

THE INFLUENCE OF ENERGY MANAGEMENT ON THAI MANUFACTURING FIRMS PERFORMANCE

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Abstract

The study objectives was to investigate the corelation between level of energy management in Thai companies and their performance measured by the balanced scorecard (BSC). The study tested different levels of energy management dividing the sample into groups of interest and examined the influence of energy management on firm performance. The sample used in this study consisted of 400 Thai companies selected by simple random sampling. The results showed that the level of both energy management and firm performance measured by the BSC was at a high level. There were significantly different levels of energy management between groups based on industry type, energy management award and ownership status. The level of energy management positively and significantly influenced firm performance as measured by the BSC, as well as each of the four perspectives of the BSC. Moreover, there were detected significant relationships between companies classified as falling within majority industries and those who had received energy awards and the level of firm performance. The main value of this study is its contribution to formulating national policy based on two disparate aspects of the academic discipline of management science.

Keywords: energy management; firm performance; balanced scorecard; Thai companies.

1. INTRODUCTION

The main goal of businesses around the world has changed from maximizing profits to maximizing wealth and sustainable development (Islam and Deegan, 2010). This is because nowadays businesses cannot only be concerned with and serve shareholders, investors, and creditors, but need to respond to all stakeholders' demands (Deegan, 2001). Moreover, to achieve sustainable development, businesses cannot only focus on the economic perspective, but they must also attend to the social and environmental perspectives (Suttipun and Nuttaphon, 2014). Therefore, the firms' actions and activities are considered to obtain those three perspectives. Performance measurement is also included. The firms used to measure their performance based on only financial performance (economic perspective), but they need to measure their performance in both financial and non-financial information to sustain their business.

In addition, financial performance alone can neither predict a firm's future performance, nor serve all its stakeholders' needs and it does not address the issue of sustainable development. There are, however, some measurement tools by which businesses can measure both their financial and non-financial performance, such as triple bottom line reporting and the balanced scorecard (BSC), which was first proposed by Kaplan and Norton (1996) and is now a performance measurement tool commonly used to measure both financial and non-financial performance. BSC divides performance into four perspectives: financial, customer, internal process, and learning. It is a strategic management system that prioritizes implementation (Kaplan and Norton, 2001).

To achieve better performance and sustainable development, firms need to perform actions and adopt strategies which serve the social and environmental perspectives as well as the economic perspective, such as corporate social responsibility, environmental management, and energy management, which are vital as means of addressing environmental issues which are of relevance to the whole planet. The concept of energy management involves ensuring that a firm carefully uses and manages its sources of energy and participation-based energy conservation is a tool by which energy management can be operationalized. The benefits of

energy management include reductions in production costs and sale and administration expenses. Therefore firms with effective energy management tend to achieve higher levels of performance.

In Thailand, even though the population is only the fourth largest in ASEAN behind Indonesia, the Philippines, and Vietnam, it has the second highest energy consumption, which is only exceeded by that of Indonesia, and it also imports the second highest quantity of natural gas and petroleum behind Singapore (Department of Alternative Energy Development and Efficiency, 2012). Therefore, the Thai government encourages all businesses in Thailand to adopt energy management strategies in all their operations (Minister of Energy, 2012). Thai government organizations claim that several benefits flow from energy management such as cost and expense reduction, improved performance, waste and pollution reduction, reductions in social and environmental impacts, and sustainable development (Suttipun et al., 2018).

However, previous studies in Thailand, while detecting the influence of energy management on firm performance measured by the BSC, have found problems regarding the implementation of energy management and the BSC. On the one hand, some organizations still regard energy management as a business cost that will reduce their performance. Therefore, although they may implement energy management in order to comply with government regulations, in practice they will do as little as possible in regard to managing their energy consumption (Minister of Energy, 2012). On the other hand, previous studies have found that there is a positive influence from energy management on firm financial performance (Zhang, 2016; Qian and Xing, 2018 because businesses wish to satisfy their stakeholders' demands and can achieve better performance based on the stakeholders' reactions. However, although there have been prior studies examining the relationship between energy management and firm financial performance, no study has investigated the influence of energy management on both financial and non-financial performance. Moreover, no previous study has considered the relationship between energy management and firm performance measured by the BSC.

Therefore, based on the research problems set out above, the study reported herein aimed to (1) investigate the level of energy management and firm performance measured by the BSC of Thai industries; (2) test the different level of energy management between groups of interest such as industry type, energy management award holders, and ownership status; and (3) examine the influence of energy management on firm performance. To address these issues, there were three research questions: (1) What is the level of energy management and firm performance measured by the BSC of Thai companies: (2) is there a different level of energy management within groups of interest based on industry type, energy management award holders, and ownership status; and (3) does energy management influence firm performance and if so how?

This study will provide several contributions. First, the study will shed light on the benefits of energy management for Thai companies as has already been done in other countries. Second, the study will contribute to the knowledge of energy management in emerging-economy nations and supplement that relating to developed countries. Next, the study's results will reveal the nature of the influence of energy management on firm performance in a developing country. Finally, the study will demonstrate how stakeholder theory can be used to explain the influence of energy management on firm performance.

The paper will next review relevant literature and develop hypotheses based on a theoretical perspective relating to energy management and the concept of performance measured by the BSC. In the following section the study's methods will be described including details of the population and sample used in the study, the methods of data collection and variable measurement, and the tools employed to analyze the data. Thereafter the study's results will be described and discussed and finally, conclusions and limitations to the study's findings are set out.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

This section reviews the literature under three headings, theoretical perspective, the concept of energy management, and the concept of performance measured by the BSC, following which the study's hypotheses are developed

2.1. Theoretical perspective

Stakeholder theory was adopted in this study because it explains that firms take actions and perform activities to satisfy stakeholder demands because they are a part of a broader social system. There are many different groups of stakeholders in any business and each group of stakeholders has a right to expect the performance of corporate actions and activities in which they have an interest. However, the power of each group to compel companies to perform actions and activities is different (Ratanajongkol et al., 2006). A business's stakeholders include its owners or shareholders, its creditors, suppliers and customers, its workforce and competitors, the government and government organizations, society and communities, charities, the environment and environmental lobbies, and future generations (Suttipun and Nuttaphon, 2014). When the demands of stakeholders are served, this will provide a positive return to companies in terms of a better reputation, better performance, better corporate value, competitive advantage, and sustainability (Islam and Deegan, 2010).

In relation to the level of energy management adopted, and the influence of energy management on firm performance as measured by the BSC, once firms try to perform actions and activities to satisfy the demands of their various stakeholders, those stakeholders will contribute to the firms' level of performance in both financial and non-financial aspects (Suttipun and Nuttaphon, 2014). For example, energy management can help to increase shareholder and investor confidence by establishing a process which can stabilize financial and non-financial results, and contribute to stakeholders' understanding of firms' activities (Quon et al., 2012). Moreover, some previous studies have also used stakeholder theory to explain the influence of energy management on firm performance (Zhang, 2016; Qian and Xing, 2018).

2.2. Energy management in Thailand

For a business to serve all its stakeholders and to achieve sustainable development, it needs to have energy management. Energy management involves the implementation of participation-based energy conservation using systematic techniques and methods. Among the benefits of energy management are reduced production costs and sales and administration expenses, as a result of which firms with energy management tend to produce better performance. In Thailand, energy management has been regulated by the Ministry of Energy since 1994, and revised and updated regulations were issued by the Department of Alternative Energy Development and Efficiency, Ministry of Energy in 2007. Under the revised version, the regulation of energy management comprises eight processes: (1) establishment of an energy management team, (2) preliminary assessment of energy management situation, (3) formulation of an energy conservation policy, (4) evaluation of energy saving potential, (5) setting a target and a plan for energy conservation, (6) implementing and monitoring the energy management system (7) internal audit of energy management system, and (8) management review for improvement. (Department of Alternative Energy Development and Efficiency, 2007).

2.3. The balanced scorecard

As noted in section 1, firms used to measure their performance based only on financial performance, but nowadays they need to measure their performance in terms of both financial and non-financial terms in order to sustain their business, serve their stakeholders and address the issue of sustainable development. The BSC is now a commonly used performance measurement tool by which both financial and non-financial performance can be measured Kaplan and Norton (1996).

The logical reason for energy management to have a positive effect on firm performance as measured by the BSC is because when firms try to efficiently managing the utilization of energy to meet the demands and expectations of groups of stakeholders, such as their employees, the environment, and society and the community, those stakeholders can be expected to contribute to improving the firms' performance in both financial and non-financial terms (Suttipun et al., 2018). Moreover, the BSC can resolve the problem of reporting only a firms' financial performance, as it captures performance within four perspectives: financial, customer, internal process, and learning and growth. The BSC also provides an excellent platform for firms to focus on all stakeholders rather than only on some groups of stakeholders (Deegan, 2001). Further, the BSC is a strategic management system that clearly emphasizes implementation (Kaplan and Norton, 2001).

2.4. Hypothesis development

To test the different levels of energy management between the groups of interest, and the influence of energy management on the performance of Thai companies, two groups of hypotheses were developed: three hypotheses in relation to differences in the level of energy management within industry types, energy management award holders/non-holders, and ownership status, with one hypothesis relating to the influence of energy management on firm performance.

To test for differences in the level of energy management based on industry type, this study grouped companies in Thailand into two types, majority and minority industries. The majority industries comprised automotive, electronic, tourism, agricultural, and food industries, while the minority industries were all the other industry types. Some previous studies have found that firms in majority industries provide a higher level of energy and environmental management than firms in minority industries (Aras et al., 2009; Dragomir, 2010; Fleite et al., 2012; Rahman et al., 2010). This is because firms in majority industries generally aim to trade internationally rather than purely domestically, and they therefore, need to comply not only with national energy management standards or regulations, but they also with international standards or regulations, such as the ISO15001 Energy Management Standard, ISO14001 Environmental Management Standard, and ISO9001 Quality Management Standard. Moreover, the stakeholders of firms in majority industries tend to have more expectations than those of firms in minority industries. However, Fauzi et al. (2007) found no different level of energy management between these industry type groups in Indonesia. Nevertheless, this study hypothesized that:

H1: There is a significantly different level of energy management between groups based on industry type

To test the different levels of energy management between groups based on whether or not businesses have received an energy management award, the sample was divided into two groups: award and no award. The previous studies of Qian and Xing (2018) and Suttipun et al. (2018) found that firms with energy or environmental management awards had implemented more extensive as well as better quality energy or environmental management than firms without awards. Moreover, the key performance index measurement of having an energy management award is quite similar to the proxy used in BSC. Therefore, holding an energy management award was very likely to have a positive influence on firm performance as measured by the BSC. To demonstrate and test the result in Thai companies, this study hypothesized that:

H2: There is a significantly different level of energy management between groups of firms based on whether or not they have received an energy management award

In terms of ownership status, this study defined two types of status: limited or listed companies and other firms consisting of limited partnerships, ordinary partnerships, or single-owner businesses. Generally, limited or listed companies are of larger size than other firms and limited or listed companies have been found to implement more energy and environmental management than other firms (Thollander et al., 2005; Zhang, 2016). This is because limited or listed companies have a greater number and variety of stakeholders than other firms, and they therefore have a greater need to respond to stakeholder expectations and demands (Islam and Deegan, 2010). In addition, the applicable standards and regulations relating to energy and environmental management are focused on limited or listed companies rather than on limited partnerships, ordinary partnerships, or single-owner businesses. Therefore, this study hypothesized that:

H3: There is a significantly different level of energy management between groups based on ownership status

Finally, many prior studies have found a positive relationship between energy or environmental management and firm performance (Suttipun et al., 2018; Suttipun and Sittidate, 2016; Thollander et al., 2005; Zhang, 2016). This is because energy or environmental management can provide several long-term benefits such as reducing production costs, satisfying stakeholder demands, and creating a new culture of sustainable development between firms and their stakeholders (Suttipun and Sittidate, 2016; Suttipun et al., 2018). In addition, once firms implement energy management in an effort to satisfy the demands of their stakeholders, those stakeholders will contribute to higher performance in both financial and non-financial terms (Suttipun and

Nuttaphon, 2014). However, Fleite et al. (2012) and Qian and Xing (2018) found that the level of energy management had a negative influence on firm performance because firms need to incur costs to develop and implement energy management. However, despite the mixed results in prior studies, this study hypothesized that:

H4: Energy management has a positive influence on firm performance as measured by the BSC

3. METHODS

This section describes the methods used in this study under three headings: population and sample, data collection and measurement of variables, and data analysis.

3.1. Population and sample

The population adopted in this study was all companies in Thailand (Minister of Energy, 2017), and the sample adopted consisted of 400 firms selected by simple random sampling (Yamane, 1973).

3.2. Data collection and measurement of variables

A mailed questionnaire was used to collect data from each firm in the sample. The questionnaire was adapted from those used in previous studies (Qian and Xing, 2018; Suttipun et al., 2018; Zhang, 2016). The questionnaire was divided into three sections as follows: (1) general information relating to the firm, (2) the extent and level of energy management, and (3) firm performance measured by the BSC. In the first section, the general information collected related to the firm's size (measured by market capitalization), the firm's age (based on the date of the registration of the firm), the industry type (measured by dummy variables: 1 = main industry, and 0 = other), energy management award (measured by dummy variables: 1 = having received an energy management award, and 0 = other), and the firm's ownership status (measured by dummy variables: 1 = limited or listed firm, and 0 = other). The dependent variable in this study was firm performance as measured by its BSC (Calandro and Lane, 2006; Suttipun et al., 2018) and the independent variables were the levels of energy management, the age of the firms and their size, the firms' industry type, their ownership status, and the holding of an energy management award (Thollander et al., 2005; Zhang, 2016; Qian and Xing, 2018).

Firm performance and the level of energy management were measured based on items in the questionnaire, to which the firms responded based on a five-point Likert scale, in which 5 represented the highest level, 4, a high level, 3, a moderate level, 2, a low level, and 1 the lowest level. The rating scale in this study was adapted from previous studies (Ghazali and Manab, 2013; Srisa-sard, 2010). The answers to each item were averaged and the mean values for each item were expressed based on five levels: 4.51-5.00 as the highest level, 3.51-4.50 as a high level, 2.51-3.50 as a moderate level, 1.51-2.50 as a low level, and 1.00-1.50 as the lowest level. The draft questionnaire was sent to three experts, who considered its content validity and credibility. In addition, the questionnaire's reliability was also measured based on Cronbach's (1951) coefficient alpha which was found to be 0.992 which was satisfactory. Table 1 indicates the basis on which the variables used in this study were measured.

TABLE 1- VARIABLE MEASUREMENT

Variables	Coded as	Measurement
1. Firm's performance	BSC	Five-point Likert scale
2. Energy management	ENERGY	Five-point Likert scale
3. Firm's size	SIZE	Market capitalization
4. Industry type	INDUS	Dummy variables 1 = majority industries in Thailand, 0 = otherwise
5. Ownership status	OWNER	Dummy variables 1 = limited and listed companies, 0 = otherwise
6. Firm's age	STAND	Firm's age (year)
7. Energy award	AWARD	Dummy variables 1 = Having an energy award, 0 = otherwise

3.3. Data analysis

To achieve the objectives of this study, descriptive statistics were used to indicate the level of energy management and firm performance measured by the BSC, while t-tests were used to test for significant differences in the levels of energy management between the groups of interest comprising industry type, energy management award, and ownership status. Multiple regression was used to determine whether of the level of energy management influenced firm performance measured by the BSC based on the following equation:

$$BSC = a + b1ENERGY + b2SIZE + b3INDUS + b4OWNER + b5STAND + b6AWARD + error$$

The study also conducted a sensitivity analysis for each performance perspective of BSC comprising financial, customer, internal process, and learning, separately.

4. RESULTS AND DISCUSSIONS

From the sample of 400 companies in this study, 287 firms (71.80 percent) fell within the definition of majority industries in Thailand (the automotive, electronic, tourism, agricultural, and food industries), while 113 firms (28.20 percent) were from minority industries. 109 firms (27.30 percent) had received an energy management award while 291 firms (72.80 percent) had not. In terms of ownership status, 345 respondents were limited or listed companies (86.20 percent), while 52 (13.80 percent) were other business types. The average age of the sample of companies in this study was 18.33 years (SD = 11.92) and the average size (capitalization) of the firms was 1097.11 million baht (SD = 150.32).

Table 2 shows descriptive statistics relating to the level of energy management and firm performance measured by the BSC based on the responses to the questionnaire. The results indicate that the mean level of both energy management (4.003, SD = .895) and firm performance (3.776, SD = .814) were at the high level. In addition, each of the performance perspectives of the BSC was also at the high level.

TABLE 2- PARTICIPATING COMPANIES' ENERGY MANAGEMENT AND BSC

Variables	Min	Max	Mean	SD	Level
Energy management	1.06	4.97	4.003	.895	High
Balanced scorecard	1.13	5.00	3.776	.814	High
Financial	1.00	5.00	3.708	.923	High
Customer	1.50	5.00	3.732	.819	High
Internal process	1.00	5.00	3.793	.921	High
Learning	1.00	5.00	3.871	.859	High

Table 3 shows the results of independent sample t-tests comparing the levels of energy management between the groups of interest in this study. The results show that there was a significantly different level of energy management between the groups based on industry type, energy management award, and ownership status at the 0.01 level. In terms of industry type, companies classified as falling within majority industries were found to have a significantly higher level of energy management than those classified as belonging to minority industries, which was similar to the prior studies of Dragomir (2010) and Fleite et al. (2012). This is explicable because the firms in majority industries are focused on trading internationally rather than domestically and therefore need to comply not only with national energy management standards and regulations but also with international standards and regulations such as the ISO15001 Energy Management Standard, ISO14001 Environmental Management Standard, and ISO9001 Quality Management Standard. The finding that firms who had received an energy management award had a significantly higher level of energy management than those which had not is consistent with the findings of Qian and Xing (2018) and Suttipun et al. (2018). This is hardly surprising, given that the Department of Alternative Energy Development and Efficiency of the Thai Ministry of Energy (Thailand gives the Thailand Energy Award to firms that implement high levels of energy management, in terms of both quality and quantity. Thus, firms who have received the Thailand Energy Award have already demonstrated better energy management than firms who have not received the Thailand Energy Award.

For ownership status, the finding that limited and listed companies have significantly higher levels of energy management than other firms is similar to the results reported by Thollander et al. (2005) and Zhang (2016). This finding is explicable because the regulations and standards of energy management imposed in Thailand by the Ministry of Energy are based on the size of business, and limited or listed companies are normally of larger size than other types of firms such as limited partnerships, ordinary partnerships, and single-owner businesses. Therefore, limited or listed companies need to provide higher levels of energy management in terms of both quality and quantity than smaller firms.

TABLE 3- INDEPENDENT SAMPLE T-TESTS FOR DIFFERENCES IN THE LEVEL OF ENERGY MANAGEMENT WITHIN GROUPS

Groups of interest	N	Mean	SD	t	Sig.
Industry type					
Majority industries	287	4.139	.741	4.989	.000**
Minority industries	113	3.658	1.133		
Energy management award					
Having award	109	4.351	.402	4.888	.000**
No award	291	3.873	.989		
Ownership status					
Limited or listed firms	342	4.065	.820	3.716	.000**
Other firms	55	3.589	1.206		

** significant at $p < 0.01$, * significant at $p < 0.05$

A correlation matrix was used to test for multicollinearity between the seven variables used in this study, consisting of one dependent variable and six independent variables, and is shown in Table 4. Based on a fixed effects model for panel testing, the variance inflation factor (VIF) of the correlation matrix between the variables was 1.106, which indicates that there was no multicollinearity which would be indicated by a VIF exceeding 10. The low coefficients in the correlation matrix between the variables used in the study therefore indicated that multicollinearity was unlikely to be a problem in the multiple regression. Based on the correlation coefficients between the seven variables used in this study, there was a positively significant correlation between ENERGY and BSC at the 0.01 level. Moreover, INDUS, AWARD, and OWNER were also correlated with BSC at the 0.01 level.

TABLE 4- CORRELATION MATRIX BETWEEN VARIABLES

	BSC	ENERGY	INDUS	AWARD	AGE	OWNER	SIZE
BSC	1						
ENERGY	.788**	1					
INDUS	.133**	.243**	1				
AWARD	.255**	.238**	.209**	1			
AGE	.032	.054	.200**	.243**	1		
OWNER	.188**	.190**	.222**	.144**	.120*	1	
SIZE	.079	.059	.076	.098	.120*	.017	1

** significant at $p < 0.01$, * significant at $p < 0.05$

Table 5 shows the outcome of the multiple regression analysis testing the influence of energy management on firm performance measured by the BSC and the sensitivity analysis based on each perspective of the BSC (financial, customer, internal process, and learning). ENERGY had a positive and significant influence on BSC at the 0.01 level. Moreover, there was a positive and significant relationship between INDUS and AWARD, and BSC at the 0.05 level. However, the study did not find any significant relationship between AGE, OWNER or SIZE, and BSC at the 0.05 level.

The finding of a positive influence of energy management on firm performance is consistent with the previous studies of Thollander et al. (2005) and Zhang (2016) who both found a positive relationship between energy efficiency and firm performance among Swedish companies. This finding is explicable because energy management can provide several long-term benefits such as reducing production costs, meeting stakeholders' demands, and creating a new culture of sustainable development between firms and their stakeholders (Suttipun et al., 2018). Thus, better energy management improves both financial and non-financial performance.

The finding of higher levels of energy management among companies who had received an energy management award is consistent with that of Suttipun et al. (2018) who found a positive relationship between environmental management and firm performance. An energy management award indicates a higher level of energy management and the key performance index measurement of having an energy management award is similar to the proxy used in the BSC. Therefore, holding an energy management award had a positive influence on firm performance as measured by the BSC.

For industry type, the finding of a significant influence on firm performance is consistent with that of Fleite et al. (2012) and Qian and Xing (2018) who found that the firms in majority industries had higher levels of performance than firms in minority industries. In the Thai context, this is explicable because stakeholders of firms in majority industries, have higher expectations than those of firms in minority industries. For example, the majority industries are defined as “Thailand flagship” industries by the Thai government under the Thailand 4.0 national policy (Suttipun et al., 2018). Therefore, majority industries have higher budgets, and are more subject to both government policy and the expectations of stakeholders than minority industries.

TABLE 5- MULTIPLE REGRESSION ANALYSIS OF THE STUDY'S VARIABLES

Variables	BSC		Financial		Customer		Internal		Learning	
	B	t (sig.)	B	t (sig.)	B	t (sig.)	B	t (sig.)	B	t (sig.)
Cont.		7.399**		4.386**		8.446**		5.242**		6.696**
ENERGY	.778	23.988**	.714	19.907**	.689	17.794**	.723	20.75**	.751	21.54**
INDUS	.077	2.349*	.095	2.616**	.057	1.461	.084	2.363*	.047	1.316
AWARD	.082	2.509*	.102	2.804**	.029	.745	.109	3.090*	.058	1.650
AGE	-.022	-.691	-.005	-.146	-.050	-1.304	-.090	-2.612*	-.066	-1.902*
OWNER	.048	1.505	.068	1.946*	.026	.696	.088	2.585**	.012	.350
SIZE	.020	.652	.023	.655	.042	1.124	.027	.823	.017	.497
R2	.634		.552		.479		.578		.577	
Adjust R2	.628		.542		.471		.572		.571	
F-Value (sig.)	113.457**		80.795**		60.308**		89.743**		89.489**	

** significant at $p < 0.01$, * significant at $p < 0.05$

Sensitivity analysis was employed to test the sensitivity of the findings relating to BSC by testing each performance perspective of BSC separately. The study found that ENERGY had a positive and significant influence on each of the BSC perspectives at the 0.01 level. Moreover, the results showed that INDUS, AWARD, and OWNER were positively correlated with the financial perspective, while neither AGE nor SIZE were correlated with any of the four perspectives at the 0.05 level. For the customer perspective, there was no relationship between any of the grouped variables used in this at the 0.05 level. However, the study found that INDUS, AWARD, AGE, and OWNER had significant influence on the internal process perspective, although SIZE had no influence on the internal process perspective at the 0.05 level. For the learning perspective, the study found that only AGE had a significant but negative influence at the 0.05 level, while the other grouped variables had no influence on the learning perspective at the 0.05 level.

5. CONCLUSIONS AND SUGGESTIONS FOR FUTURE RESEARCH

In answer to the three main research questions of this study, the results showed that the level of both energy management and firm performance measured by the BSC of Thai companies was at the high level. In addition, energy management had a positive and significant influence on firm performance. There were significantly different levels of energy management found between the groups based on industry type, energy management award, and ownership status. Moreover, the type of industry and the holding of an energy award were also correlated with the level of firm performance. However, the study was unable to find any relationship between the other groups of interest based on firm age, ownership status or firm size and performance measured by the BSC.

The study's findings provide some theoretical and practical contributions and implications. In terms of its theoretical contribution, this study's results demonstrate that stakeholder theory can explain the different levels of energy management between the groups of interest, and the influence of energy management on firm

performance in emerging economic countries in a manner similar to that already demonstrated in developed countries. Further, the results of this study support the idea of sustainable development because although firms may incur increased costs in implementing energy management, their performance in both financial and non-financial terms should thereby be improved.

In terms of practical contributions and implications, this study provides baseline data for future researchers in this area. Further, the study's results are of practical value to various stakeholder groups. For example, top-management will benefit from being aware of the positive influence of energy management on firm performance and will be able to plan actions and activities and set key performance indices with a view to achieving the goal of energy management. Moreover, the results relating to energy management can help to change shareholder perceptions that energy management represents a drain on a company's resources and can actually be successful in increasing firm performance and thereby increase the level of shareholders' dividends. Under the heading of labor, the results of this study will show the benefit of having energy management in firms, and employees should not regard work related to energy management as being a waste of time. Finally, for regulators and policy makers, the results indicate the benefit of energy management standards and regulations for both firms and their stakeholders.

However, there are some limitations to in the findings of this study. Firstly, the questions used in the questionnaire were all closed-ended questions, and the study was therefore unable to establish in detail how each firm performs or does not perform energy management. Second, there are other firm characteristics not used in this study which might influence energy management. Finally, this study focused on only one country and its findings may not therefore be applicable in the other countries such as the other ASEAN member countries.

REFERENCES

- Aras, G., Aybars, A., & O. Kutlu. (2009). The interaction between corporate social responsibility and value added intellectual capital: empirical evidence from Turkey. *Social Responsibility Journal* 7(4): 622–637.
- Cronbach, L.J. (1951). Coefficient alpha and the internal structure of tests. *Psychometric*, 16, 297-334.
- Calandro, J., & Lane, S. (2006). An introduction to the enterprise risk scorecard. *Measuring Business Excellence*, 10(3), 31-40.
- Deegan, C. (2001) *Financial accounting theory*. McGraw-Hill Book Company Australia Pty Limited, Roseville, Australia.
- Department of Alternative Energy Development and Efficiency. (2007). *Handbook of energy management system development*. Retrieved from www.dede.go.th/km_berc/download/menu4.pdf.
- Department of Alternative Energy Development and Efficiency. (2012). *Handbook of energy conservation analysis for SMEs*. Retrieved from www.dede.go.th/testmax/sites/default/files/172-56s.pdf.
- Dragomir, V.D. (2010). Environmentally sensitive disclosures and financial performance in a European setting. *Journal of Accounting & Organizational Change* 6(3): 359–388.
- Fauzi, H., Mahoney, L.S., & A.A. Rahman. (2007). The Link between Corporate Social Performance and Financial Performance: Evidence from Indonesian Companies. *Issues in Social and Environmental Accounting*, 1(June 2007), 149-159.
- Fleiter, T., Schleich, J., & Ravivanpong, P. (2012). Adoption of energy-efficiency measures in SMEs-An empirical analysis based on energy audit data from Germany. *Energy Policy*, 51, 863-875.
- Ghazali, Z., & Manab, N.A. (2013). Enterprise risk management and value creation: initial findings amongst non-financial public listed companies in Malaysian bourse. *Asian Economic and Financial Review*, 3(7), 913-922.

- Islam, M., & Deegan, C. (2010). Media pressures and corporate disclosure of social responsibility performance information: a study of two global clothing and sports retail companies. *Accounting and Business Research*, 40(2), 131-148.
- Kaplan, R.S., & Norton, D. P. (1996). *The balanced scorecard: translating strategy into action*. Harvard Business Press.
- Kaplan, R.S., & Norton, D.P. (2001). *The Strategy-focused Organization*. Harvard Business School Press, Boston.
- Minister of Energy. (2012). Vision of energy learning. *Energy Plus*, 32, 1-5.
- Minister of Energy. (2017). *Industry Lists of Thailand*. Retrieved from www.dede.go.th.
- Qian, W., & Xing, K. (2018). Linking Environmental and Financial Performance for Privately Owned Firms: Some Evidence from Australia. *Journal of Small Business Management*, 56(2), 330-347.
- Quon, T.K., Zeghal, D., & Maingot, M. (2012). Enterprise risk management and firm performance. *Procedia-Social and Behavioral Sciences*, 62(24), 263-267.
- Rahman, S., Yusoff, R. B., & Mohamed, W.N.B.W. (2010). Environmental disclosures and financial performance: an empirical study of Malaysia, Thailand, and Singapore. *Social and Environmental Accountability Journal* 29(2): 46–58.
- Rattanajongkol, S., Davey, H., & Low, M. (2006) Corporate social reporting in Thailand: the news is all good and increasing. *Qualitative Research in Accounting & Management*, 3(1), 67-83.
- Srisa-ard, B. (2010). *Introductory research*. (8th Edition). Bangkok: Suweeriyasarn.
- Suttipun, M., & Nuttaphon, C. (2014). Corporate social responsibility reporting on websites in Thailand. *Kasetsart Journal (Social Sciences)*, 35, 536-549.
- Suttipun, M. & Sittidate, N. (2016). Corporate social responsibility reporting and operation performance of listed companies in the Stock Exchange of Thailand. *Songklanakarin Journal of Social Sciences and Humanities*, 22(1), 269-295.
- Suttipun, M., Srirat, T., Samang, N., Manae, N., & Maithong, A. (2018). The Influences of Corporate Social Responsibility on Firm Performance Measured by Balanced Scorecard: An Evidence of Hotel in Thailand's Southern Border Provinces. *ABAC ODI Journal Vision. Action. Outcome*, 5(2), 97-113.
- Yamane, T. (1973). *Statistic: An Introductory Analysis* (3rd Edition). New York, Harper and Row.
- Thollander, P., Karlsson, M., Söderström, M., & Creutz, D. (2005). Reducing industrial energy costs through energy-efficiency measures in a liberalized European electricity market: case study of a Swedish iron foundry. *Applied Energy*, 81(2), 115-126.
- Zhang, S. (2016). *Energy Efficiency and Firm Performance: Evidence from Swedish Industry*. Department of Forest Economics, Swedish University of Agricultural Sciences.