

Sustainability, Environmental Management and Green Innovation Industrial Business in Thailand ^{*}

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Abstract

The aim of this research was to develop the structural equation model on sustainable performance and its determinants. The population used in the research included 240 of entrepreneurs, top executives, innovation managers, and environmental managers in industrial business who were certified by ISO14001 standard in Thailand. Questionnaire was used as a tool for data collection. The data was analyzed by inferential statistics using structural equation model. The results indicated that competitive advantage had a significantly positive effect on sustainable performance. Environmental management, green innovation had the significantly positive direct effect on competition, both environmental management had the significantly positive direct effect toward green innovation.

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Moreover, competitive advantage is a significant mediator between environmental management and green innovation on sustainable performance. These findings illustrate that industrial business in Thailand could achieve sustainable performance by developing environmental management, green innovation to develop their competitive advantage.

Keywords: environmental management, green innovation, competitive advantage, sustainable performance

Introduction

The environment is strategic for national development and it is one of the key resources of all nations. Especially, for the activities that operated by the business organizations. Thus, any measures have been used for example, ISO14001 standard for the operational auditing on activities or any projects with impact on environment (ILEG, 2003) and to develop the organization into the universal standard to receive the considered for products exporting (Elkington & Knight, 1997). The different practices of environmental management also affect the difference in competition. Therefore, regardless of the size of business, company should be aware of using green strategy to improve and develop the organization's sustainability (Christmann, 2000).

Sustainable development is the ethics ideally related to fighting with poverty and protection of environment in the macro level (Hillary, 2000). If it is resulted from the internal cooperation, it would be the sustainability which can be used to establish the operational guidelines toward goal. Sustainability consists

of social equity, economic efficiency, and environment (Ebner, 2010). Currently, businesses have to confront with the pressure on social responsibility and to take more parts in environmental management from the waste released and pollutions they have directly made into public environment (Labuschagne, 2005). Therefore, there is the law enforcement or best practice on the social ethic of business (Kirk, 1995), which is the beginning of guideline practices on the production that emphasis on sustainable environment. It would result on higher cost but better operation in the long run (King & Lenox, 2001). Therefore, at the organizational level, it is generally accepted that the social, economic and environmental dimensions are the factors that reflect the efficiency in sustainable development (Elkington, 1994).

Environmental management in the organization context can reduce the impact on environment by bringing technology to apply in which causes green innovation such as products and any processes development (Anton et al., 2004; Sharma & Henriques, 2005; Chertow, 2007; Darnall et al., 2008; Seiffert, 2008; Van Berkel, 2010). Since the environmental management is the use of rules and regulations with the effect on environment as required by the organization and lead to the improvement toward more efficiency in the production processes (Marshall et al., 2005). Therefore, the environmental management does not only reduce the effect on environment, but also leads to changes of organization on green innovation. It also originates the new innovation that results in sustainable development onward (Horbach, 2008; Marchi, 2012; Martin et al., 2014).

Regarding product's development process, the environmental management and green innovation aspects are used to create new product and

decrease environmental effect (Chen, 2011). Therefore, to form competitive advantage on any aspects, business should develop the sustainability for the organization in three aspects: economics, society and environment (Shahbazpour & Seidel, 2006). In order to acquire the benefit from the environmental management and to seek low cost and form product differentiation as well as adjusting the position of the organization (Thomas et al., 2011). Moreover, the guideline to practice on environmental management can also help protecting the pollution and to keep sustainable natural resources (Guthey & Whiteman, 2009; Hertsgaard, 2010). To solve the industry's environmental problems, one way is to form the awareness for the business organization and stress on green friendly management. It is then necessary to integrate all the systems both directly and indirectly (Weeranan, 2015). Therefore, business organization should practice environmental management and green innovation to develop the products and processes that lead to "main green capacity" and competitive advantage thoroughly the positive result toward sustainable performance in three aspects: economics, social and environment (Chen, 2008).

Therefore, if the industrial businesses in Thailand had improved the operational strategies by adopting the best practices on environment and green innovation which were environmentally friendly to use in the organization, it would create the competitive advantages over the rivals and promote for the organization sustainability. This would lead to the reduction in the use of raw materials and energy resources as well as the pollution disposal costs. It could also reduce risks in community and to promote for the good relationship among the communities, governmental and private sectors, mass media, customers and

employees. Thoroughly, to form the reputation as the leader in environmental preservation and to add more business opportunities in which would be beneficial in the long term (Moody International Certification, 2007). In addition in 21st century, industrial business shall seek for the Positive Side of The Bad such as to adjust itself with Climate Change in which could lead toward low carbon dioxide society and the development toward Green Growth Industrial.

Review of Literature

1. Sustainable Performance (SP)

Many of academicians and operators defined the general meaning of sustainability as ecology in which refers to environmentally friendly (Wittgenstein, 1953). They also defined that sustainable development is the development that serves the current needs with no impact on the future ability in satisfying the needs of the organization (Adams, 2006; Dresner, 2002). Sustainable development shall have the conformance between economics, social and environmental objectives which will result in wealthy living of people in the present and the future (Ciegis et al., 2008). Therefore, if the organization is aware of the impacts taking place from the production and services in the industrial processes in which would lead to damages in the balance of eco-system, the organization shall seriously improve the production process in the industry to sustainably preserve the natural resources (Rahbar, 2008).

Sustainability has become even more important in business conducting since it results from the quick loss of natural resources and the attention of the

business organizations on economics security and social responsibility (Bulent & Sibel, 2013). The view toward sustainability consists of three components: economics, social and environmental performance (Ambec & Lanoie, 2008). The economics performance refers to the economics strength and local economics system or at the national or international level such as on the financial efficiency, organization profits and organization surviving (GRI, 2000-2006). Social performance refers to efficiency of the internal operation toward social system (Cooper, 2004), and the environmental performance refers to the result of environmental management of the organization thoroughly the land and air ecosystem (ISO, 1999).

2. Competitive Advantage (CA)

The pro-competitive environment will reflect the strong level of competition in the organization market by showing the amount of rivals and contesting dimension. Business organization under the strongly competitive environment will be highly pressured to increase the work and production efficiency (Jansen et al., 2006). It is criticizing that is why some industry has higher ability than the other in same industry and why some industry success quicker before other in the same industry. This reflects the competitive advantage that is not just pop up by itself but it can be built and could be changed either in the positive and negative way (Porter & Van der Linde, 1995). The organization itself can form its competitive advantage by selecting the competitive strategy that consists of cost leading strategic and differentiation (Porter, 1990). Besides, the organization can form more competitive advantages over the rival by having low cost or make the products differentiation (Preble & Hoffman, 1994).

Industry business can form the competitive advantage by focusing on the environmental operation by making the green policy to make the organization toward better social and environmental performance (Richard, 2014). The guideline for internal environment practice and cooperation will have good impact on green efficiency and it would help increase the competitive ability of the organization which will result in the performance in both economic and social (Chung-Shan Yanga et al., 2013). Forming the competitive advantage by cost reduction and product differentiation of industry leads the organization to remain its competitive advantage and promote its sustainability (Genesh & Mathan, 2015). Moreover, the competitive advantage and sustainable development concept are connected by the competitive advantage is the organization strategic forming to lead toward sustainable development in economic, social and environment. This is why we set the first hypothesis as follow:

H1: Competitive advantage has direct effect on sustainable performance positively.

3. Environmental Management (EM)

Environmental management is the activity that helps the organization to manage the environmental problems (Henriques & Sadorsky, 1999), and it has the operation methods which is the strategic management related to environmental problems (Aragon & Rubio, 2007). However, it depends on the level of organization operations in which they can reduce the impact on the natural environment since the organization has improved on the operational structure to increase the environmental efficiency. For example, the recycle activity, green management guideline, and assessment on the impacts that may happen to the environment

from any organizational operation (Darnall et al., 2010a; Darnall & Kim, 2012; Khanna & Anton, 2002). Managing the environmental problem is the key components in planning to gain the competitive advantage (Thomas et al., 2011). It also depends on the organization, both how to operate to use the benefits from the environmental management to seek for the low cost and make products differentiation as well as to adjust the organization position above the rivals (Orsato, 2006).

The study on the relationship between the environmental management and guideline practicing for the organization performance is the key principle on the research on the organization environmental management (Cohen et al., 1995). Environmental management has the positive relationship with the business operation (Molina, 2008), and it is the tool to enhance the business to lower its cost, raw material using and energy as well as for the organization to be able to survive (Lamond, 2008). Therefore, the environmental management is positively related to the business performance (Ying Qu et al., 2015). It can form the sustainability for the origination in either economic, social and environment (Zhu & Geng, 2005; Fujita & Hashimoto, 2010). The producers' council in Malaysia has supported SME to join green industry and set the activities related to environmentally friendly operation which gained acceptance from many industries and countries. This has made environmental management have the positive effect toward both large and small business operations. This leads to the efficiency and least impact on the environment (Yacob et al., 2013). Therefore, we propose the following hypotheses.

H2: Environmental management has direct effect on competitive advantage positively.

H3: Environmental management has direct effect on sustainable performance positively.

H4: Competitive advantage mediate the relationship between environmental management and sustainable performance.

Using environmental management best practices to promote general products and services improvement in global market results in the business operation either innovation or sustainability together on economics and environment (Jabbour et al., 2012). Green innovation originates from the motivation in environmental management (Qi et al., 2010). The green innovation will be taking place if the organization seriously runs on environmental management (Dibrell et al., 2011). It was also found that the environmental management is the key strategy to create green innovation (Eiadat et al., 2008). While at the same time, environmental management is the driving force on green innovation creation and effect on the performance as well (Yen & Yen, 2012). Therefore, environmental management and environmental operation reflects the applying of any environmentally friendly processes to form green innovation both in the product itself and the processes to add more competitive efficiency for the business organization (Salvado et al., 2015). We propose the following hypothesis.

H5: Environmental management has direct positive influence on green innovation.

4. Green Innovation (GI)

A green product innovation refers to the application of new innovative ideas that lead to production design and new market of atypical product that is better than general products (Baumann et al., 2002; Soylu & Dumville, 2011). This includes becoming the new innovation or improving on specific techniques. The approach comes from participation in energy saving, reducing pollution as well as forming the new organization products (Chen et al., 2006; Santamaria et al., 2012; Huang & Wu, 2010; Conding et al., 2012). Moreover, the green process innovation is also referred to as the innovation process to apply the creative idea leading to the adjustment in production process and operational management that result in the negative impacts to environment (Chen, 2011). Besides, innovation process is also directly related to the organization production (Cheng, Yang & Sheu, 2014). It uses different technology of the organization and makes innovation process achieve the goals of reducing raw material usage, pollution, and disposal of waste thoroughly.

Green innovation has the positive relationship with competitive advantage and environmental performance (Chen, Lai & Wen 2006; Chang et al., 2011). To eliminate pollution and reuse the materials or managing on green to form the marketing opportunities and production differentiation as well as to form the production process and reduce costs with more profits (Bhattachatyya, 2010; Moullin, 2007). It can be seen that the organization that joins green innovation forming will have better performance and be able to response well to the new rules and regulations of the government and it to set for the new measures to enhance the organization potential and sustainability (Hua-Hung et al., 2015). To

form the sustainable green innovation in production industry, it requires consideration on the purpose of sustainable development of the next generations. Green innovation shall take place in the organization to support businesses toward sustainability (Widya et al., 2016). Therefore, Green innovation is the factor to form the innovation that reduce environmental impact either intended or not (Cai & Zhou, 2014).

Moreover, green innovation has the major role on environmental, economic and social performance and leads to sustainability as well (Bulent & Sibel, 2013). We propose the following hypotheses.

H6: Green innovation has direct effect on competitive advantage positively.

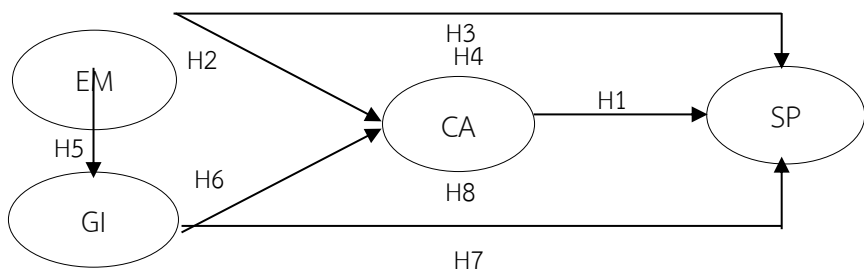
H7: Green innovation has direct effect on sustainable performance positively.

H8: Competitive advantage mediate the relationship between green innovation and sustainable performance.

Research Framework

Therefore, it can be concluded that the sustainable performance concept of industrial business in Thailand is shown in figure 1.

Figure 1: Research Framework



Methodology

This research focuses on the sample groups are the entrepreneurs, top executives, innovation managers, and environmental managers of 240 industrial businesses certified by ISO14001 standard from six regions of Thailand. The size of the sample is considered to be sufficient for the analysis according to the Rule of Thumb (Hair et al., 1998).

The content validity testing was conducted using Index of item Objective Congruence: IOC identified by three experts. The questions with 0.70 and 1.00 of score were considered to remain while the questions with score lower than 0.50 were cut off. (Rovenelli & Hambleton, 1977). For the reliability testing result, it was found that all factors had ALPHA coefficient values around 0.730 – 0.921 which were more than 0.70. (Nunnally, 1967).

Results

Data analysis using SEM can be concluded as follows:

Stage 1: Measurement Model Estimation

The result of explorative factor analysis (EFA) of environmental management, green innovation, competitive advantage and sustainable performance factors showed that Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) index was more than 0.5 and the significance value are equal to 0.000. Hence, it can be concluded that information is suitable for the components analysis (Hair et al., 2006). This can be seen in Table 1.

Table 1: Results of exploratory and confirmatory factor analysis

Variables	KMO and Bartlett's test	CR	Factor loading	Cronbach's	χ^2/df	GFI	CFI	RMSEA
EM	0.709*	0.69			1.391	0.991	0.987	0.040
- E1			0.533	0.837				
- E2			0.624	0.881				
- E3			0.601	0.844				
- E4			0.521	0.902				
- E5			0.513	0.827				
GI	0.702*	0.64			0.825	0.994	0.982	0.004
- G1			0.641	0.882				
- G2			0.730	0.871				
CA	0.706*	0.67			1.715	0.994	0.994	0.055
- C1			0.758	0.886				
- C2			0.659	0.834				
SP	0.797*	0.77			0.825	0.994	0.982	0.004
- SP1			0.540	0.730				
- SP2			0.741	0.885				
- SP3			0.713	0.921				

Notes: * and ** = significant at $p < 0.01$ and $p < 0.05$, respectively.

df = degrees of freedom, KMO = Kaiser-Meyer-Olkin value, CR = composite reliability,

GFI = goodness-of-fit index, CFI = comparative fit index,

RMSEA = root mean square error of approximation, EM = Environmental management,

GI = Green innovation,

CA = Competitive advantage, SP = Sustainable performance.

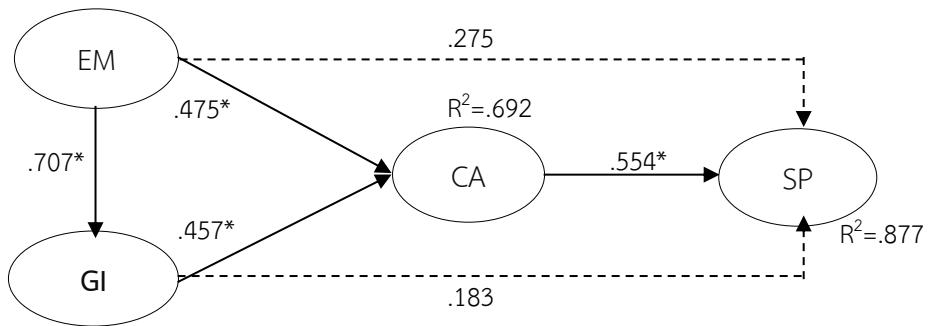
The analysis result of Confirmatory Factor Analysis (CFA) found that most of the weighing values of the hidden variable component were equal to or greater than 0.5 with the statistical significance at the level of 0.01 and the Composite Reliability (CR) was not lower than 0.60 (Tenenhaus et al., 2004). The fit index between the model and empirical data showed that the values of $(\chi^2/df) < 3$ (Hair et al., 2010), GFI > 0.90 (Kelloway, 1998), CFI > 0.90 (Kelloway, 1998; Hu & Bentler, 1999), and RMSEA < 0.08 (Hair et al., 2010), as shown in Table 1.

Stage 2: Structural Equation Assessment

The SEM analysis was applied to test the research hypotheses. The results showed that SEM model was fit with the data as the observed variable had high reliability. In other words, $\chi^2 = 60.153$; $df = 44$; $\chi^2/df = 1.367$; GFI = 0.962; CFI = 0.974; and RMSEA = 0.039. Therefore, the result of analysis of the developed structure model has conformed and blended with the empirical data as can be seen in Figure 2 and Table 2.

Stage 3: Mediating Assessment

The analysis on Mediating Assessment was confirmed by the results of the variables used in the study by Baron & Kenny (1986). That is, the characteristic of influential relationship between the studied independent variables and the mediating variables resulted in dependent variables.

Figure 2: The Structural model and results for hypothesized model

$\chi^2 = 60.153$; $df = 44$; $\chi^2/df = 1.367$; GFI = 0.962; CFI = 0.974; and RMSEA = 0.039.

The relationship influenced by the results of dependent variables is indirectly sent through the mediating variable. (Baron & Kenny, 1986; Morgan-Lopez et al., 2003; Edwards & Lambert, 2007).

Results of Hypothesis testing

We conducted SEM to test the hypotheses. H1: CA has direct positive effect on GI ($p < 0.05$) with the statistical significance of 0.01, H2: EM has direct positive effect on CA ($p < 0.05$) with the statistical significance of 0.05, H3: EM has no direct effect on SP ($p > 0.05$), H4: EM has indirect effect on SP through CA ($p < 0.05$) with the statistical significance of 0.05, H5: EM has the direct positive effect on GI ($p < 0.05$) with the statistical significance of 0.05, H6: GI has directly positive effect on CA ($p < 0.05$) with the statistical significance of 0.05, H7: GI has no direct effect on SP ($p > 0.05$) and H8: GI has indirect effect on SP through CA ($p < 0.05$) with the statistical significance of 0.05 as shown in Figure 2 and Table 2.

Table 2: Results of hypotheses

Causal path	Hypothesis	D.E.	I.E.	Hypothesis support
CA → SP	H1	0.554*		Yes
EM → CA	H2	0.475*		Yes
EM → SP	H3	0.275		No
EM → CA → SP	H4		0.559*	Yes
EM → GI	H5	0.707*		Yes
GI → CA	H6	0.457*		Yes
GI → SP	H7	0.183		No
GI → CA → SP	H8		0.536**	Yes

Notes: * and ** = significant at $p < 0.01$ and $p < 0.05$, respectively.

EM = Environmental management, GI = Green innovation, CA = Competitive advantage, SP = Sustainable performance, DE= Direct effect, IE= Indirect effect, TE=Total effect.

From the results of the study, it was found that CA has direct positive effect on SP for companies in the industrial businesses in Thailand. It implies that to lead to the sustainability in economics, social and environment, the organizations shall give themselves a chance to develop the competitive advantage, both in the aspect of green product innovation and green process innovation (Poter & Van der Linde 1995; Chung-Shan et al., 2013). The results conform to the research by Genesh & Mathan, (2015) that to form the competitive advantage. using the cost reduction and differentiation approach can make the sustainable survive in the organization. According to Raz & Anna,(2016), competitive advantage is linked with the sustainable development concept which

is the organization strategy to step toward development of economic, social and environment. It is the key opportunity for the industrial businesses in Thailand to change their organization position and step into universal venues.

Besides, this study found that EM and GI has direct positive effect on CA of industrial business in Thailand which means that the industrial business organizations in Thailand should focus on promoting and developing environmental management as well as strictly conforming the government rules and regulations for their competitive advantage (Thomas et al., 2011). It was stated that the organization shall have green innovation integration to improve the environmentally friendly operation approach while any industries can success if it has at least the green innovation that reflects the specific characteristics of the organization. (Juriah et al., 2012).

The results also showed that EM has direct effect on GI. It implies that if the organization adopts the environmental management guideline to improve the product and procedures, it must lead to new innovation (Jabbour et al., 2012). In addition, Salvado et al., (2015), stress on the environmental operation that would reflect the applying of any environmentally friendly procedures both with the products and processes.

This study found contradicting results to the previous researches that EM and GI have no direct effect on SP., However, it could be explained that the relationship of environmental management, green innovation and sustainable performance was not suited with the industrial business context in Thailand. This insignificant result is in contrast to the study of Fujita & Hashimoto (2010) also found that there was the support for SME to set up the activities related to

environmental management and it caused the efficiency with least impact on the environment in Malaysia.

The results of the study presented the difference from the existing research on green innovation by Bhattachatyya, (2010) and; Moullin, (2007) who found that if the business created green innovation, it would lead to good performance and sustainability. Widya et al., (2016) stated that forming green innovation can build strength and efficiency for the organization either in economics, social and environment. Besides, the researcher has also found that competitive advantage functions as the complete mediating variable which is in accordance with the study of Baron & Kenny (1986). That is, the environmental management and green innovation have no direct effect on the sustainable performance but had an indirect effect through competitive advantage (Baron & Kenny, 1986; Morgan-Lopez et al., 2003; Edwards & Lambert, 2007).

Limitations and future research

With regarding a limitation of this study, data collection process was gathered from the Thailand's industry that approved ISO14001 especially. Therefore, in the future research should process as follows:

- 1) It is suggested to enlarge the scope of research (such as for other businesses without ISO14001 standard certified). It is to step into green industry and move forward to green industry and sustainable development either in economic, social, and environment.

2) It is suggested to include other factors that may have effect on the sustainable performance in Thailand.

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