencies.

5 The US Dollar is chosen to be the outside currency in this study due to its continued dominance in the global financial system. Despite the fear of eroding USD due to the rising level of the US public debt, the aggressive use of unconventional monetary policies and the fiscal tightening, the USD has remained a dominant foreign currency reserves and global investors have increased their holdings of US financial assets (Prasad, 2014).

6 The Vietnamese Dong (VND) is included together with ASEAN-5 currencies in the sample due to the fact that the Vietnamese economy has been growing rapidly in recent years. According to a report in December 2005 forecasted by Goldman Sachs, Vietnamese economy will become the world’s 21st-largest by 2025. In 2008, Price Waterhouse and Coopers also predicted that Vietnam may be the fastest-growing of the world’s emerging economies by 2025, with a potential growth rate of almost 10% per annum in real dollar terms.

7 The two-year period was selected based on the coincidence of the turbulent periods of all the ASEAN currencies in the sample as can be shown upon requested.
the relationships among the currencies. Three standard unit root tests widely adopted in the existing currency cointegration literature are employed in the current study. These included the Augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1981). The Phillip-Perron (PP) test (Phillips & Perron, 1988) and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test (Kwiatkowski, Phillips, Schmidt, & Shin, 1992). The unit root tests are conducted both on the level and the first-different data to also ensure that all the time series in the sample have an equal order of integration, $I(1)$, a necessary basis for further cointegration tests.

We proceed to examine pairwise cointegrating relationships among the bilateral exchange rates in the sample by employing the Engle-Granger (EG) test (Engle & Granger, 1987), the linear cointegration test which can be employed to examine whether the deviations from the long-run equilibrium are subject to a mean-reverting behavior. If two exchange rates are both $I(1)$ and have a long-run relationship, any error deviation must be pulled back to the long-run equilibrium level of zero. In other words, there must be an error correction in the data which can be modeled as shown below.

$$ y_t = \alpha + \beta x_t + \varepsilon_t $$

$$ \hat{\varepsilon}_t = y_t + \hat{\alpha} + \hat{\beta} x_t $$

Where, $y_t$ and $x_t$ are two bilateral exchange rates in the sample. The OLS residuals from (1) are a measure of disequilibrium. The EG cointegration test is a test of whether $\hat{\varepsilon}_t$ is stationary. This is determined by ADF tests on the residuals, with critical values adjusted for the number of variables (MacKinnon, 1996). The rejection of the null hypothesis of nonstationary $\hat{\varepsilon}_t$ indicates that $y_t$ and $x_t$ are cointegrated.

The investigation of the long-run relationships among the ASEAN currencies extends to the adoption of the Johansen multivariate cointegration test (Johansen, 1988), to seek for and to determine the number of multivariate cointegrating relationships. The Johansen cointegration test is conducted on both the pre-crisis and post-crisis subsamples. According to Johansen (1988), when $n$ time series in the sample are all $I(1)$, there can be up to $n-1$ cointegrating long-run relationships among the variables. The author suggests a multivariate generalization of the Dickey Fuller test as shown below to determine the number of cointegrating vectors and to estimate all the distinct relationships.

$$ \Delta F_t = (A_t - I)F_{t-1} + \mu_t = \pi F_t + \mu_t $$

Where, for this study, $F_t$ denotes the matrix of bilateral ASEAN exchange rates in the sample. $\mu_t$ is the error matrix and $A_t$ is the matrix of parameters, while $I$ is the identity matrix. If the rank of vector $\pi$ is zero, each element of $\pi$ equals zero. $F_t$ is then a first-order Vector Autoregressive (VAR) process where all the variables follow unit root processes, indicating no linear combination of the exchange rates and no cointegration among them. If the rank of $\pi$ is $r$ then there are $r$ cointegrating vectors in which each of these $r$ equations is an independent restriction on the long-run relationship solution of the variables.

The rank of $\pi$ is the number of characteristic roots of $\pi$ that differs from zero and can be determined by using the following two likelihood ratio test statistics.

$$ \lambda_{\text{trace}}(r) = -T \sum_{j=1}^{\alpha} \ln(1 - \hat{\lambda}_j) $$

$$ \lambda_{\text{max}}(r, r+1) = -T \ln(1 - \hat{\lambda}_{r+1}) $$

---

8 Employing a traditional regression technique on non-stationary time series (time series with unit root) may cause a spurious regression problem. Although the problem can be remedied by running regression tests on the first difference of the non-stationary data, a valuable long-run information may be lost due to the first-difference transformation. A cointegration technique however can be used to test whether a long-run relationship among non-stationary time series exists. More specifically, there exists a long-run relationship among two or more non-stationary time series (the time-series are cointegrated) if a linear combination among the time series is found to be significant and stationary.
Where, $\hat{\lambda}_t$ denotes the eigenvalue obtained from the reduced rank regression problem and $T$ is the number of observations. $\lambda_{\text{trace}}$ and $\lambda_{\text{max}}$ are the trace and the maximum eigenvalue test statistic respectively. Using the trace statistic, the null hypothesis is that $\lambda_{\text{max}}(r) \leq r$, against the alternative hypothesis of $\lambda_{\text{max}}(r) > 0$ while the null hypothesis, using the $\lambda_{\text{max}}$, is $\lambda_{\text{max}} = r+1$

**Vector Error Correction Model (VECM)**
Given an evidence of a multivariate cointegrating relationship among the national currencies of the six emerging ASEAN economies, we continue to set up and to estimate a VECM, which provided us a richer understanding of the dynamics of the short-run deviation from the long-run relationship equilibrium, as shown by the following VECM specification.

$$\Delta F_t = \pi F_{t-1} + \sum_{j=1}^{k-1} \varphi_j \Delta F_{t-j} + \theta_t$$  \hspace{1cm} (6)

$$\varphi_j = - \sum_{j=1}^{k-1} A_j, \hspace{0.5cm} i=1,...,k-1$$  \hspace{1cm} (7)

$$\pi = -(I - A_1 - ... - A_k) = -A(1)$$  \hspace{1cm} (7)

Where, $\pi$ denotes the coefficient vector of error correction terms, $\varphi$ signifies the matrix of the coefficients of short-run relationships while $\theta$ symbolizes the residual vector, assumed to be multivariate normal with mean vector equal to zero and covariance matrix independent across time periods. $k$ is the number of lag of the variables in matrix $\Delta F$. A negative and significant error correction coefficient indicates that there exists a long-term multivariate cointegrating relationship among the ASEAN currencies. Short-run causality was determined using the Wald test on the joint significance of the lagged explanatory variables.

**Results and Discussions**
The cointegration analysis of six ASEAN currencies
Table 1 Panel A and B, displays the results of the stationarity tests on the logarithmic transformed bilateral exchange rates in the sample. Almost all of the t-statistics and adjusted t-statistics, obtained from the ADF and the PP tests respectively, are significant at 1% level on the first difference but not on the level data. The results indicate that the null hypothesis of a unit root cannot be rejected for all the exchange rate time series and are integrated of order 1, or $I(1)$. Along the same line, the rejection of the null hypothesis of stationarity at 1% on all the level but not on the first difference data when employing the KPSS test confirms that all the time series in the sample are non-stationary and are $I(1)$. The results stand for the data in the pre- and post-2008 GFC subsamples and provide us a basis to proceed to the cointegration tests and analyses.
Table 1  Panel A: The unit root test results for 6 ASEAN currencies against the USD (Pre-GFC 2008)

<table>
<thead>
<tr>
<th></th>
<th>ADF</th>
<th>PP</th>
<th>KPSS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Level</td>
<td>First Difference</td>
<td>Level</td>
</tr>
<tr>
<td></td>
<td>t-statistic</td>
<td>p-value</td>
<td>t-statistic</td>
</tr>
<tr>
<td>USD/IDR</td>
<td>-2.2914</td>
<td>0.4367</td>
<td>-11.0822</td>
</tr>
<tr>
<td>USD/MYR</td>
<td>-0.9969</td>
<td>0.9415</td>
<td>-13.7495</td>
</tr>
<tr>
<td>USD/PHP</td>
<td>-0.1489</td>
<td>0.9938</td>
<td>-11.4455</td>
</tr>
<tr>
<td>USD/SGD</td>
<td>-2.7113</td>
<td>0.2329</td>
<td>-11.1977</td>
</tr>
<tr>
<td>USD/THB</td>
<td>-0.7619</td>
<td>0.9666</td>
<td>-8.8573</td>
</tr>
<tr>
<td>USD/VND</td>
<td>-2.3778</td>
<td>0.3903</td>
<td>-15.3965</td>
</tr>
</tbody>
</table>

Table 1  Panel B: The unit root test results for 6 ASEAN currencies against the USD (Post-GFC 2008)

<table>
<thead>
<tr>
<th></th>
<th>ADF</th>
<th>PP</th>
<th>KPSS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Level</td>
<td>First Difference</td>
<td>Level</td>
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<tr>
<td></td>
<td>t-statistic</td>
<td>p-value</td>
<td>t-statistic</td>
</tr>
<tr>
<td>USD/IDR</td>
<td>-2.1213</td>
<td>0.5311</td>
<td>-10.2061</td>
</tr>
<tr>
<td>USD/MYR</td>
<td>-2.5293</td>
<td>0.3137</td>
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<td>USD/PHP</td>
<td>-2.1393</td>
<td>0.5210</td>
<td>-11.3593</td>
</tr>
<tr>
<td>USD/SGD</td>
<td>-1.4312</td>
<td>0.8497</td>
<td>-10.3311</td>
</tr>
<tr>
<td>USD/THB</td>
<td>-2.5891</td>
<td>0.2857</td>
<td>-10.2866</td>
</tr>
<tr>
<td>USD/VND</td>
<td>-2.4814</td>
<td>0.3372</td>
<td>-7.9289</td>
</tr>
</tbody>
</table>

Note: The figures shown in the table are t-statistics, adjusted t-statistics and the LM statistics for the ADF, PP and KPSS unit root tests respectively. The test results are based on the model containing a constant and a trend term. The lag length selection for the ADF test is based on the AIC. The bandwidth selection for the PP and KPSS is based on Newey-West. *** indicates that the test statistic is significant at 5% level. The asymptotic critical LM value (constant and trend model) for the KPSS test is 0.146 at 5% level. The null hypothesis of the ADF and the PP tests is that the times series has a unit root while the null hypothesis of the KPSS is that the time series is stationary. The critical values for the ADF and the PP tests are based on the values provided by MacKinnon (1996) one-sided p-values. The critical values for the KPSS test are based on the Kwiatkowski et al. (1992) in Table 1).
### Table 2  Panel A: The tau-statistics from Engle-granger test (constant and trend model) Pre-GFC 2008

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>IDR</th>
<th>MYR</th>
<th>PHP</th>
<th>SGD</th>
<th>THB</th>
<th>VND</th>
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<tr>
<td></td>
<td>tau-statistic</td>
<td>p-value</td>
<td>tau-statistic</td>
<td>p-value</td>
<td>tau-statistic</td>
<td>p-value</td>
</tr>
<tr>
<td>IDR</td>
<td>-</td>
<td>-</td>
<td>-1.7974</td>
<td>0.8483</td>
<td>-1.2261</td>
<td>0.9601</td>
</tr>
<tr>
<td>MYR</td>
<td>-2.7733</td>
<td>0.3783</td>
<td>-</td>
<td>-</td>
<td>-2.7781</td>
<td>0.3759</td>
</tr>
<tr>
<td>PHP</td>
<td>-2.7143</td>
<td>0.4088</td>
<td>-3.0436</td>
<td>0.2523</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>SGD</td>
<td>-2.8394</td>
<td>0.3453</td>
<td>-2.3830</td>
<td>0.5873</td>
<td>-2.3091</td>
<td>0.6266</td>
</tr>
<tr>
<td>THB</td>
<td>-2.8798</td>
<td>0.3257</td>
<td>-3.8709 ***</td>
<td>0.0437</td>
<td>-2.1363</td>
<td>0.7130</td>
</tr>
<tr>
<td>VND</td>
<td>-2.1995</td>
<td>0.6824</td>
<td>-2.6654</td>
<td>0.4346</td>
<td>-2.7460</td>
<td>0.3924</td>
</tr>
</tbody>
</table>

Note: *** implies significance at 5% level. Critical values are obtained from MacKinnon (1996) p-values (adjusted for degree of freedom). Automatic lags specification is based on Schwarz criterion with maximum lag of 18. All the exchange rates involve ASEAN national currencies and the USD.

### Table 2  Panel B: The tau-statistics from Engle-granger test (constant and trend model) Post-GFC 2008

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>IDR</th>
<th>MYR</th>
<th>PHP</th>
<th>SGD</th>
<th>THB</th>
<th>VND</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>tau-statistic</td>
<td>p-value</td>
<td>tau-statistic</td>
<td>p-value</td>
<td>tau-statistic</td>
<td>p-value</td>
</tr>
<tr>
<td>IDR</td>
<td>-</td>
<td>-</td>
<td>-3.1343</td>
<td>0.2161</td>
<td>-3.2261</td>
<td>0.1842</td>
</tr>
<tr>
<td>MYR</td>
<td>-2.7733</td>
<td>0.3783</td>
<td>-</td>
<td>-</td>
<td>-2.7781</td>
<td>0.3759</td>
</tr>
<tr>
<td>PHP</td>
<td>-2.7143</td>
<td>0.4088</td>
<td>-3.0436</td>
<td>0.2523</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>SGD</td>
<td>-2.8394</td>
<td>0.3453</td>
<td>-2.3830</td>
<td>0.5873</td>
<td>-2.3091</td>
<td>0.6266</td>
</tr>
<tr>
<td>THB</td>
<td>-2.8798</td>
<td>0.3257</td>
<td>-3.8709 ***</td>
<td>0.0437</td>
<td>-2.1363</td>
<td>0.7130</td>
</tr>
<tr>
<td>VND</td>
<td>-2.1995</td>
<td>0.6824</td>
<td>-2.6654</td>
<td>0.4346</td>
<td>-2.7460</td>
<td>0.3924</td>
</tr>
</tbody>
</table>

Note: *** implies significance at 5% level. Critical values are obtained from MacKinnon (1996) p-values (adjusted for degree of freedom). Automatic lags specification is based on Schwarz criterion with maximum lag of 18. All the exchange rates involve ASEAN national currencies and the USD.
The results of the pairwise cointegration tests employing the EG test procedure with a drift are shown in Table 2, Panel A and B. At the 5% confidence level, during the pre-2008 GFC, uni-directional long-term relationships are found to be running from the Thai Baht to the Malaysian Ringgit and the Singapore Dollar, suggesting loose long-run ties between Thailand vis-à-vis Malaysia and Singapore with the latter two being the ones adjusting policies in response to changes in Thailand. Another uni-directional cointegrating relationship is also found between the Philippine Peso and the Vietnamese Dong during the pre-crisis period. The relationship however is relatively independent from the first group of cointegrated currencies.

Surprisingly, only one uni-directional co-movement between the Malaysian Ringgit and the Singapore Dollar is found in the region during the post-2008 GFC period. As opposed to the mutual suggestion in the extant literature, currency cointegration is generally strengthened after a financial crisis as a result of a higher level of economic policy coordination and links in the exchange rate policies among group members (Chin & Azali, 2010; Choudhry, 2005; Enders & Hurn, 1994; Gharleghi et al., 2015; Kawasaki, 2012); we find ASEAN currencies appear to be less cointegrated after the 2008 GFC in the current study.

There is no bi-directional cointegrating relationship among the currencies of ASEAN members in both pre- and post-2008 GFC periods. This indicates an absence of a strong tie among their currencies and suggests that it may be difficult for ASEAN economies to form a monetary union (Thong et al., 2010). Unlike other members for cointegration of ASEAN currencies, and a leading currency to form an OCA in the region, found by most previous studies (Choudhry, 2005; Gharleghi et al., 2015; Kawasaki, 2012; Ng, 2002; Sun & Simons, 2011), we find that the Indonesian Rupiah does not have any significant pairwise cointegrating relationship with other currencies in the present study, despite Indonesia’s status as the largest economy in Southeast Asia. Figure 1 illustrates all the pairwise relationships found to be statistically significant at 5% in this study, as shown in Table 2, Panel A and B.

![Figure 1](image_url)  
**Figure 1** Significant pairwise cointegrating relationships among ASEAN currencies

The first step in performing the Johansen multivariate cointegration test is to choose a model and the lag of variables in the model that best explains the variation of the dependent variables. We perform the lag structure analysis on the unrestricted vector autoregressive (VAR) model and chose the lag length of 2 based on the AIC and SIC test statistic at 5% level. The summary of the Johansen test shown in Table 3, Panel A and Panel C reveals that the model without a deterministic trend but an intercept should be tested according to the SIC and the consistency between the Trace and the Maximal Eigenvalue statistics regarding the number of cointegrating relationship found.

The Trace statistics and the Maximal Eigenvalue statistics shown in Table 3, Panel B, suggest a rejection of the null hypothesis of no cointegration among the currencies in the sample. The result reveals an
evidence of one cointegrating relationship at 5% significance level among the six ASEAN currencies in the sample prior to the 2008 GFC. Nevertheless, no significant multivariate cointegrating association can be found among the currency group post-2008 GFC (See Table 3, Panel D). Similar to the findings from the pairwise cointegration analysis, ASEAN currencies seems to be less cointegrated after the crisis. A possible explanation for the findings in this study is that the 1997 AFC originated at the center of ASEAN region and resulted in a relatively higher impact on the ASEAN members, forcefully requiring them to converge their economic and monetary policies after the crisis. The 2008 GFC, however, began in the US and has infected European economies, potentially causing fund outflows to emerging markets including those in Southeast Asia after the crisis. Nonetheless, the choice of fund flows destinations may be differ due to the differences in the extent of the financial market development of the destination economies. Consequently, the value of ASEAN currencies may move divergently due to uneven fund inflows to the region.

The dynamics of the short-run and long-run relationships among currencies of six ASEAN members are further examined for the pre-crisis subsample by constructing and estimating a VECM. The chi-square test statistics of the short-term and long-term causality among the currencies are reported in Table 4. The only equation in the VECM where the coefficient of the error-correction term is negative and significant is the one in which the difference of the Philippine Peso (PHP) is the dependent variable. This finding confirms the result from the Johansen cointegration test in Table 3, Panel B, that there is one cointegrating relationship among the ASEAN currencies and it also provides an evidence that the ASEAN members could form an OCA during the pre-2008 GFC. The error-correction coefficient of -0.0005 indicates that a change in the PHP/USD in the VAR responds to the disequilibrium changes represented by the cointegration vector at the rate of about 0.05% per week toward the long-run equilibrium. We also find short-term casual relationships from the Malaysian Ringgit, the Thai Baht and the Vietnamese Dong to the Philippine Peso to be significant at 5 percent level, indicating that the short-term movement of the Philippine Peso can be explained by the short-term movements of the three currencies.

Table 3  Panel A: Summary of all five sets of assumptions for Johansen cointegration test (Pre-GFC 2008)

<table>
<thead>
<tr>
<th>Deterministic Trend</th>
<th>Information Criteria by Rank and Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept and Trend in CE</td>
<td>Trace</td>
</tr>
<tr>
<td>Intercept and Trend in CE</td>
<td>No Intercept</td>
</tr>
<tr>
<td>No Intercept</td>
<td>No Trend</td>
</tr>
<tr>
<td>Selected (0.05 level*)</td>
<td>Number of Cointegrating Relations by Model</td>
</tr>
<tr>
<td>0</td>
<td>-49.0280</td>
</tr>
</tbody>
</table>

Note: * indicates the best fit model and rank according to SIC. The lag length for VAR model was selected based on the AIC and SIC test statistics at 5% level.
Table 3 - Panel B: Multivariate Johansen cointegration test results (Pre-GFC 2008)

<table>
<thead>
<tr>
<th>Null Hypothesis</th>
<th>Trace Statistic</th>
<th>5% Critical Value</th>
<th>Maximal Eigenvalue Statistic</th>
<th>5% Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>r = 0</td>
<td>114.5752 ***</td>
<td>103.8473</td>
<td>42.6867 ***</td>
<td>40.9568</td>
</tr>
<tr>
<td>r ≤ 1</td>
<td>71.8885</td>
<td>76.9728</td>
<td>24.3705</td>
<td>34.8059</td>
</tr>
<tr>
<td>r ≤ 2</td>
<td>47.5181</td>
<td>54.0790</td>
<td>18.6472</td>
<td>28.5881</td>
</tr>
<tr>
<td>r ≤ 3</td>
<td>28.8708</td>
<td>35.1928</td>
<td>12.9777</td>
<td>22.2996</td>
</tr>
</tbody>
</table>

Note: *** implies significance at 5% level. Critical values for the trace and maximal eigenvalue tests are obtained from MacKinnon, Huag, and Michelis (1999). The lag length for the VAR model was selected based on the AIC and SIC test statistics at 5% level.

Table 3 - Panel C: Summary of all five sets of assumptions for Johansen cointegration test (Post-GFC 2008)

<table>
<thead>
<tr>
<th>Deterministic Trend</th>
<th>Information Criteria by Rank and Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Intercept</td>
</tr>
<tr>
<td>Intercept and Trend in CE</td>
<td>Intercept</td>
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<tr>
<td></td>
<td>No Trend</td>
</tr>
<tr>
<td>Trace</td>
<td>0</td>
</tr>
<tr>
<td>Max-Eig</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: * indicates the best fit model and rank according to SIC. The lag length for VAR model was selected based on the AIC and SC test statistics at 5% level.

Table 3 - Panel D: Multivariate Johansen cointegration test results (Post-GFC 2008)

<table>
<thead>
<tr>
<th>Null Hypothesis</th>
<th>Trace Statistic</th>
<th>5% Critical Value</th>
<th>Maximal Eigenvalue Statistic</th>
<th>5% Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>r = 0</td>
<td>76.2336</td>
<td>103.8473</td>
<td>21.4776</td>
<td>40.9568</td>
</tr>
<tr>
<td>r ≤ 1</td>
<td>54.7560</td>
<td>76.9728</td>
<td>19.2647</td>
<td>34.8059</td>
</tr>
<tr>
<td>r ≤ 2</td>
<td>35.4913</td>
<td>54.0790</td>
<td>11.8039</td>
<td>28.5881</td>
</tr>
<tr>
<td>r ≤ 3</td>
<td>23.6874</td>
<td>35.1928</td>
<td>9.6156</td>
<td>22.2996</td>
</tr>
</tbody>
</table>

Note: *** implies significance at 5% level. Critical values for the trace and maximal eigenvalue tests are obtained from MacKinnon et al. (1999). The lag length for the VAR model was selected based on the AIC and SIC test statistics at 5% level.
Table 4 Temporal causality results based on the vector error correction model (VECM)

<table>
<thead>
<tr>
<th>ΔIDR</th>
<th>ΔMYR</th>
<th>ΔPHP</th>
<th>ΔSGD</th>
<th>ΔTHB</th>
<th>ΔVND</th>
<th>Coefficient</th>
<th>t-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>ΔIDR 23.3627 ***</td>
<td>0.8015</td>
<td>0.3547</td>
<td>0.5833</td>
<td>0.6560</td>
<td>1.3509</td>
<td>0.0001</td>
<td>0.5308</td>
</tr>
<tr>
<td>ΔMYR 2.5250</td>
<td>1.9509</td>
<td>1.9244</td>
<td>0.1184</td>
<td>1.8004</td>
<td>5.1312</td>
<td>-0.0003</td>
<td>-1.3519</td>
</tr>
<tr>
<td>ΔPHP 4.7200</td>
<td>6.0926 ***</td>
<td>28.7738 ***</td>
<td>3.9425</td>
<td>7.2647 ***</td>
<td>12.7035 ***</td>
<td>-0.0005 ***</td>
<td>-4.1565</td>
</tr>
<tr>
<td>ΔSGD 1.0584</td>
<td>0.3982</td>
<td>3.1878</td>
<td>25.5782 ***</td>
<td>0.1643</td>
<td>5.2966</td>
<td>-0.0002</td>
<td>-1.0131</td>
</tr>
<tr>
<td>ΔTHB 0.2492</td>
<td>1.6013</td>
<td>1.8395</td>
<td>5.8996</td>
<td>26.2204 ***</td>
<td>3.6751</td>
<td>-0.0002</td>
<td>-1.4431</td>
</tr>
<tr>
<td>ΔVND 4.1589</td>
<td>6.6198 ***</td>
<td>2.3213</td>
<td>0.0436</td>
<td>2.5448</td>
<td>7.2268 ***</td>
<td>0.0001</td>
<td>2.5768</td>
</tr>
</tbody>
</table>

Note: the result shown was estimated from the AR equation in the VECM in which the first difference of the logarithm of bilateral exchange rate enter the model as the dependent variable one at a time. *** implies significance at the 5% level. Indicates the first difference. The lag length for the VECM was selected based on the sequential modified LR test statistic at 5% level. All the exchange rates are against USD.

Conclusion
In this study, we evaluate the readiness of ASEAN members toward becoming an OCA and examine a disruptive effect of the 2008 GFC on the short-run and long-run linkages among the ASEAN currencies. We employ bivariate and multivariate cointegration techniques on the pre- and post-crisis subsamples containing weekly bilateral exchange rates of the national currencies of six ASEAN members with regard to the USD. The results reveal that there are short-run and long-run multivariate linkages and there are relatively more pairwise cointegrating relationships among the ASEAN currencies prior to the 2008 GFC. The cointegrating relationships, however, disappear after the crisis. Therefore, we suggest that although ASEAN has potential, it is not ready to form an OCA within Southeast Asia due to its members’ varying sensitivity to an asymmetric external shock such as the 2008 GFC, and the absence of some key ASEAN currencies in the weekly cointegrated group. An emerging observation worth noting in this study is that financial crisis does not always result in a relatively greater extent of currency cointegration as suggested by previous studies and that the origin of a crisis may play an important part in explaining the effect of a financial crisis on currency linkages.

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The ASEAN Secretariat. (2014). ASEAN Economic Community Blueprint (8th Reprint). Jakarta, Indonesia: The ASEAN Secretariat.


QUALITY MANAGEMENT SYSTEM DESIGN FOR SUSTAINABLE EXCELLENCE: AUTOMOTIVE PARTS INDUSTRY

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ABSTRACT

The main objective of this paper is to present current standard and tools in quality management system for automotive industry. Although TQM, Six Sigma and Lean are one of the methods for automotive parts manufacturers to reach their business goals, most manufacturers would prefer the method that focuses mainly on the clients’ satisfaction. This article will suggest quality management system for particular automotive parts industries, ISO/TS 16949: 2009 and TQM, which is the standard system that is widely used and acceptable. The standard systems that are accepted in the U.S.A and EU are MBNQA and EFQM respectively. Various research studies indicated that these two standard systems are easily applied to align with technical differences for each business.

Keywords: Quality management system, automotive industry, TQM, MBNQA, EFQM

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Introduction
Nowadays ‘quality’ is everything for a business. If a business has quality product or service, it will benefit that organization in every way. Quality control, quality development, quality product or quality service are all vital to the organization as they are the drives for improvement and production, which will result in clients’ satisfaction. Then clients’ satisfaction results in company’s profit which will encourage human resource development within the organization at the end.

Review of the literature
In this paper, authors reviewed research articles concerning the definition, the importance, and result of implementation of quality management system regarding to automotive industry. The Evolution of Quality Management Concept can describe as following; (Juran, 1999, Bon & Mustafa, 2013)
1. Fitness to standard – all products must adhere to high quality standards to compete in the market.
2. Fitness to Use – all products must serve the purpose.
3. Fitness to Cost – all products should fit the concept of ‘low capital, high yield cash’.
4. Fitness to Implied Needs – all products are useful for the clients in the unpredicted future.
The most well known automotive industry management system is ISO/TS16949:2009 which was developed from the manufacturing management system that decreased the variance and damages in supply chain. This standard was set up based on ISO 9001 which has included other client requirements (IATF, 2009). A highly competitive market drives businesses to improve and apply their production processes which are targeted at the technical requirement of the product. Certainly, business measurement of the production success is profit margin, not the quality. In the past 20 years, there have been more than a thousand organizations competing in Baldridge Award and EFQM Award but only 10% made and achieved it. Why? There is one theory that was based on MBNQA, EFQM (Bou-Llusar, Escrig-Tena, Roca-Puig, & Beltrán-Martín, 2009; Karastathis, Afthinos, Gargalianos, & Theodorakis, 2014). The application of TQM (Total Quality Management) increases production and client relationship competency (Agus & Hassan, 2011; Santos-Vijande, & Alvarez-Gonzalez, 2007). This idea, created after the World War II by W. Edwards Deming, was meant to improve the production process and service but it was not widely introduced in the U.S. until 1950. At that time, Japan, facing problem with their products below par, started applying TQM with their industries until their products became acceptable and sought after in the market.

What is TQM?
Total Quality Management: TQM is a 1939 developed system based on Statistical Quality Control: SQC and Statistical Process Control: SPC. In 1950, Dr. William Edwards Deming (1946-1993) worked through the Japanese Union of Scientist and Engineers (JUSE) to establish Quality Control Circle (QCC) using the statistical methods which focused on quality and cycle time. His methods were so successful that the Deming Prize was set up in his honor for helping the country’s industry (Oakland, 2014). The Deming cycle is presented below.
Total Quality Management (TQM) is a people-focused management system because it mainly changes the way people operate in the organization. A variety of definitions of total quality management have been offered over the years. Reviewing previous contributions (Agus & Hassan, 2011; Santos-Vijande, & Alvarez-Gonzalez, 2007; Corredor, & Góñi, 2011) a dominant insight among experts seems to define TQM as an approach to management characterized by some guiding principles or core concepts that embody the way the organization expected to operate, which, when effectively linked together, will lead to high performance. The TQM has the necessary strategy and technical management system including the philosophy and tools to solve the industry problem, which was caused by production and market volatile (DL, 2008).

Dire circumstances and competition in the world market force businesses to rethink how they should operate their industry with TQM, seeing that it has helped increase the production and client relation efficiencies in Japan and other countries around the globe (Agus & Hassan, 2011; Santos-Vijande, & Alvarez-Gonzalez, 2007; Corredor, & Góñi, 2011). Most world class standard quality systems, including TQM, are designed to prevent damages and improve productions. It can be easily adapted and applied to fit the organization needs. TQM will help organization improve their performances, production, marketing, client relation, human resource, finance, etc.
The applications of TQM in business and industry are different because the goal and services vary and it becomes difficult for business to measure the success (Juneja, Ahmad, & Kumar, 2011). The number of participants in Thailand Quality Award (TQA) can speak of the TQM efficiency in the business. The winners of the prize usually come from businesses that have used TQM for quite some time.

**The Malcolm Baldrige National Quality Award (MBNQA)**

The Malcolm Baldrige National Quality Award (MBNQA) is the most well known award in 1980s when the leaders in each industry group and U.S. government emphasized the product quality to compete in the world market. MBNQA became a benchmark that linked up all the important issues into one, and it was recognized for being easily applied to private sector, education and health sectors. MBNQA is based on TQM and is a tool used to evaluate organizational performance and award top performers (Kleindorfer, Singhal, & Wassenhove, 2005). This special prize is similar to Deming Prize of Japan which was created by the Japanese Congress in 1987 to honor the Secretary of Ministry of Commerce, Mr. Malcolm Baldridge. Mr. Baldrige was a supporter of the quality management concept which he had foreseen that it would be the vital key to improve the country’s economy. According to Prybutok, Zhang, and Peak (2011), their study examines the government sector applicability of the MBNQA 2002 criteria and contributes to the growing body of literature that addresses the need for performance metrics for organizations. This study demonstrates that local governments usually have positive leadership and data analysis skills which align with MBNQA 2012 model. These measures can enhance decision making about resource allocations because such measures allow evaluation of processes and a better understanding of the integration among these processes. In the same way, the MBNQA is being proposed and pilot tested in government organizations, and these works provide support for the transference and
application of the model to government services in a municipal government. The findings of the study show that the proposed Malcolm Baldrige National Quality Award (MBNQA) criteria-based instrument provides a viable set of measures for a municipal government to review and measure their business (organization) processes. However, this is also evidenced by Bou-Llusar, Escrig-Tena, Roca-Puig, and Beltrán-Martín (2009) who considered that technical element of MBNQA has strong relationship with component of the EFQM Excellence Model which found from result obviously improved.

**European Foundation for Quality Management (EFQM)**

EFQM (2015) is an agency that evaluates the practice of The EFQM Excellence Model and guarantees the EFQM standard. EFQM is an organization that supports and educates other agencies in private sector and government sector. The EFQM Excellence Model is a standard to measure and evaluate an organization’s capability which mainly covered:

1. Results
2. Approach
3. Deployment
4. Assessment and Review

EFQM management has 2 subcategories:

1. Enablers - working process, human resource management, leadership, organizational policies and strategies, and resources
2. Results - effects on society, clients, employees and organization

Any organization wishes to utilize EFQM needs to clearly determine both enablers and results in order to fully improve the management system to the level of excellence. According to Mahalli (2013) EFQM Excellence Model, only good resources and proper allocation make good management. EFQM Excellence Model is a perfect tool for organization improvement (Calvo-Mora., Picón-Berjoyo, Ruiz-Moreno, & Cauzo-Bottala, 2015). In developing countries, applying EFQM Model in a Small and medium sized enterprises (SMEs) gives a more outstanding result than large enterprises (Michalska, 2008; Ismail, Darestani, & Irani, 2011). Beside this, Bou-Llusar, Escrig-Tena, Roca-Puig, & Beltrán-Martín (2009) have found regulation and framework to apply the MBNQA and organization relations. As a result of literature reviewed, EFQM and MBNQA can be applied in the organization in order to reach continual improvement in organization management system as a roles model.


ISO/TS 16949 Particular requirements for the application of ISO 9001 for automotive production and relevant service part organizations (IATF, 2009), automotive core tool such as Advance Product Quality Planning (APQP), Failure Mode and Effect Analysis (FMEA), Production Part Approval Process

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Figure 3  The EFQM Excellence Model (2015)
(PPAP), Statistical Process Control (SPC), Measurement System Analysis (MSA) and other automobile quality management systems such as Germany’s VDA 6.1, France’s EAQF and Italy’s AVSQ. (run on เขียนต่อๆๆ ไม่มีverb หลัง) ISO/TS 16949 focuses on client satisfaction. The ISO/TS 16949 can improve automotive parts manufacturers and suppliers in the U.S., Germany, France, Italy, England, Japan etc. The implementation of the system usually takes time to adjust but the results are worthwhile; higher quality products and higher management system. Uniting all the regulations into one single standard system decreases the different demands and also eliminates the loss of other system implementations.

**The Principle of Quality Management system has included:**
1. Customer Focus
2. Leadership
3. Involvement of People
4. Process Approach
5. System Approach
6. Contiual Improvement
7. Factual Approach to Decision Making
8. Mutually Beneficial Supplier Relationship

<table>
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<tr>
<th></th>
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</tr>
</thead>
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<td>Leadership</td>
<td>✓</td>
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<td>✓</td>
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<tr>
<td>Customer and Market Focus</td>
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<td>-</td>
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Summary and Suggestion: Quality Management System Design Caution for Automotive Industry

In the past 20 years, manufacturers have focused on the products quantity and the usage of the management system, so there has been growing pressure on businesses to pay more attention to the environmental and resource consequences of the products and services they offer and the processes they deploy. Nowadays, the higher market competition pushes manufacturers to focus on clients’ requirements, implied need and future expectations. Anyway, the pressure is also from the movement towards triple bottom line reporting (3BL) including the relationship of profit, people, and the planet. In the same way, companies developed their core competencies and included them in their business processes, so the tools and concepts of TQM were applied to develop new product development and to manage supply chains, and they typically involved multi-disciplinary team. The resulting challenges include green-product design, lean and green operations, and closed-loop supply chains (Seuring, & Müller, 2008; Yang, Hong, & Modi, 2011). Therefore, to accomplish what customers need, the design of the quality management system has changed from quantity focus to customer requirements focus. Hence, the organization should focus on the selection of QMS’s tools and standard by comparing its usefulness and organization’s culture. However, ISO/TS 16949 standard is widely applied in automotive industry even in Thailand. MBNQA, EFQM and TQM should be more considered to implement in the organization in order to improve overall business management system and business results.

References


THE INTERVENTION OF LEARNING ORGANIZATION LEARNING FOR HUMAN RESOURCE DEVELOPMENT TO ACHIEVE THE GRADUATION GOAL (A CASE STUDY OF UNDERGRADUATES AT THE FACULTY OF COMMERCE AND BUSINESS ADMINISTRATION BURAPHA UNIVERSITY)

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ABSTRACT

This research aims to study the intervention of learning organization relating to the students’ learning achievement, and aims to improve human resource management to accord with learning organization, and the learning achievement of the undergraduates, to help them achieve the graduate goal. This research is quantitative research, and a questionnaire was used to analyze the Learning Organization (LO) based on Peter Senge’s strategy, which proposes the following five characteristics for self-improvement and organization operation, 1) personal mastery, 2) mental models, 3) shared vision, 4) team learning, 5) systems thinking.

The questionnaire collected data from the senior and sophomore, major management from three groups; general business, international business and marketing from the faculty of Commerce and Business Administration Burapha University.

Following Senge, the findings indicated that there were only three characteristics which influenced the learning achievement, the grade point average: 1) personal mastery; if the students’ personal mastery increased, the grade point average increased as well, and there was a positive achievement, 2) team learning; if the students shared learning more, their grade point average decreased and there was a negative achievement and 3) system thinking; if the students had the system thinking, the grade point average increased and there was a positive achievement.

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Introduction
Thai students compete to pass the entrance examination to study in their preferred choice of university according to both intrinsic and extrinsic motivations. As a result, each year when they graduate from Mattayom 6, many would like to study at university. Regarding the data from the Association of University Presidents of Thailand from 2013-2015, the number of the students who passed the Central University Admission Systems is shown as following.

For Chulalongkorn University in 2013, there were 18,532 candidates but passed 3,205, in 2014 18,738 candidates but passed 2,533 and in 2015, there was 19,805 candidates but passed 2,952. For Mahidol University in 2013, there were the candidates 10,109 but passed 1,837, in 2014 10,249 candidates but passed 2,056 and in 2015 there were 12,492 candidates but passed 2,127. For Burapha University in 2013 there were 29,236 candidates but passed 4,935, in 2014 25,775 contestants but passed 5,868 and in 2015 there were 36,949 contestants but passed 5,701. Burapha University is one of the target universities for higher education having three campuses; Bangsaen city, Sakaeo province and Chanthaburi province, including 28 faculty in total. The number of both undergraduates and graduates were 46,170 (data from the Office of Registrar, 2014)

The Faculty of Commerce and Business Administration Burapha University offers three groups; general business, international business and marketing in Sakaeo campus, and the Graduate School of Commerce was a mentor at the beginning. The Faculty of Commerce and Business Administration was established to expand the education opportunity to the eastern residents and to support the government strategy for the ASEAN Community.

This strategy for ASEAN encourages the establishment of special economic zones in Sakaeo province, development the new permanent crossing border in Sakaeo province, and to be the twin town of Siem Reap in Cambodia and in Amphoe Aranyapratthath, Sakaeo province in Thailand. The establishment of the faculty of Commerce and Business Administration served Burapha University’s strategic plan (BUU2020) regarding the outstanding in ASEAN and Sakaeo campus could be expanded because of the increase in number of students and to be the education center. At the moment, according to the Office of Registrar on the 19 January 2016, there are 576 students and the expecting students for the new semester 2016 is approximately 240 students, consequently the the Faculty of Commerce and Business Administration would have 716 students (Division of register and education evaluate, 2014)

The students of the Faculty of Commerce and Business Administration from each major have the different factors; however, they have the same goal, which is to achieve the education goal. When they study at the university, they find that they have freedom for life, ideas and behaviors, sometime if they do not plan well for study, they might have the freedom beyond the limit without concerning about the university principles and regulations. Serious consequences might be the lower study result or retirement from university. These effects do not happen suddenly, but they are cumulative negative behaviors, and it is often too late to solve the problem in the end.

The theory of learning organization of Peter Senge was used as a tool to create the learning organization and to interview the study process of the undergraduates of faculty of Commerce and Business Administration Burapha University by using 5 characteristics of Peter Senge (1994); personal mastery, mental models, shared vision, team learning, systems thinking. These theories study the behaviors to stimulate and to persuade the learners to self-improve all the time to achieve the education goal.

Research objective
To investigate the intervention of learning organization which relates to the students’ learning achievement.

Research Hypothesis
The principles of the learning organization are personal mastery, mental models, shared vision, team learning and system thinking affecting the students’ achievement.
Conceptual Framework

Scope of Study
1. The scope of study emphasizes the intervention of Peter Senge’s learning organization to improve the learners and targeted the undergraduates, major Human Resource Management, faculty of Commerce and Business Administration Burapha University. This intervention would perhaps facilitate the learners to achieve graduation by using Peter Senge’s five characteristics as follows: Personal Mastery, Mental Model, Shared Vision, Team Learning and Systems Thinking (Senge, 1994).

Human Resource Management emphasizes that various personal administrations such as sex, gender, experience or married status can result in different behaviors. Consequently, the strategy or tool needs to be used to administrate human resource, so that they plan their visions or other thinking process to achieve self-improvement according to their study aims.

2. Population and sampling
Quantitative Research

2.1 The undergraduates of faculty of Commerce and Business Administration Burapha University, Sakaeo campus, management major, general business management, international business, marketing, 217 second year and the third year students. The samples were calculated by using the table of Krejcie & Morgan (Krejcie & Morgan, 1970, p.4, cited in Yothongyod & Sawadisap, 2016).

3. Timing Scope
It took a week to collect quantitative data.

4. Location scope
Data were taken from undergraduates from the faculty of Commerce and Business Administration Burapha University, Sakaeo campus, management major, general business management, international business, marketing, the second year and the third year students. At the moment, they study at Burapha University, in Bangsaen city, Chonburi province.

Expected Benefits
This research could be beneficial for the undergraduates who are majors in management general business management, international business, marketing, faculty of Commerce and Business Administration Burapha University, They could plan the idea management, create vision and self-improve by using the intervention of Peter Senge’s learning organization to achieve graduation goal for the bachelor’s degree.

Research conduct
The research used the quantitative research methodology to analyze data. The data were collected by the questionnaire from the undergraduates at the faculty of Commerce and Business Administration Burapha University, Sakaeo campus, management major, general business management, international business, marketing, the second year and the third year students. The samples were calculated by using the table of Krejcie & Morgan (Krejcie & Morgan, 1970, p.4, cited in Yothongyod & Sawadisap, 2016).
business, marketing, the second year and the third year students. The data revealed what factors would influence the students’ learning achievement. Consequently, the learners could improve themselves and to achieve goals in the future.

**Research findings**

The intervention analysis of learning organization to develop human resource to achieve graduation goal, a case study of the undergraduates, faculty of Commerce and Business Administration Burapha University analyzed by using five characteristics of Senge as follows; personal mastery, mental model, shared vision, team learning and system thinking. The prediction equations are as following:

\[
\hat{Y} = 0.229 \text{ (Personal Mastery)} - 0.278 \text{ (Team Learning)} + 0.166 \text{ (Systems Thinking)}
\]

The research result reported the relation learning achievement from Senge’s five characteristics by using the Stepwise Multiple Linear Regression. There were only three characteristics that influenced the grade point average which was the learning achievement as follows.

1. Personal Mastery had the standardized coefficient 0.229 which means if the personal mastery of the students increased 1 unit, the grade point average will increase 0.229.
2. Team Learning had the standardized coefficients -0.278 which means if team learning of the students increased 1 unit; consequently, the grade point average will drop -0.278.
3. System Thinking had the standardized coefficients 0.166 which means if the students’ system thinking increased 1 unit; the grade point average will increase 0.166.

The research findings showed information about the student’s behavior. If the graduation achievement needs to be created for the students’ benefit, the institution could provide the learners with personal mastery and system thinking. In addition, the learning encouragement should be done all the time so that the students have the systematic thinking process and they could see the changes in both big and small scales. Regarding Team Learning, if positive achievement is the goal for the students, the team working process should be reduced. According to the result, the student learning was not effective because their communication process did not make them understand within the group. As a result, there was a lack of negotiation or shared knowledge to improve skills or increase the intelligence among the group. If the institution encourages team learning, it could result in a drop in learning achievement.

**Discussion**

The research result related to the conceptual framework raises interesting issues as follows.

1. The Personal Mastery; if the learners are enthusiastic and keen on learning, they would have better study results. Chiraprapha Akaraborworn (2011) mentioned a person in an organization who was their own master of learning wishing to improve their own abilities to achieve their aimed success. As a result, that organization will have the learning persons all the time and they can persuade themselves to be self-motivated learners. The research results indicated that the students who had learning characteristics or could persuade themselves to learn for new knowledge would achieve the positive education achievement.

2. Team Learning: the students work with the others for the same purpose which was to share ideas and to achieve the mission. This idea was explained by Chiraprapha Akaraborworn (2011) who discussed the advantages of team working as being group members learning together, sharing ideas and developing the intelligence of each person among the group. In the learning organization, there were people who could cooperate, share knowledge and team learning could be the working power in the organization. On the other hand, team learning could be a negative result for a certain circumstance or some organizations.

This research found when the students worked as a team, there was no team learning target. The learners had no shared ideas and did not concern about team aims; consequently, there was output from one person in a team and there was no team learning. Moreover, there was no improvement for the team members, and this influenced the negative
achievement; the more they worked as a team, the worse result they had.

3. System Thinking: the students could create systematic thinking which causes the thinking process and planning, doing, checking and acting to be more systematic. This qualification would make better and effective communication. Chiraprapha Akaraborworn (2011) showed that the systems thinking were the most important aspect for knowledge management. The system thinking method helps us to understand the circumstances. This circumstance would help us to change systematically and effectively to understand the big and the small phenomenon scales.

The research output reported the current students’ behaviors should focus on two characteristics for the students’ benefits were 1) Personal Mastery and 2) System Thinking by encouraging a progress learning all the time so that the students could create the system thinking of analytical method to see the big and the small scales.

Regarding the team learning, to create the positive achievement, the institution should perhaps reduce the team learning because it did not produce the effective communication among the group. In other words, they had the communication problems; as a result there was not shared knowledge to improve skills and intelligence. So, the institution should avoid the team learning because this would cause a drop in achievement.

Recommendations
This research is based on the basic data collection from the graduated, management major, second year, and third year students from three groups; general business management, international business and marketing from the faculty of Commerce and Business Administration Burapha University. This faculty was founded three years ago and does not have any fourth year students as yet. They have first, second, and third year students. The data collection is not diverse because of the small scale of the population, and as a result the target is small as well. In the future there might be more students and there would be the concepts, attitudes or another factor which makes the students’ thoughts change. As a result, the intervention of learning organization would be diverse and a benefit for the students’ learning achievement. In addition, to make the data more reliable, there should be the qualitative research method helping to gather and analyze further data from the population related.

References
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4. Manuscripts must be typed with A4 white paper, full length papers of not more than 15 pages.

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6. Articles must have keywords.

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