

THE IMPACT OF GHGS EMISSIONS ON FINANCIAL PERFORMANCE OF THAI LISTED COMPANIES FOR SUSTAINABLE INVESTMENT



**A THESIS REPORT SUBMITTED IN PARTIAL FULFILLMENT
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KMITL-2018-IC-M-002-004**

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RADY CHHANG



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THESIS TITLE The Impact of GHGs Emissions on Financial Performance of Thai Listed Companies for Sustainable Investment

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ABSTRACT

Sustainable or green supply chain management have been integrated into business strategy. End-to-end operations have been adapted to reduce Greenhouse Gases (GHGs) emissions in their process, while GHGs emissions are the main contributors to global climate change. In 2015, the 21st session of the Conference of the Parties (COP21) issued the Paris Agreement that all nations rectify to take actions to combat climate change. Under the agreement, Thailand pledged to reduce GHGs emissions 20-25% by 2030. The Stock Exchange of Thailand (SET) launched Thailand Sustainability Investment (THSI) in 2015. THSI provides a list of companies with leading sustainability performance for investors. THSI assumes that sustainable companies might perform better compared to their peers that are not as sustainable. Thus, this paper discusses the relationship of sustainability and business in value chains, and also examines the impact of GHGs emissions on financial performance including Return on Asset (ROA), Return on Equity (ROE) and Tobin's Q using multiple regression models and historic data of the 30 listed companies in THSI scheme. By testing the statistical significance, the results indicate that GHGs emissions have negative significant correlation with Tobin's Q and insignificant relationship with ROA and ROE.

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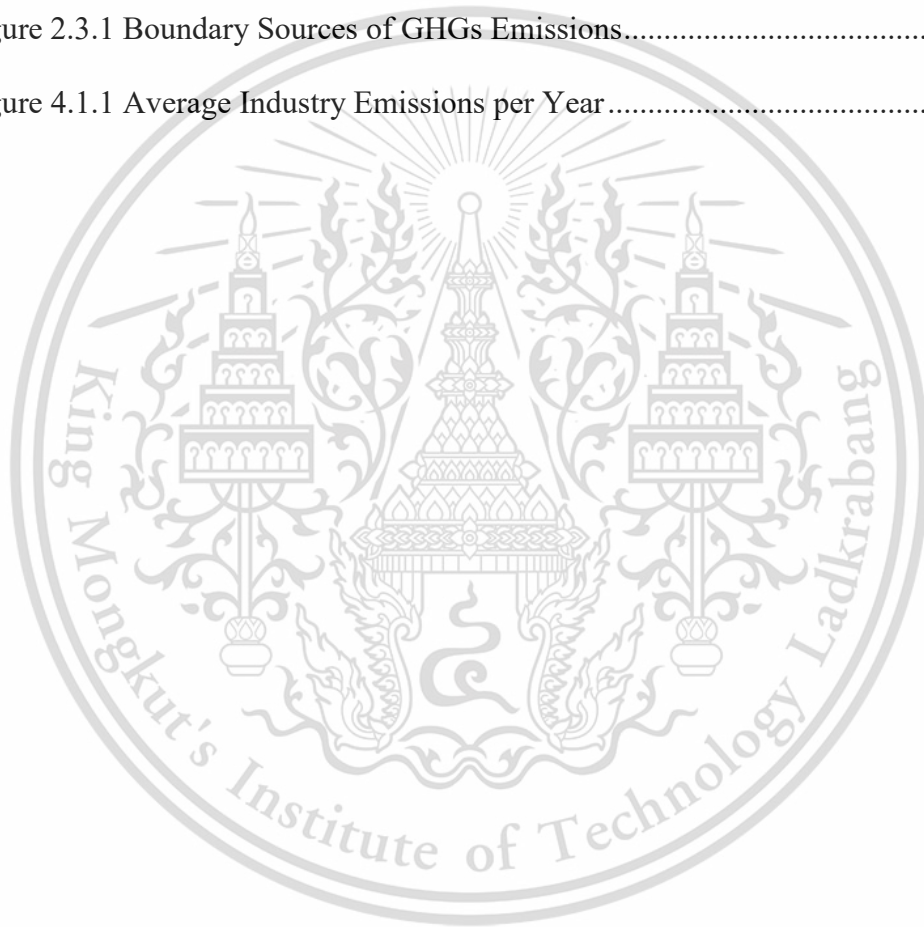
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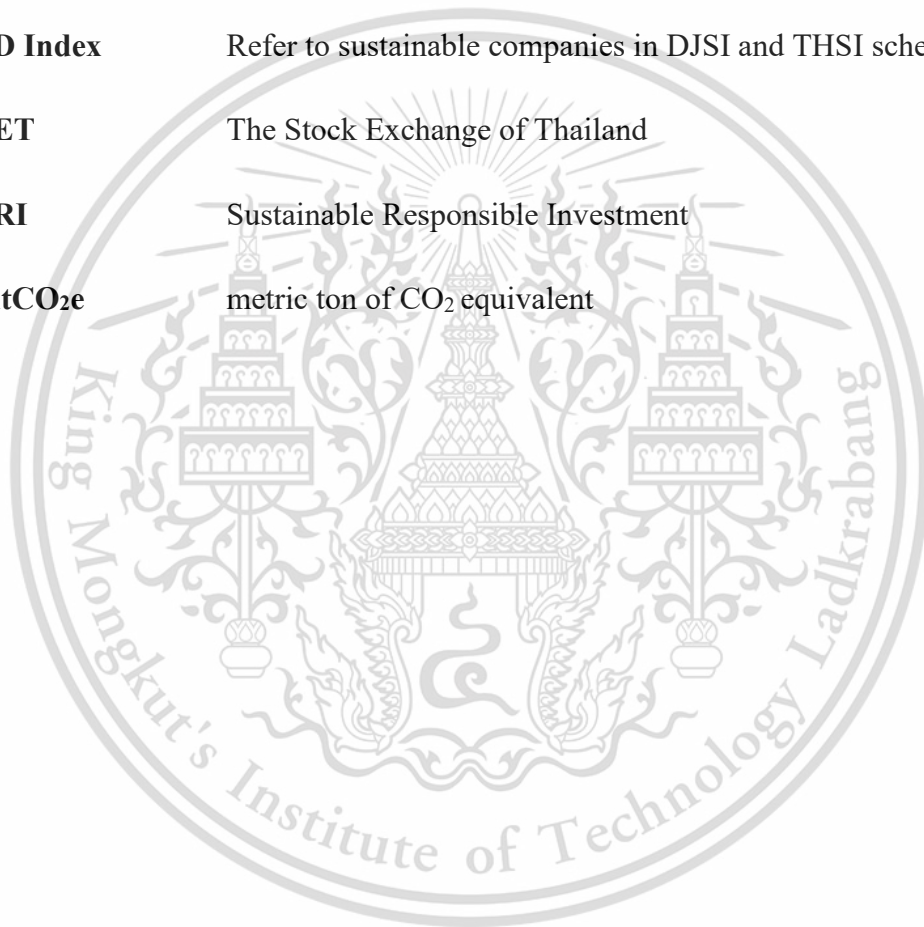


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LIST OF SYMBOLS

GHGs	Greenhouse gases
EP	Environmental Performance
FP	Financial Performance
DJSI	Dow Jones Sustainability Indices
SD Index	Refer to sustainable companies in DJSI and THSI scheme
SET	The Stock Exchange of Thailand
SRI	Sustainable Responsible Investment
mtCO_{2e}	metric ton of CO ₂ equivalent



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LIST OF DEFINITIONS

ROE	Return on equity is computed by dividing net income by average shareholders' equity.
ROA	Return on assets is calculated by dividing the earnings before interests and tax expenses by average book value of total assets.
Tobin's Q	It is defined as (total debt + stock prices × the number of stocks) divided by total assets.
Size	Company size is the natural logarithm of sales and operating revenue (in the unit of million Thai Baht).
Growth	Company growth is the growth rate in sales and operating revenue.
Capital structure (D2E)	D2E is defined as the sum of liabilities and net assets (average of 2 terms) is divided by total stockholders' equity.
Dividend Yield (DY)	It is calculated as a percentage of the last paid a dividend in the current market price of share.

CHAPTER 1

INTRODUCTION

1.1 Research Background

Climate change is one of the most important global issues that gain interests of both public and private sectors including investors in stock markets around the world. Climate change refers to any change in climate variations over time by human activity, which has increased the amount of Greenhouse Gases (GHGs) in the atmosphere (IPCC, 2014). Similarly, “Climate Change” is defined as the effects from decomposition of atmosphere directly or indirectly of human being actions (Fridahl, 2017). The world finally accepted that climate change really exists (UNFCCC, 2014). As a result, this is a main reason that links public awareness of climate change risk and investors’ expectations to GHGs emission reporting. In this sense, many governments are taking step to reduce GHGs emission from national policies to international frameworks. It is expected that investors may tend toward companies with good sustainability practices with the belief that those companies might perform well in the long run.

In responding to this interest, some global entities have invited listed companies to issue sustainability reports to disclose their sustainability related information to the investors. The number of companies issuing sustainability reports has grown from fewer than 30 in the early 1990s to more than 7,000 (Khan et al., 2016). Moreover, based on a Morgan Stanley’s survey, 71% of the respondents stated that they are interested in sustainable investing and 65% of the respondents believe that sustainable investing will become more prevailing in the future (Tyson, 2015). MIT Sloan Management Review and the Boston Consulting Group conducted a survey study

with more than 300 managers and investors in organization affiliated in 100 different countries in 2016. They found that 75% of senior executives in investment firms agree that a company's good sustainability performance is materially important when making investment decisions (Unruh, 2016). Thus, sustainable investment is the core for investment trend from business and financial risk management perspective beside regulatory and business image perspective.

The first world climate conference, which was an international gathering of experts and politicians in Geneva, Switzerland in 1979, assessed and integrated current knowledge of climate from other disciplines in combination with climate and policies, affect human activities, and impact of climate on humankind (WMO, 1979). This conference came up with initiative to first definition of climate change and United Nations Framework Convention on Climate Change (UNFCCC), which was established in 1992 to respond to the problem of global warming. Five years later, the Kyoto Protocol was adopted in 1997, which strengthened the convention by setting legally binding emission reduction requirements for 37 industrialized countries. As the second commitment period of the Kyoto Protocol, Doha Amendment was established in 2012 that has been a valuable part of the momentum for global climate action for the years leading up to 2020.

As a result, the 21st session of the Conference of the Parties (COP21) issued the Paris Agreement in 2015 that all nations rectified to take actions to combat climate change. Under the agreement, Thailand pledged to reduce GHGs emissions 20-25% by 2030 compared to projected Business-As-Usual (BAU) in second biennial update report of Thailand (ONEP, 2015). Through this agreement, Thai government has promoted sustainable investment to reduce GHGs. As an outcome of this commitment, Thailand is ranked 14th among the countries that listed companies disclose their sustainability

reports with the average of 50% environmental disclosure (Russell, 2016). The Stock Exchange of Thailand (SET) also recently issued Thailand Sustainability Investment (THSI) scheme in 2015 as a guideline for investors to select to invest in sustainable companies.

1.2 Problem Statement

Thailand is one of the emerging markets that have encouraged investors to further explore opportunities in sustainable listed companies, which some of them are members in international ethical investment indices such as Dow Jones Sustainability Indices (DJSI). The number of listed companies in those indices is increasing. For example, there are 17 listed companies in DJSI and 65 companies in THSI scheme in 2017 (SET, 2017a, 2017b). However, there are no empirical studies related to relationship between Environmental Performance (EP) such as GHGs emissions and Financial Performance (FP) among those companies in Thailand yet and remain unproven. Furthermore, most of the existing studies do not distinguish industry sectors in order to analyze the impact of GHGs emissions on FP. This is important for the investors to know if they invest in sustainability index-listed companies. Therefore, this study aims to find the impact of GHGs emissions on FP among companies listed in DJSI and THSI.

1.3 Objectives of the Study

The aim of this study is to investigate the impact of GHGs emissions on financial performance, which links to sustainable supply chain management and attributes to sustainable business practices. Following four specific objectives were defined below:

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1. Any relationship between sustainability practices and business performance in the context of sustainable supply chain management is defined and discussed.
2. To analyze how GHGs emissions contribute from different types of industrial sectors. This objective reveal whether classification type of industry has the possibility factors to influence financial performance of sustainable companies.
3. To explore which financial performance indicators are influenced by GHGs emissions of its business operation and supply chain.

1.4 Structure of the Study

This study is divided into five chapters including the introduction and the conclusion. The introduction outlined the research background, the objectives of the study and summarized the structure of the study. Chapter 2 provides a review of the literature relating to the concept of sustainable investment, linking between sustainability and business as well as supply chain in sustainable value chain, and GHGs emissions as EP and its relation with FP. The subchapters divide the literature review into three sections. Section 2.1 defines sustainable investment and discusses the process of establishment of SRI, concept of triple bottom line of sustainability, and its report. Section 2.2 describes the relationship between sustainability and supply chain. It focuses on the role of stakeholders that effects and contributes to companies for achieving sustainability. Plus, the explanation of how business process makes sustainable value chain. Besides that, national development or regulations also describe its effect to sustainability. Section 2.3 describes about GHGs emissions as EP and the reason why this study focuses on GHGs emissions as EP indicators and its importance.

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Moreover, this study reviews the studies about relationship between GHGs emissions and FP. Chapter 3 shows about research methodology. This part is discussed scope of study, methods and its formulas. After this chapter, the results and discussion reveal the impact of GHGs emissions and FP and the explanation of how those influences. The final chapter provides conclusion and recommendation about this study with the limitation.



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CHAPTER 2

LITERATURE REVIEW

2.1 Sustainable Investment

2.1.1 History of Sustainable Investment

Ethical investment has a long practice in Jewish, Christian and Islamic traditions. In the bible, Judaism and Christian have a common of teachings on how to use money or wealth ethically (i.e., Exodus 22:25 “*If you lend money to my people, to the poor among you, you are not to act as a creditor to him; you shall not charge him interest*”). The founder of Methodism, John Wesley (1703-1791), stated in his sermon ‘The Use of Money’ that people should not engage in sinful trade or profit from exploiting others, which made Methodist Church in the UK avoided investing in ‘sinful’ companies, such as companies involved in alcohol, tobacco, weapons and gambling, when they began investing in the stock market in 1920s (Wheeler, 2010). Similarly, based on the teachings of the Koran and its interpretations, Islamic investors avoid investing in companies involved in pork production, pornography, gambling, and interest-based financial institutions.

Modern Sustainable Responsible Investment (SRI) is based on growing social awareness and behavior of investors. Since the 1960s, a series of social and environmental campaigns have made investors consider about the social and environmental consequences of their investments. The first of mutual fund, so called “Pioneer Fund”, was found in 1928 which screened negative impacts of companies that were not inconsistent with the personal values of investors and this fund was restricted investment in the alcohol, tobacco, military and gambling industry (SocialFunds, 1928).

Following that mutual fund, Pax World fund was found in 1971, which concerned on

peace, housing and employment issues which it opposed investment in weapon industry in US during Vietnam war (PaxWorld, 1971).

The best-seller book about environmental movement in 1962 was “Silent Spring” which told the true story about Dichlorodiphenyltrichloroethane (DDT) impact on ecosystem in US (Carson et al., 1962). This book pushed the government to change its policies about environmental issues. Furthermore, on March 23rd, 1989 the worst environmental disaster for 11 million gallons of crude oil spilled near Alaska by Exxon Company. This disaster was a point when US Congress passed the Oil Pollution Act in 1990 and made investors aware of the negative environmental impacts of industrial development (Struck, 2009). Since then, the SRI has grown stronger in US, Europe and other countries (Wagemans et al., 2013). In this sense, issues like environment protection, anti-human rights, child-labor, and social related have become common method to screen SRI.

2.1.2 Triple Bottom Line of Sustainability

Sustainability was defined by the United Nations Brundtland commission as the development, which meets the needs of the present without compromising the ability of future generations to meet their own needs (United Nations, 1987). The concept of sustainability is the achievement of economic, social, and environmental benefits that is also called “Triple Bottom Line” (Elkington, 1998). The environmental aspect of sustainability with regard to the effects of climate changes has turned into an important factor in some recent studies. Its related issues have also become a value of investors, private and public sectors (Varadarajan, 2014). Moreover, the United Nations Sustainable Development Goals (SDGs) were issued in September 2015 on 17 goals to be achieved by 2030. One of those goals is Goal 13 which takes urgent action to combat climate change and its impacts (United Nations, 2015). In 2016, the Paris Agreement

on climate change entered into force which addresses the need to limit the rise of global temperatures. Thus, stock exchange institutions around the world play a leading role in creating and promoting climate-linked financial products, providing guidance and training on climate related reporting and supporting national and international policies (SSEInitiative, 2015). To follow that guideline, SET created THSI scheme and have provided trainings to private sectors to report their sustainable performances regarding to society, environment, and economy (SET, 2015). Not surprisingly, the process of sustainability in SET has developed many years as shown in **Figure 2.1.1**. Since 2006, SET issued principle of Good Corporate Governance. This principle encouraged the Thai listed companies to practice a good governance such as anti-corruption, which then led to the development of Thai capital market for transparency and recognition (SET, 2015).

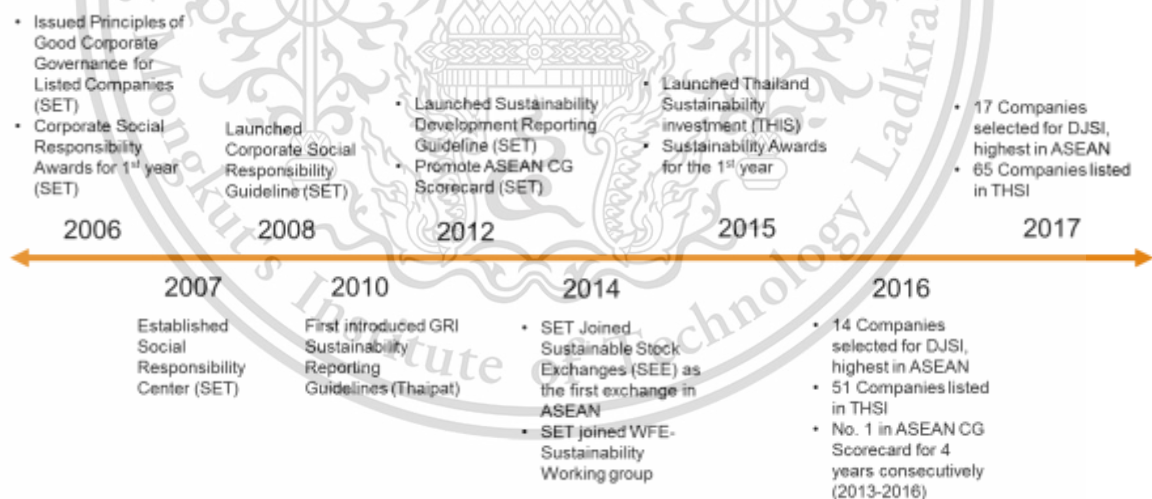


Figure 2.1.1 Development of Sustainability in SET

Source: SET Website (2018), News Release, Retrieved <https://www.set.or.th/set/newsrelease.do?language=en&country=US>

2.1.3 Sustainability Report

To be able to invest in sustainable companies, investors need to have a standard of measurement, which can be consistently applied in their decision-making process. This material is reserved for educational use only, not allowed for commercial use.

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(Slager, 2015). According to the Global Reporting Initiative (GRI), sustainability reports convey disclosure on an organization's impacts both positive and negative effects on environment, society and the economy. In doing so, sustainability reports make the abstract tangible issues, thereby assisting in understanding developments on the organization's activities and strategies (GRI, 2015).

There are some reasons that companies disclose sustainable performance. First, companies have to comply with the government or stock exchange regulations. For example, SET requires all listed companies to submit Corporate Governance (CG) report, which is to balance the interests of stakeholder in efficiency, transparency and accountability. Second, investors consider that sustainability practice is a criterion to create long term financial benefits because good sustainability practices help ensure long-term operation of the companies (López et al., 2007).

Some studies have suggested the use of sustainability reports is a significance to guide investment decision (Searcy and Elkhawas, 2012). Thus, executives in listed companies have to measure and report their sustainable performance. To ensure the proper reporting of sustainability practice, SET has guided Thai listed companies to prepare the sustainability reports in line with the GRI's internationally-recognized frameworks.

2.2 Linking Sustainability into Supply Chain

2.2.1 Stakeholder Values

Sustainability has become more important to mainstream of stakeholders' demand. Stakeholders are shareholders, customers, competitors, creditors, government, suppliers, employees, and communities...etc (Denktas-Sakar and Karatas-Cetin, 2012; Hassini et al., 2012). Stakeholder pressure refers to the degree of accountability an organization perceives for the actions and decisions it takes regarding product design, sourcing, production, or distribution to stakeholders (Parmigiani et al., 2011). Stakeholders may ask for information on the conditions under products or services that have been produced in the supply chains (Phillips and Caldwell, 2005). Not surprisingly, the fight to save the planet has turned into a battle between governments and companies, between companies and consumer activists, and between companies and suppliers (Nidumolu et al., 2015). Stakeholders seek an overriding issue and consequence about sustainability across companies because there are more data to work with social and environmental issues to prevent risks. For example, Facebook Inc had the scandal of leaking personal information up to 87 million user accounts due to its operational management which caused its share down 16 per cent and stock has lost almost 100 billion of dollar in market value (Reuters, 2018). Other prominent examples include Nike and child labor, Apple and sweatshop labor, or Mattel and toxic materials usage that also made companies lost million US dollar. It reflected that stakeholders are really the great challenges on business as well as supply chains for sustainability.

Figure 2.2.1 shows some potential key stakeholders that impact sustainability.

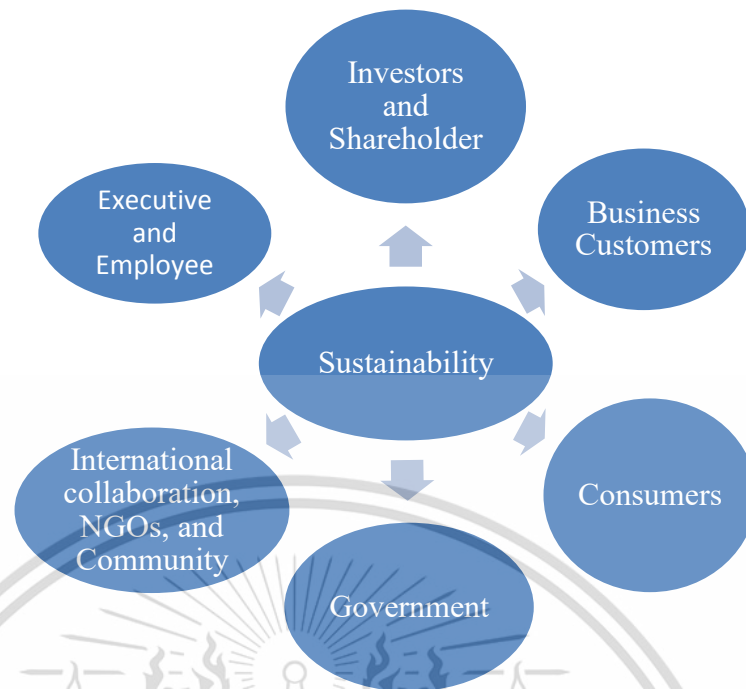


Figure 2.2.1 Potential Stakeholders on Sustainability

Source: GRI Website, Retrieved <https://g4.globalreporting.org/introduction/glossary/Pages/default.aspx#Scope>

A. Government

Government is the primary influence to companies' sustainability practices. Regulatory standards are the pressure from government makes environmental practices more important (Palmer et al., 1995; Tilt, 1994). Weak government is a major problem to unsuitable policies, anti-corruption enforcement, labor and social policies. Furthermore, environmental law is also main impact to companies' sustainability. Yet some enforcement is sometimes weak, with the result that there is a little incentive for companies comply with those policies or laws. Thus, government participate with Public Private Partnership (PPP) for discussing about its proposed policies and reactions from related companies or feedbacks during market sounding seminars. Recently, few emerging market governments are introducing environmental charge, carbon tax scheme, and other instrument for social and environment protection (IFC,

2002). It is good sign for Thailand to adopt carbon tax scheme not only vehicles, but also business operations.

B. Investors and Shareholder

There are variety group of private, financial institution investors, and shareholders that are very influential to sustainability. Many studies have proven that companies' sustainability activities and financial performance link to investment decision (Wen, 2009). Sustainability offers value to investment analysts and investors because sustainability initiatives are useful to manage intangible assets such as brand and reputation as well as sustainability risks and opportunities (Mays et al., 2003). Thus, it can be expected to use lending policies to move companies towards more sustainable behavior.

C. Business Customers (Business Alliances)

Through supply chain management, business customers take part in an important influence to improve social and environmental compliances. Many companies especially in developed economies are under pressure of NGOs and consumers over its sustainable performance which is pertinent base on their suppliers. For example, Nike has responded to the pressure of International Labor Organization (ILO) to improve condition of labor by strengthen strategic with key suppliers from factories (Distelhorst, 2016). For environmental scandal, the world's most popular companies (PepsiCo, Unilever and Nestlé) were accused of illegal of logging rainforest in Indonesia by its palm oil production sourcing (Neslen, 2017).

D. Consumers

Consumers are also the main key stakeholder to be green. While consumers put price and quality as priority, sustainability is also particularly considered in demands. Based on survey of Unilever, 33 per cent of consumer are choosing to buy brand of

products by considering sustainable impacts (Unilever, 2017). Similarly, the Nielsen Global survey of corporate social responsibility and sustainability showed that 66% of global respondents say they're willing to pay more for products and services that come from companies that are committed to positive social and environmental impacts, up from 55% in 2014, and 50% in 2013 (Nielsen, 2015). However, the study of green consumption behavior and perspective of consumer about green products in Chiang Mai, Thailand showed that 33.56% of respondent are conventional and only 9.23 % of lifestyle of health and sustainability group (Leerattanakorn, 2015).

E. International Collaboration, NGO's, and Community

International collaboration, Non-Government Organizations (NGOs), and community are the primary initiative to collaborate with the companies to achieve the sustainability. The expectations of these group are to ensure safe operations through impact management, address environmental impact on communities, and join community building activities for quality of life and education. Those groups have created frameworks and platforms for the companies to practice sustainability properly. For example, Global Reporting Initiative (GRI) has established standards of the best practice for reporting sustainability performance.

F. Executive and Employee

Human resource has a key role to help company achieve its sustainability objectives. In order to plan and develop sustainability and sustainable strategies it is necessary for people to express themselves internally and externally by using appropriate modes of communications (Genç, 2017). Employee involvement is a critical key factor for sustainable performance internally, which leverage employee commitment and engagement in company's sustainable strategies (Young, 2013).

2.2.2 Making Value Chain Sustainable

Once companies have learned to keep pace with regulation, they become more proactive about environmental issues. Then, they may focus on reducing the consumption of non-renewable resources such as coal, petroleum, and natural gas and replace by renewable resources. In this spirit, companies operate to be more efficient that extend from manufacturing facilities and offices to the value chains. Consideration of the end-to-end value chain is an importance to embrace more holistic thinking from upstream to downstream emissions as shown in **Figure 2.2.2**. Companies develop sustainable operations by analyzing each link in the value chain and evaluating where is great impact of emissions or where have opportunities to reduce it. Tools such as enterprise carbon management, carbon and energy footprint analysis, and life-cycle assessment help companies identify the sources of waste in supply chains (Nidumolu et al., 2015). Life-cycle assessment is particularly useful which captures the environment related inputs and outputs of entire value chains, from raw materials supply through product use to returns in closed-loop supply chains (Fiksel, 2010).

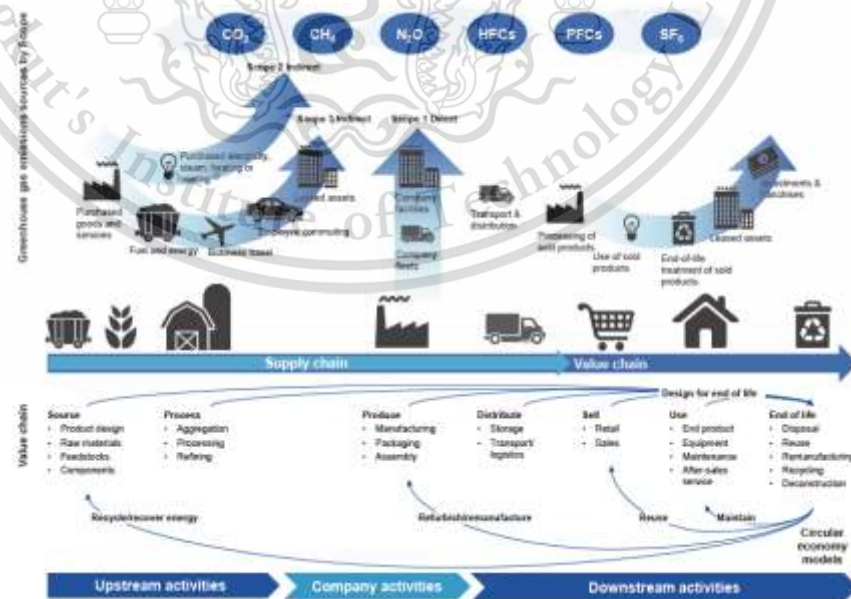


Figure 2.2.2 Overview of Activities and Emissions in the Value Chain

Source: World Economic Forum (2016), Scaling Up Climate Action through Value Chain Mobilization, http://www3.weforum.org/docs/WEF_2016_Scaling_Up_Climate_Action.pdf

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Furthermore, the ability of a company to create value for itself is linked to the value, which it creates for others. Chumpitaz and Paparoidamis (2007) confirmed the effects of the business activities and outputs on customer satisfaction, suppliers' willingness to trade with the companies, and the terms and conditions upon which they do. Thus, the initiatives that business partners agree to undertake with the companies, the companies' reputation, conditions imposed on the companies' code of conducts, and the imposition of supply chain conditions or legal requirements to create the value chains in sustainability.

2.2.3 Sustainability as National Development

Many companies are aligning their sustainability efforts with, or are encouraged by, national development plans. The companies initially set their sustainability strategies usually from the laws or national policies (Nidumolu et al., 2015). For example, Singapore government has made strides to increase the number of green buildings (Siva et al., 2017), while China's latest Five-Year Plan has led to business innovations in the area of renewable energy (Dent, 2015). Moreover, it should be noted that sustainability has long been a part of Thailand's society. For decades, His Majesty King Bhumibol Adulyadej's Sufficiency Economy Philosophy (SEP), which has contributed to the country's development. Thus, Thailand has officially reaffirmed its commitment to sustainability a number of times including in its 20-year National Strategy and its 12th National Economic and Social Development Plan 2017- 2021 (UNDP, 2017). For example, as a global seafood leader, Thai Union has a responsibility to set the standard for social, environmental and economic performance across its operations and into its supply chains. Thai Union is a member of the United Nations (UN) Global Compact and has been working to implement the commitments in the Global Compact's Ten Principles since 2013. All of the principles have been

incorporated into business ethics, anti-corruption, labor code of conduct, and environmental protection which governs not only how own staff operate but also its supply chain to operate (Thai Union, 2016). In this way, companies are extending its influence and using business as a powerful force for change.

2.2.4 Integration of Sustainability into Business

As all of the functions of a firm integrated with organizational strategy, the sustainability strategy is generally a part of it. The public is increasingly looking to the private sector to address problems such as dwindling resources, climate change and inequality, thus it essential for firms to integrate environmental issue into strategic planning process. This is a necessity to determine how to respond those environmental issues and reaction of stakeholders. This lack of an integrated approach limits the impact of a company's sustainability efforts, its ability to resiliently thrive in the future and its opportunities to address today's most urgent problems (SustainAbility, 2015). Banerjee (2002) presented that researchers had modified models of organizational strategy in an attempt to integrate environmental issues mentioning that firms that are more proactive towards environmental issues will be more sustainable in the long-term. Sustainability as a strategic issue implies the degree of integration of environmental concern into the strategic management process or organizational strategy. Figure 2.2.4 illustrates the embedding as incorporating sustainability into the business strategy such that the business model creates social and environmental value in addition to financial value (SustainAbility, 2015).



Figure 2.2.4 Integration Model of Sustainability Business

Source: SustainAbility (2015)

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2.3 Greenhouse Gases Emissions and Financial Performance

2.3.1 Linking Environmental Performance to Financial Performance

A number of literature reviews on the relationship between EP and FP have inconclusive results (Albertini, 2013; Dixon et al., 2012; Horváthová, 2010; Mazzi et al., 2016; Molina-Azorín et al., 2009). The vast majority of empirical analyses examining the relationship between EP and FP use linear models that result in either a positive, negative, or neutral (i.e. empirically insignificant) relationship (Trumpf and Guenther, 2017). The results of researches on environmental–financial performance are still inconclusive. Horváthová (2010) performed a meta-analysis of 64 outcomes from 37 empirical studies proposed a summary of the main reasons for the inconclusive results: the firm, size, country location, environmental criteria, and time coverage of the analyses were considerable factors that influenced the variation in empirical evidence. This study suggested that the likelihood of finding a negative link between EP and FP significantly increases when using the correlation coefficients and portfolio studies. The results also suggested that appropriate time coverage is important in order to establish a positive link between EP and FP.

Similarly, Mazzi et al. (2016) discussed about relationship of EP and FP at the firm level. The results of this research confirmed the relevance of this topic in different disciplines that have been increased recently. Moreover, there is substantial commitment among the authors to demonstrate the existence of a relationship between the EP and the BP of companies in different countries and across industrial sectors. However, in some studies, this relationship is not verified for all of the environmental or economic variables considered. Thus, some relationships between EP-FP were shown as the **Table 2.3.1** below:

Table 2.3.1 The Finding of Relationship between EP and FP

Authors	Relationship between EP-FP
Santis et al. (2016)	No evidence of economic and financial performance differences between companies from each of the studied indices.
Muhammad et al. (2015)	Strong positive association between environmental performance and financial performance during the pre-financial crisis period, and no relationship during financial crisis.
Skare and Golja (2012)	Firms in DJSI World showed a much better financial performance than corporations with different profiles (non DJSI), confirming a positive relationship between financial and sustainable performance.
Horváthová (2012)	Effect of environmental performance on financial performance is negative for environmental performance lagged by 1-year lag, it becomes positive for 2-year lag.
Iwata and Okada (2011)	Waste emission does not generally have signification effects on financial performance. GHGs reduction lead to an increase in financial performance in the whole sample and clean industries
Horváthová (2010)	Likelihood a negative link between EP & FP Portfolio studies tend to report a negative link between EP &FP. The positive link is found more frequently in common law countries than in civil law countries.
Elsayed and Paton (2005)	EP has a neutral impact on firm performance.

2.3.2 GHGs Emissions as Environmental Performance

Relationship between GHGs emissions and FP is much more complicated and different outcomes. There are many reasons that causes the studies not consensus. They used different company sizes, industry classifications, countries, and EP/FP variables to analyze (Mazzi et al., 2016). EP requires a specific measurement approach. EP has

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three main categories, namely environmental impacts, regulatory compliances, and organization processes (Delmas and Nairn-Birch, 2010). First, environmental impacts refer to the effects of the firm's activities and products on the natural environment by consumption of resources or generation of waste and emissions (Klassen and Whybark, 1999). Second, regulatory compliance is also the concern to EP that most of the common law countries have better EP (Horváthová, 2010). It can reduce liability costs, avoid fines, and allow the firms anticipate future regulation such as carbon tax (Ambec and Lanoie, 2008). Regulatory standards are the pressure from government and stakeholders that makes environmental practices more important (Palmer et al., 1995; Tilt, 1994). Third, organization processes are the strategic of EP that describes environmental management system, environmental policies, and the amount of environmental expenditures spent of company (Guenther and Hoppe, 2014).

Among these main categories, many studies focused on environmental impacts of GHGs emissions on FP (Fujii et al., 2013; Horváthová, 2012; Iwata and Okada, 2011; Sánchez-Medina et al., 2015; Vincent et al., 2009; Wagner, 2005; Wang et al., 2014). There are various assumptions and measurement models of GHGs emissions. However, disclosure of GHGs emissions that is based on the requirements of World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD), which is more well recognized. This protocol serves as the foundation of every GHGs standards and frameworks. For example, GRI 305 sets out standard requirements to report emissions, which are based on this protocol. In operational boundaries, the GHG Protocol classified direct and indirect into three scopes of GHGs emissions: Scope 1, Scope 2, and Scope 3 as illustrated in Figure 2.3.1. Scope 1 covers the direct emissions from owned or controlled organizational operations. Scope 2 covers the indirect emissions from buying electricity, heat and cooling to use in

organization. Basically, Scope 3 covers other emissions in supply chains where GHGs emissions occur outside organization. However, Scope 3 is optional disclosure and difficult to provide generic guidance (WBCSD & WRI, 2004).

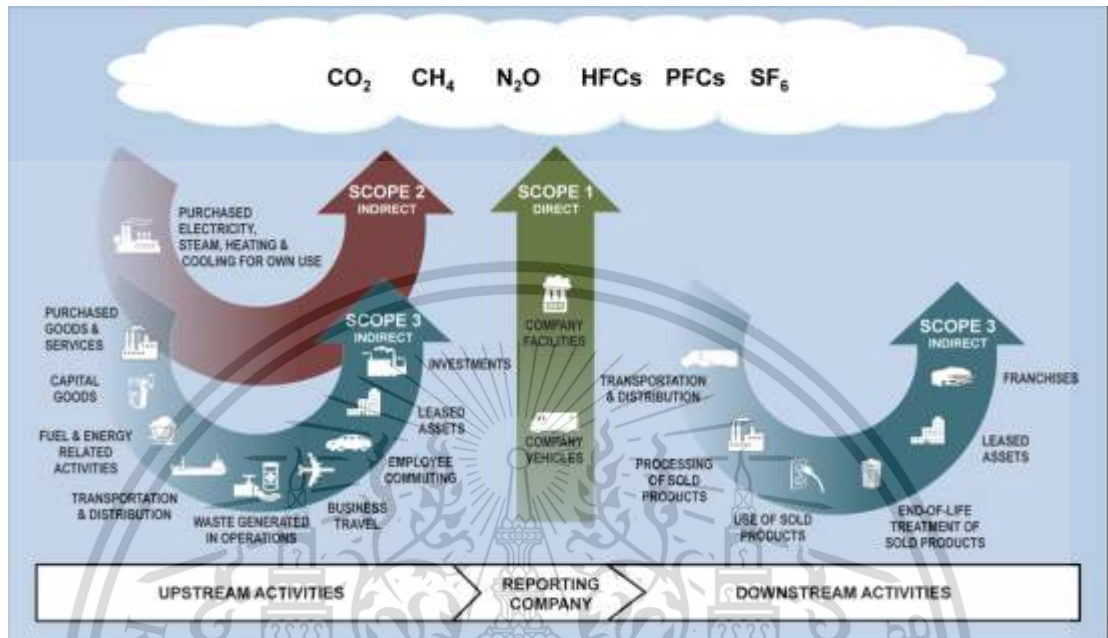


Figure 2.3.1 Boundary Sources of GHGs Emissions

Source: The greenhouse gas protocol. A corporate accounting and reporting standard
http://www.wri.org/sites/default/files/pdf/ghgp_corporate_value_chain_scope_3_standard.pdf

The importance of using GHGs emissions for examining relationship has some purposes. First, GHGs emissions are the main contribution of climate change (IPCC, 2014). The governments of 195 nations agreed to limit global warming to less than 2°C above pre-industrial levels in the 21st Conference of the Parties (COP21) in Paris 2015 that respond to commitment to achieve a green low-carbon economy by 2020 (UNFCCC, 2015). Thailand has committed to reduce its GHGs emissions by 20 per cent from the projected Business-As-Usual (BAU) level by 2030 (ONEP, 2015). Moreover, GHGs emissions are unique challenges to all organizations in the global context of climate change (Howard-Grenville et al., 2014). Second, GHGs emissions reduction could reduce production cost and increase energy efficiency (Ambec and

Lanoie, 2008; Fujii et al., 2013). It also provides companies the ability to identify and eliminate waste in operation, which can reduce electricity consumption by 5-25% per million dollars of revenue (Vasan et al., 2014).

GHGs emissions have a negative impact on firm value. Therefore, reducing emissions creates positive impacts on financial performance (Misani and Pogutz, 2015). Higher GHGs emissions have a positive impact on Return on Asset (ROA) but a negative impact on Tobin's Q (Delmas and Nairn-Birch, 2010). Thus, GHGs emissions are importance to examine level of emissions and determine how it impacts on FP (Busch and Hoffmann, 2011). However, these studies examined the GHGs emissions of mixed international companies and countries, which ignored the nature of GHGs emissions to FP in firm-level by fit one line across the whole sample (Wang et al., 2014).

2.3.3 Financial Performance (FP)

Financial performance illustrates how companies are profitability or loss in operations. Generally, FP is classified into three categories: market-based (investor returns), accounting-based (accounting returns), and organizational measured indicator (Albertini, 2013). Market-based indicators had been frequently used in empirical research examining performance effects over time horizons (Richard et al., 2007). They are a price-earnings ratio, price per share, or share price appreciation, book value, and Tobin's Q to underline the improvement of the firm's performance (Orlitzky, 2005). Among these market-based indicators, Tobin q has been employed particularly by manufacturing firms to explain a number of diverse corporate phenomena. These have involved with multi-purposes such as:

- a) cross-sectional differences in investment and diversification decisions
- b) the relationship between managerial equity ownership and firm value

- c) the relationship between managerial performance and tender offer gains, investment opportunities and tender offer responses
- d) financing, dividend, and compensating policies (Chung and Pruitt, 1994; Wolfe and Sauaia, 2005).

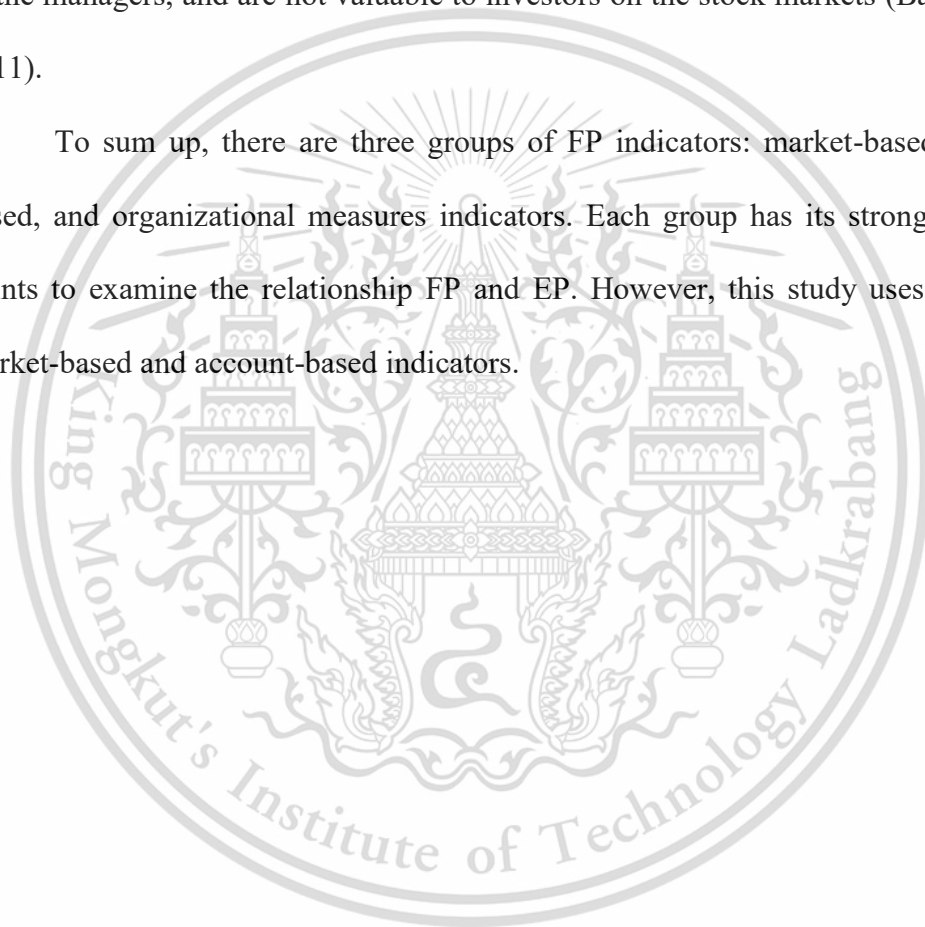
Moreover, Tobin's Q has the advantage of capturing short-term performance and long-term prospects (Allen, 1993; Lubatkin and Shrieves, 1986). Horváthová (2010) also confirmed that Tobin's q is the variable, mostly used in measuring the market-based financial performance of a firm. Tobin's q is a forward-looking indicator of firm performance popularized by economists because it represents investors' expectation about risk-adjusted future cash flow of the firm (Morgan and Rego, 2009).

On other hand, Accounting-based indicators often used such as earnings per share (EPS), Return on Equity (ROE), and Return on Assets (ROA), Return on Sales (ROS), and Return on Investment (ROI) to measure the financial performance of the firm. ROA and ROE are generally accepted standard measures of financial performance that found in research on business strategy (Iwata and Okada, 2011). They reflect internal business strategies that are decision making capabilities and managerial performance rather than external market responses to organizational actions (Albertini, 2013; Cochran and Wood, 1984).

Furthermore, organizational processes measured indicators are more complicated than other indicators: accounting-based or market-based. These indicators used many forms such as cost advantage generated by pollution control equipment, or differentiation advantage due to green product sales or due to a firm's good environmental reputation to measure financial performance (Christmann, 2000). Green product innovation and environmental process innovation are considered to be good proxies for the evaluation of competitive advantage in natural resource-based view

research (Judge & Douglas, 1998). Hart (1995) also stated that pollution prevention and product stewardship of green products are the source of competitive advantage. These competitive advantages are outcomes of strengths built up through environmental strategies. These strengths are generally described as organizational capabilities based on tacit learning that is difficult for competitors to imitate (Albertini, 2013). Thus, the organizational measured indicators are intangible in nature, rely on the tacit knowledge of the managers, and are not valuable to investors on the stock markets (Barney et al., 2011).

To sum up, there are three groups of FP indicators: market-based, account-based, and organizational measures indicators. Each group has its strong and weak points to examine the relationship FP and EP. However, this study uses mix some market-based and account-based indicators.



CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

There are many studies that have been examined the relationship between EP and FP. However, there are three main approaches that most of studies have determined such as: portfolio analysis, event studies, and long-term studies using regression analysis (Ambec and Lanoie, 2008).

3.1.1 Portfolio Analysis

Portfolio analysis is determined how SRI fund is differentiated from other funds in term of investment decision. The relationship between FP and EP usually used indicators such as Jensen's alpha & Sharpe and Treynor ratios (Bauer et al., 2005). Ambec and Lanoie (2008) found that portfolio analysis has some weak points. This approach used average performance effect to compare FP. It is hardly separated these management effects from social or environmental performance effects and other influences like management of fund, capitalization.

3.1.2 Event Study

Event study is the assumption of capital market performance, which get influences from the events that lead to impact on FP (Fama and et al., 1969). Most of the event studies are about negative news such scandal of environmental illegal, social issues such as human rights. However, this study is coincidental accident, which does not reflect the main strategy of the companies to achieve sustainability.

3.1.3 Regression for Long-term Studies

Regression analysis long-term studies are the most popular to examine the relationship between FP and EP. Regression analysis is the study of how a response

variable depends on one or more predictors (Cook, 2001; Weisberg, 2001). Moreover, it can evaluate the effects for long term of performance (Horváthová, 2012). In contrast to other approaches above, long-term studies using regression cover all measured performances (i.e., Tobin's Q, ROE, ROA, input and output of EP, ...etc.). Therefore, this study used regression analysis approach to determine relationship between GHGs as EP and FP.

3.2 Scope and Data Collection

The study examined a total of 30 companies that are listed in both DJSI and THSI (hereafter referred to as 'SD Index') using the data from 2014 to 2016. The studied companies encompass 8 industries, categorized by SET including resources/energy & utilities (11), agro & food industry (3), financials (3), industrials (3), property & construction (2), services (4), technology (3) and consumer products (1) that disclosed EP data. However, this industry classification does not meet international criteria yet. Thus, Global Industry Classification Standard (GICS), developed by Standard & Poor's (S&P) and Morgan Stanley Capital International (MSCI), is more precisely distinct and better supported by validity tests to analyze financial than other industry classifications (Hrazdil and Zhang, 2012). Based on GICS, companies in this study are divided into ten industries: consumer discretionary, consumer staples, energy, financials, industrials, information technology, materials, real estate, telecom services, and utilities. In practice, those companies disclosed GHGs emissions in their Sustainability (SD) reports or Corporate Social Responsibility (CSR) reports follow the guideline of GRI, while annual reports and form 56-1 provided the financial data.

As presented previously about FP, three financial parameters were used to represent in this study, included ROA, ROE, and Tobin's Q. ROA reflects the ability utilization of its total assets to produce profits for shareholders, creditors, and investors (Carton, 2007). ROE is used by investors to measure amount of return from their investment and Tobin's Q is used in measuring market-based financial indicator to examine the behavior of various stakeholders (Horváthová, 2012; Iwata and Okada, 2011; King and Lenox, 2001; Uotila et al., 2009; Wang et al., 2014). Tobin's Q is a ratio of the market value of a firm's assets to the replacement value of its assets. Tobin's Q is also a comparison of the marginal efficiency of capital and the required rate of return of capital. Tobin's Q is a performance measurement in terms of investment opportunity. Tobin's Q of less than 1 denotes that the market value of the firm's assets exceeds the replacement cost. In other words, the marginal efficiency of capital is greater than the required rate of return of capital. This also implies that investors are willing to pay a premium over the firm's assets, as the current management is expected to perform well in the future (Benjamas and Panya, 2015). The higher Tobin's Q is, the more preferable the stock is. In this case, the stock would likely gain the long-run and vice versa.

3.3 Data Analysis Method

In order to establish a solid foundation to test whether the GHGs emission variable is statistically significant, this study runs the regression for two cases. Firstly, the significance of GHGs emissions is tested without including the industry dummy variable to examine effects in general of Thai listed companies. Secondly, the industry dummy variable is included to the model to investigate if there is still any significant contribution from the GHGs emissions. Following two regression models are adopted

to analyze impacts of GHGs emissions on FP, which are evaluated using two pooled models based on Ordinary Least Squares (OLS) regression models below by R program:

$$\text{Model 1} \quad FP_{i,t} = \alpha_i + \beta_n GHG_{i,t} + \beta_p \omega_{i,t} + \varepsilon_{i,t} \quad (3.1)$$

$$\text{Model 2} \quad FP_{i,t} = \alpha_i + \beta_p \omega_{i,t} + \beta_n GHG_{i,t} + \beta_q IND X_{i,t} + \varepsilon_{i,t} \quad (3.2)$$

Where:

- $\omega_{i,t}$ are the control variables (Size is measured by the natural logarithm of total sales revenue in million Baht, Capital structure (D2E), and Dividend Yield (DY), and growth (Growth)).
- GHGs emissions are natural logarithm total emissions in scope 1 and 2 in mtCO₂e divide total sales revenue in million baht (MB).
- α_i is constant; β is coefficient; ε is the standard error term; i denote to firm; and t is year.
- $IND X_{i,t}$ is dummy variable of industries (the number of companies in the studied SD index): $IND1_{i,t}$ (Consumer Discretionary), $IND2_{i,t}$ (Consumer Staples), $IND3_{i,t}$ (Energy), $IND4_{i,t}$ (Financials), $IND5_{i,t}$ (Industrials), $IND6_{i,t}$ (Information Technology), $IND7_{i,t}$ (Materials), $IND8_{i,t}$ (Real Estate), $IND9_{i,t}$ (Telecom Services), and $IND10_{i,t}$ (Utilities). $IND1_{i,t}$ is a reference variable of model. It equals 1 if companies are assigned to those industry sectors and zero otherwise.
- $FP_{i,t}$ represents (ROA, ROE, and Tobin's Q)

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Descriptive Statistics

Table 4.1.1 shows the descriptive statistics including number of observation, minimum, maximum, mean, and standard deviation. The first dependent variable is ROA, which the mean value is 9.066 % with standard deviation 6.43%. The minimum of ROA is -3.76% whereas maximum value is 39.95%. This result shows that some companies still have problem with assets management efficiency. Moreover, other of FP is ROE, which the mean value is 16.07% with standard deviation 15.02% that is the huge gap among companies. The maximum value of ROE is 82.32%, while the minimum value is -16.43%. This result shows that even they are sustainable companies, it does not mean that they have better FP because some of them remain in debt from investment. The last FP indicator is Tobin's Q, which has the mean value at 1.759 with standard deviation of 1.022. There is good sign that Tobin's Q has value at minimum 0.71 and 6.93 at maximum. This Tobin's Q shows that investors still get similarly proportion of investment for stock markets. Another possible explanation is that SET has maintained a good performance among stock markets.

On other hand, GHGs emissions have the mean value of $e^{1.817} = 6.158$ mtCO₂e/MB with standard deviation at $e^{2.133} = 8.44$ mtCO₂e/MB. The minimum and maximum are $e^{-2.214} = 0.109$ mtCO₂e/MB and $e^{8.325} = 4125.737$ mtCO₂e/MB, respectively. The gap GHGs emissions are large because difference industrial sectors have unique nature of emissions as illustrated in **Figure 4.1.1**. For example, information technology, telecommunication, financials, and industrials are the lowest emitted sector while energy, materials and utilities have higher GHGs emissions.

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Table 4.1.1 Descriptive Statistics

Variables	Number of obs.	Min	Max	Mean	Std. Deviation
ROA	90	-3.760	39.95	9.066	6.430
ROE	90	-16.430	82.32	16.074	15.022
Tobin's Q	90	0.710	6.93	1.759	1.022
GHGs	90	-2.214	8.325	1.817	2.133
DY	90	0.300	9.190	3.599	1.947
D2E	90	0.386	9.465	2.134	2.314
Size	90	3.278	6.469	5.114	0.823
Growth	90	-29.250	30.43	0.289	12.123

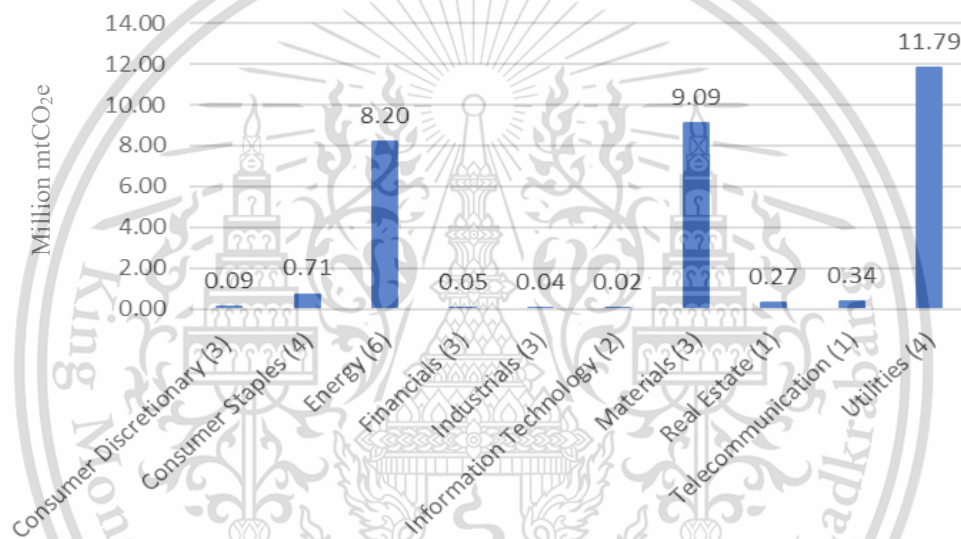


Figure 4.1.1 Average Industry Emissions per Year

4.2 The Impact of GHGs Emission on FP Variable

Table 4.2.1 presents the Pearson's correlation matrix for the regression variables. Each of the variables was tested for its correlation against the others. There is no multicollinearity issue in the models because control variables have correlation less than 0.4. GHGs emissions have positive significant correlation with the size of companies. However, it has a weak negative significant correlation with Tobin's Q and growth. Moreover, it has a negative insignificant correlation with ROA and ROE.

Table 4.2.1 Correlation Coefficients Matrix

	GHGs	ROA	ROE	Tobin's Q	DY	D2E	Size	Growth
ROA	-0.06	1						
ROE	-0.17	0.83***	1					
Tobin's Q	-0.27*	0.70***	0.61***	1				
DY	0.09	0.10	0.10	-0.10	1			
D2E	-0.20	-0.29**	0.21	-0.10	-0.07	1		
Size	0.38**	-0.23*	-0.02	-0.22*	-0.09	0.31**	1	
Growth	-0.23*	-0.21*	0.28**	0.36***	-0.38***	0.21*	-0.25*	1

“***”, “**”, and “*” indicate significant level when $p < 0.001$, $p < 0.05$, and $p < 0.1$, respectively.

Furthermore, the graph correlation between GHGs and FP of industry dummy variables illustrated in **Appendix C**. Based on those graphs, companies in utilities sector have significant negative (-0.58) correlation between ROA and GHGs. The relationship between ROE and GHGs are negative significant impact at (-0.70), (-0.36), and (-0.21) in consumer discretionary, DJSI, and full sample, respectively. Similarly, relationship between TobinQ and GHGs are negative and statistically significant impact at (-0.73), (-0.55), (-0.80), (-0.38), (-0.25) in consumer discretionary, energy, utilities, DJSI, and full sample, respectively. The result indicates that companies in consumer discretionary, energy, utilities, and companies listed in DJSI are sensitive influence with GHGs emissions. The higher emissions caused lower ROE and TobinQ. It reflects influence of shareholders and investors on environmental performance which companies try to reduce their emissions. Whereas, it has positive significant impact at (0.72) in industrial sector. However, the full sample has GHGs a negative significant impact on ROE and TobinQ. This result indicated that Thai listed companies in THSI scheme have better environmental performance.

4.3 Regression Analysis on EP and FP

Table 4.3.1 shows the results of regression analysis (Model 1), which GHGs have positive significant impacts on Tobin's Q at confidence level of 90%. However, GHGs emissions have insignificant relationship with ROA and ROE. The result is in line with what was found in 2,500 largest companies by market capital within the Dow Jones Global Index market (Busch and Hoffmann, 2011). Also, the results this study are not in line with the findings of the study in Japan Nikkei stock exchange (Iwata and Okada, 2011), which found that GHGs emissions have a significant negative effect on ROA and insignificant relation between GHGs and Tobin's Q. However, it found an insignificant relation of GHGs with ROE.

Moreover, the result of this study found a negative significant correlation with Tobin's Q, which shows a decrease in GHGs emissions that may lead to an increase in the intangible value of overall industrial sectors in DJSI and THSI scheme. This finding is opposite to the results of a study in 2014, which found a positive significant correlation between GHGs and Tobin's Q in Australia (Wang et al., 2014).

Table 4.3.1 Results Regression Analysis of Model 1

Variables	ROA		ROE		Tobin's Q	
	Estimate	Std. Error	Estimate	Std. Error	Estimate	Std. Error
LnGHGs	-0.4436	0.391	-0.6849	0.966	-0.1627 **	0.058
Size	-0.1750	0.475	-0.7394	1.162	0.009	0.065
Growth	0.1748**	0.062	0.3659*	0.153	0.0329 ***	0.009
DY	0.7276	0.371	1.7838	0.909	0.0400	0.055
D2E	-1.0770*	0.434	1.0934	1.064	-0.1490**	0.054
Constant	11.4095*	5.479	16.9941	13.400	2.0742 **	0.758
No. of obs.	90		90		90	
R ²	0.2224		0.1665		0.2508	

***, **, and * indicate significant level when $p < 0.001$, $p < 0.05$, and $p < 0.1$, respectively.

Based on results regression analysis of Model 2 in **Table 4.3.2**, show that dummy variables of industry sectors do not contribute any impacts of GHGs on FP.

These results are in line with Galbreath (2006) and Wang et al. (2014), that both studies were conducted in Australia.

Table 4.3.2 Results Regression Analysis of Model 2

Variables	ROA		ROE		Tobin's Q	
	Estimate	Std. Error	Estimate	Std. Error	Estimate	Std. Error
LnGHGs	0.0624	0.354	-0.2498	0.798	-0.0541	0.073
Size	0.1947	0.424	0.0086	0.955	0.1190	0.066
Growth	0.0474	0.046	0.0187	0.103	0.0089	0.007
DY	-0.6296	0.323	-1.3507	0.728	-0.1205 *	0.050
D2E	-0.6070	0.380	2.8936**	0.856	-0.0107	0.059
IND2	-1.3497	1.859	-4.8767	4.181	-0.6039 *	0.397
IND3	-2.5860	2.153	-8.5723	4.843	-0.9414 **	0.407
IND4	-2.9408	3.142	-20.3764**	7.066	-1.2373*	0.343
IND5	3.8487*	1.899	0.4742	4.272	0.5891*	0.676
IND6	7.8786**	2.311	11.9215*	5.199	1.0289**	0.440
IND7	-0.2495	2.206	-1.6159	4.963	-0.8884*	0.473
IND8	0.4006	2.583	0.4438	5.811	0.6367	0.360
IND9	24.8709 ***	3.227	59.3714 ***	7.258	2.7996 ***	0.437
IND10	1.1032	2.232	-0.3106	5.021	-0.3146	0.580
Constant	9.4264*	9.587	16.5818	10.612	1.2589	0.8110
No. Obs.	90		90		90	
R ²	0.7121		0.7333		0.7222	

“***”, “**”, and “*” indicate significant level when $p < 0.001$, $p < 0.05$, and $p < 0.1$, respectively.

Consumer Discretionary (IND1) is the baseline case for industry dummies.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

This study examines the impact of GHGs emissions on financial performance of Thai listed companies in DJSI and THSI scheme from 2014 to 2016. The study used financial data extracted from annual reports and GHGs emissions data Scope 1 and 2 extracted from sustainability reports.

The study lends support to assumption that relationship between sustainability in context of reduction GHGs and supply chain really exists from end-to-end operations. These findings suggest that sustainability links to stakeholders' values, creating sustainable value chains, complying of national policies and regulations, and integrating into best practices of business model.

Furthermore, the study found negative relationship between GHGs emissions and Tobin's Q. The negative relationship indicates that there is an influence of stakeholders' behaviour to invest in stock markets. In this sense, listed companies have to consider sustainable practices as their priority (e.g., reduction of GHGs emissions in their operations) for setting up the right business strategies to attract the investors. On the other hand, no significant relationship between GHGs emission and the other FP indications (ROA and ROE) was found. The results provide two implications. First, investing in GHGs emission does not clearly provide positive impact on company's FP. In contrast, investing to be green does not significantly consume financial resources from the company neither. The study shows some relationship between industrial classification and GHGs emissions. The results show that consumer discretionary, energy, utilities sector are the main GHGs emitters, which shareholders or investors determine seriously to invest. The more emitted, the lower stock is.

The results of the study also have some implication for the larger picture of Thailand's GHGs reduction effort. Even for the companies listed in SD Index, the relationship between their GHGs emissions and FPs is either negative or unclear. It may be hard for Thai government to convince private firms to spend more GHGs reduction effort in compliance with COP21 without additional regulatory incentives such as carbon tax.

As the regular investors usually base their investment decisions on FP indicators, it is remained questionable whether how environmental performance like GHGs emissions contribute to their decision. This is especially interesting due to the fact that only Tobin's Q is impacted by GHGs emissions as it is found in this study. Therefore, it is recommended that a survey study regarding the investment criteria including environmental performance used by the investors should be done in Thai markets. The results of this recommended survey can be used in conjunction with the findings in this study to draw a more solid conclusion about the importance of sustainability in investor's investment decision.

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APPENDIX A

LIST OF FINANCIAL PERFORMANCE

Table A.1 ROA 2014-2016 of Companies

No.	Company Name	2014	2015	2016
1	Advanced Info Service PCL	39.95	33.18	17.53
2	Airports of Thailand PCL	11.15	15.92	15.55
3	Bangkok Aviation Fuel Services PCL	13.43	16.02	15.33
4	Bangkok Bank PCL	1.68	1.54	1.37
5	Banpu PCL	5.34	3.09	4.30
6	Better World Green PCL	11.2	13.46	11.14
7	Central Pattana PCL	11.39	10.37	11.24
8	CPALL PCL	6.84	7.77	8.39
9	Charoen Pokphand Foods PCL	6.85	6.51	7.15
10	CSL PCL	-1.59	22.05	21.2
11	Delta Electronic (Thailand) PCL	16.29	17.17	12.75
	Eastern Water Resources			
12	Development and Management PCL	12.5	11.99	8.94
13	Electricity Generating PCL	7.81	6.87	6.91
14	Glow Energy PCL	12.41	11.8	12.01
15	Home Product Center PCL	39.95	10.87	11.34

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Table A.2 ROA 2014-2016 of Companies (Continue)

No.	Company Name	2014	2015	2016
16	Indorama Ventures PCL	3.61	5.96	9.43
17	IRPC PCL	-3.76	8.74	6.81
18	Kasikornbank PCL	2.69	2.20	2.07
19	Minor International	9.01	10.41	9.25
20	PTT PCL	7.02	4.33	8.36
21	PTT Exploration & Production PCL	8.87	-0.83	4.37
22	PTT Global Chemical PCL	4.68	7.14	8.60
23	Ratchaburi Electricity Generating Holding PCL	9.64	6.15	8.82
24	S & J International Enterprises PCL	5.36	5.63	7.10
25	Siam Cement PCL	10.86	14.12	15.49
26	Siam Commercial Bank PCL	2.55	2.15	2.08
27	Somboon Advance Technology PCL	8.77	8.23	7.75
28	Thai Oil PCL	-0.33	9.11	13.34
29	Thai Union Group PCL	7.58	7.79	6.42
30	The Bangchak Petroleum PCL	2.3	8.04	7.51

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Table A.2 ROE 2014-2016 of Companies

No.	Company Name	2014	2015	2016
1	Advanced Info Service PCL	77.91	82.32	67.44
2	Airports of Thailand PCL	12.96	18.22	17.03
3	Bangkok Aviation Fuel Services PCL	15.58	18.45	19.14
4	Bangkok Bank PCL	11.73	9.98	8.59
5	Banpu PCL	3.79	-2.34	2.36
6	Better World Green PCL	12.9	15.58	13.17
7	Central Pattana PCL	18.93	18.12	18.87
8	CPALL PCL	34.09	40.16	36.04
9	Charoen Pokphand Foods PCL	9.29	9.46	11.76
10	CSL PCL	-16.4	49.67	44.66
11	Delta Electronic (Thailand) PCL Eastern Water Resources	22.53	23.09	17.67
12	Development and Management PCL	16.29	17.83	13.58
13	Electricity Generating PCL	10.76	5.74	10.45
14	Glow Energy PCL	21.28	17.8	18.36
15	Home Product Center PCL	23.32	21.46	23.99

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Table A.2 ROE 2014-2016 of Companies (Continue)

No.	Company Name	2014	2015	2016
16	Indorama Ventures PCL	2.22	8.62	19.18
17	IRPC PCL	-7.31	13.09	12.41
18	Kasikornbank PCL	19.38	14.54	13.23
19	Minor International	16.56	23.14	18.77
20	PTT PCL	8.08	2.86	12.96
21	PTT Exploration & Production PCL	5.38	-7.68	3.15
22	PTT Global Chemical PCL	6.29	8.71	10.72
23	Ratchaburi Electricity Generating Holding PCL	10.87	5.27	10.07
24	S & J International Enterprises PCL	7.17	7.91	9.24
25	Siam Cement PCL	19.83	23.68	25.14
26	Siam Commercial Bank PCL	20.07	15.92	14.84
27	Somboon Advance Technology PCL	12.88	11.94	10.64
28	Thai Oil PCL	-4.64	13.92	21.3
29	Thai Union Group PCL	12.24	11.86	11.8
30	The Bangchak Petroleum PCL	2.09	12.07	12.73

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Table A.3 Tobin's Q 2014-2016 of Companies

No.	Company Name	2014	2015	2016
1	Advanced Info Service PCL	6.93	3.80	2.93
2	Airports of Thailand PCL	2.99	3.48	0.64
3	Bangkok Aviation Fuel Services PCL	2.81	2.56	2.69
4	Bangkok Bank PCL	1.05	0.99	0.99
5	Banpu PCL	0.92	0.83	1.01
6	Better World Green PCL	2.00	1.63	2.07
7	Central Pattana PCL	3.02	2.78	2.95
8	CPALL PCL	2.19	1.95	2.51
9	Charoen Pokphand Foods PCL	1.19	1.01	1.15
10	CSL PCL	2.85	2.60	2.48
11	Delta Electronic (Thailand) PCL	2.63	2.65	2.58
	Eastern Water Resources	1.72	1.69	1.49
12	Development and Management PCL			
13	Electricity Generating PCL	1.20	1.07	1.16
14	Glow Energy PCL	1.62	1.43	1.49
15	Home Product Center PCL	3.42	2.62	3.41

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Table A.3 Tobin's Q 2014-2016 of Companies (Continue)

No.	Company Name	2014	2015	2016
16	Indorama Ventures PCL	1.13	1.16	1.37
17	IRPC PCL	0.97	1.07	1.13
18	Kasikornbank PCL	1.14	1.05	1.08
19	Minor International	2.60	2.58	2.21
20	PTT PCL	1.03	0.90	0.96
21	PTT Exploration & Production PCL	1.08	0.71	0.94
22	PTT Global Chemical PCL	0.94	0.94	1.11
23	Ratchaburi Electricity Generating Holding PCL	1.30	1.07	1.13
24	S & J International Enterprises PCL	0.88	0.81	0.85
25	Siam Cement PCL	1.86	1.68	1.63
26	Siam Commercial Bank PCL	1.16	1.05	1.09
27	Somboon Advance Technology PCL	1.16	1.13	1.03
28	Thai Oil PCL	0.95	1.19	1.24
29	Thai Union Group PCL	4.47	1.28	1.54
30	The Bangchak Petroleum PCL	1.16	1.15	1.13

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APPENDIX B

LIST OF GHGS EMISSION

Table B.1 GHGs emission 2014-2016 of Companies

No.	Company Name	2014	2015	2016
1	Advanced Info Service PCL	299,524.51	328,936.86	403,714.83
2	Airports of Thailand PCL	142,472.22	148,419.45	217,866.28
3	Bangkok Aviation Fuel Services PCL	4,456.13	4,964.12	5,319.63
4	Bangkok Bank PCL	15,185.73	24,218.90	23,542.14
5	Banpu PCL	5,240,000.00	3,960,000.00	3,456,558.00
6	Better World Green PCL	2,308.69	2,509.82	756.58
7	Central Pattana PCL	383,077.00	205,719.00	213,613.00
8	CPALL PCL	903,379.94	1,021,629.79	1,131,651.73
9	Charoen Pokphand Foods PCL	890,000.00	880,000.00	910,000.00
10	CSL PCL	7,185.03	8,418.79	9,688.84
11	Delta Electronic (Thailand) PCL	38,486.00	40,346.00	41,886.10
12	Eastern Water Resources Development and Management PCL	68,113.00	79,512.00	83,373.00
13	Electricity Generating PCL	19,190,457.86	23,073,651.00	22,582,506.07
14	Glow Energy PCL	13,198,858.24	12,129,356.44	11,580,974.29
15	Home Product Center PCL	90,101.00	92,142.00	86,039.00

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Table B.2 GHGs emission 2014-2016 of Companies (**Continue**)

No.	Company Name	2014	2015	2016
16	Indorama Ventures PCL	3,654,718.00	406,868.00	5,154,586.00
17	IRPC PCL	3,125,000.00	3,293,000.00	3,749,000.00
18	Kasikornbank PCL	95,294.29	100,384.43	99,696.00
19	Minor International	12,056.00	11,993.00	208,681.00
20	PTT PCL	33,504,284.00	32,916,851.00	31,586,190.00
21	PTT Exploration & Production PCL	5,126,229.00	4,890,180.00	4,637,157.00
22	PTT Global Chemical PCL	7,280,000.00	7,030,000.00	7,220,000.00
23	Ratchaburi Electricity Generating Holding PCL	11,936,359.00	13,376,516.00	14,147,604.00
24	S & J International Enterprises PCL	11,131.40	10,689.20	10,513.50
25	Siam Cement PCL	24,740,000.00	2,480,000.00	23,850,000.00
26	Siam Commercial Bank PCL	27,405.00	24,836.00	22,499.00
27	Somboon Advance Technology PCL	97,510.00	105,020.00	102,452.00
28	Thai Oil PCL	2,420,000.00	2,540,000.00	3,650,000.00
29	Thai Union Group PCL	464,673.00	545,690.00	558,734.00
30	The Bangchak Petroleum PCL	933,718.00	1,165,887.00	1,362,539.00

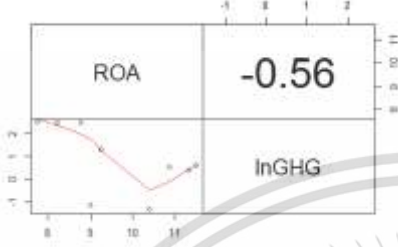

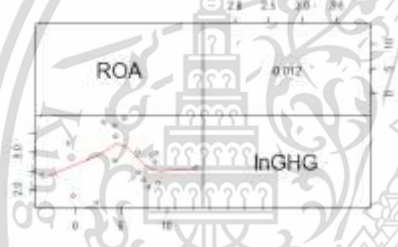
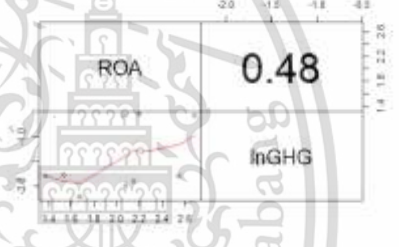
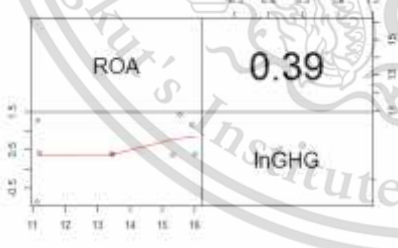
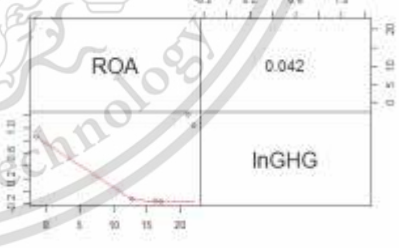
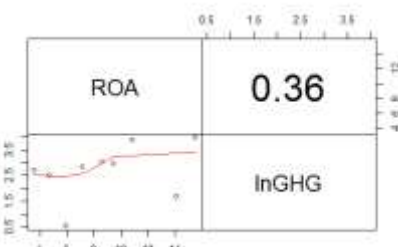

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APPENDIX C

CORRELATION BETWEEN GHG AND FP OF INDUSTRIES

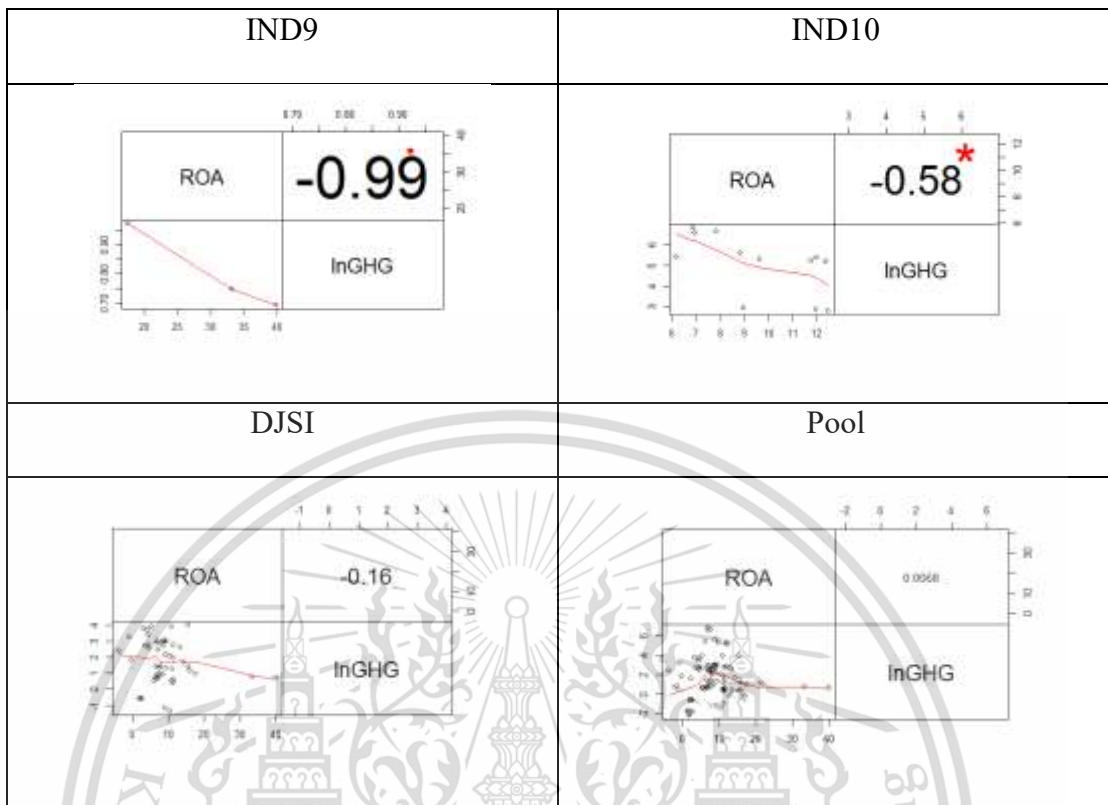
Table C.1 Correlation between GHGs and ROA

IND1	IND2
	
IND3	IND4
	
IND5	IND6
	
IND7	IND8
	

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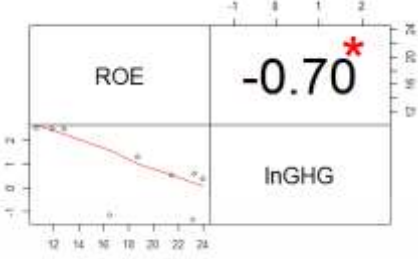
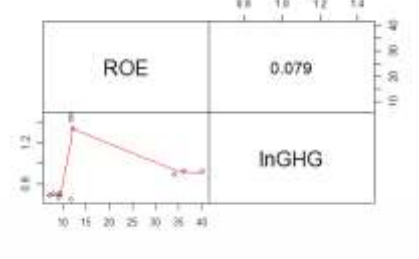
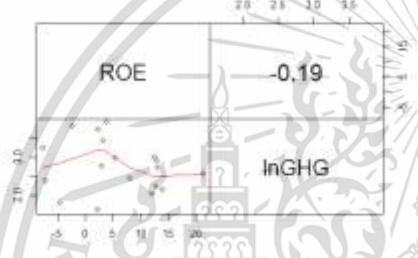
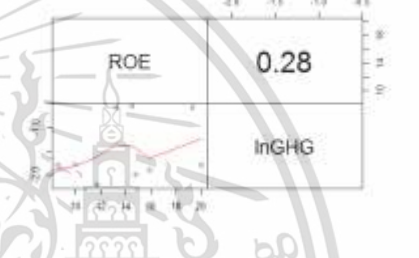

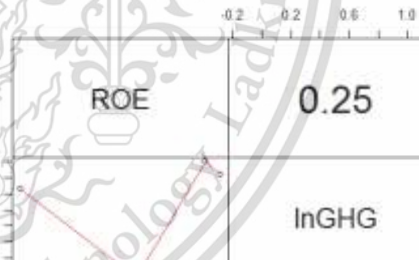
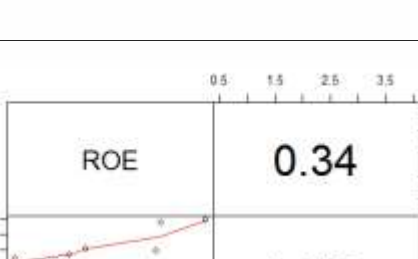
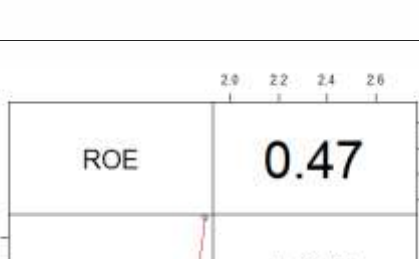
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Table C.1 Correlation between GHGs & ROA (continue)



“***”, “**”, and “*” indicate significant level when $p < 0.001$, $p < 0.05$, and $p < 0.1$, respectively.

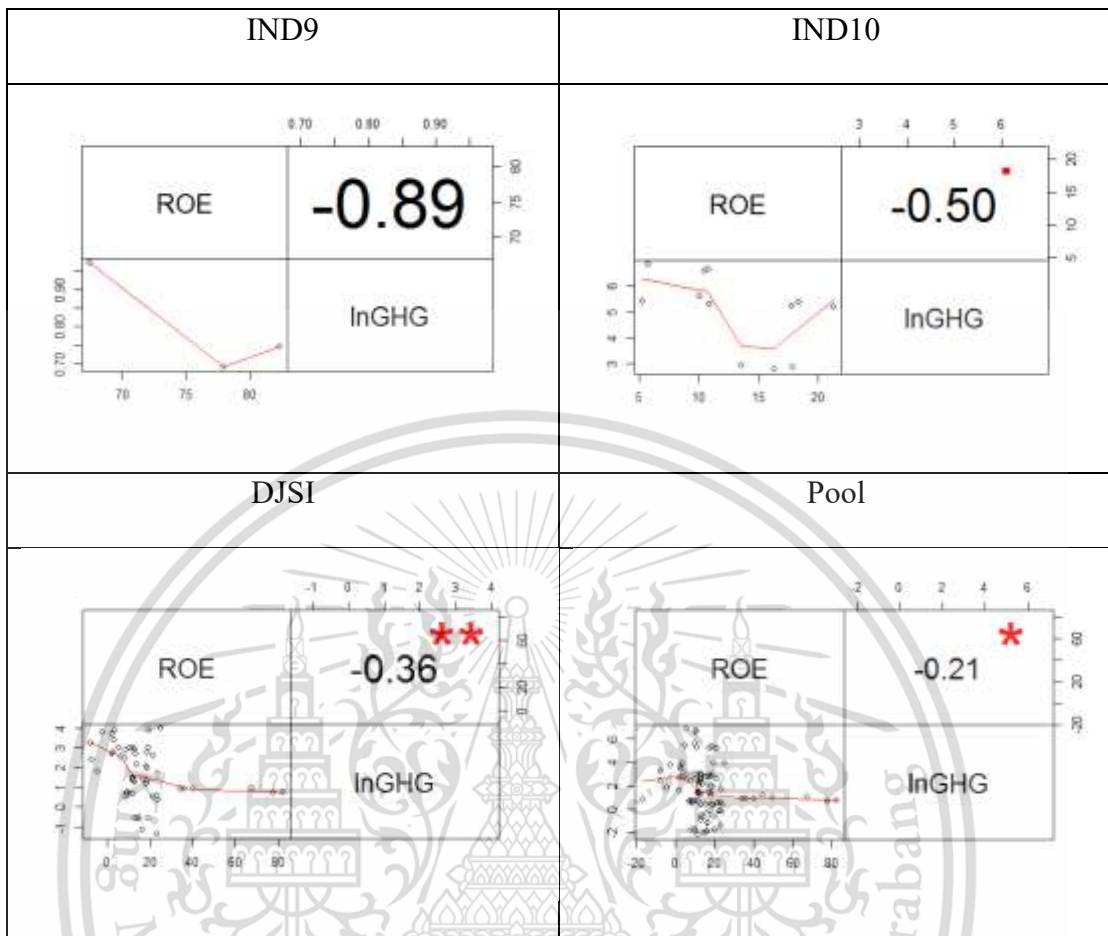
Table C.2 Correlation between GHGs & ROE

IND1	IND2
 <p>ROE</p> <p>-0.70*</p> <p>lnGHG</p>	 <p>ROE</p> <p>0.079</p> <p>lnGHG</p>
IND3	IND4
 <p>ROE</p> <p>-0.19</p> <p>lnGHG</p>	 <p>ROE</p> <p>0.28</p> <p>lnGHG</p>
IND5	IND6
 <p>ROE</p> <p>0.22</p> <p>lnGHG</p>	 <p>ROE</p> <p>0.25</p> <p>lnGHG</p>
IND7	IND8
 <p>ROE</p> <p>0.34</p> <p>lnGHG</p>	 <p>ROE</p> <p>0.47</p> <p>lnGHG</p>

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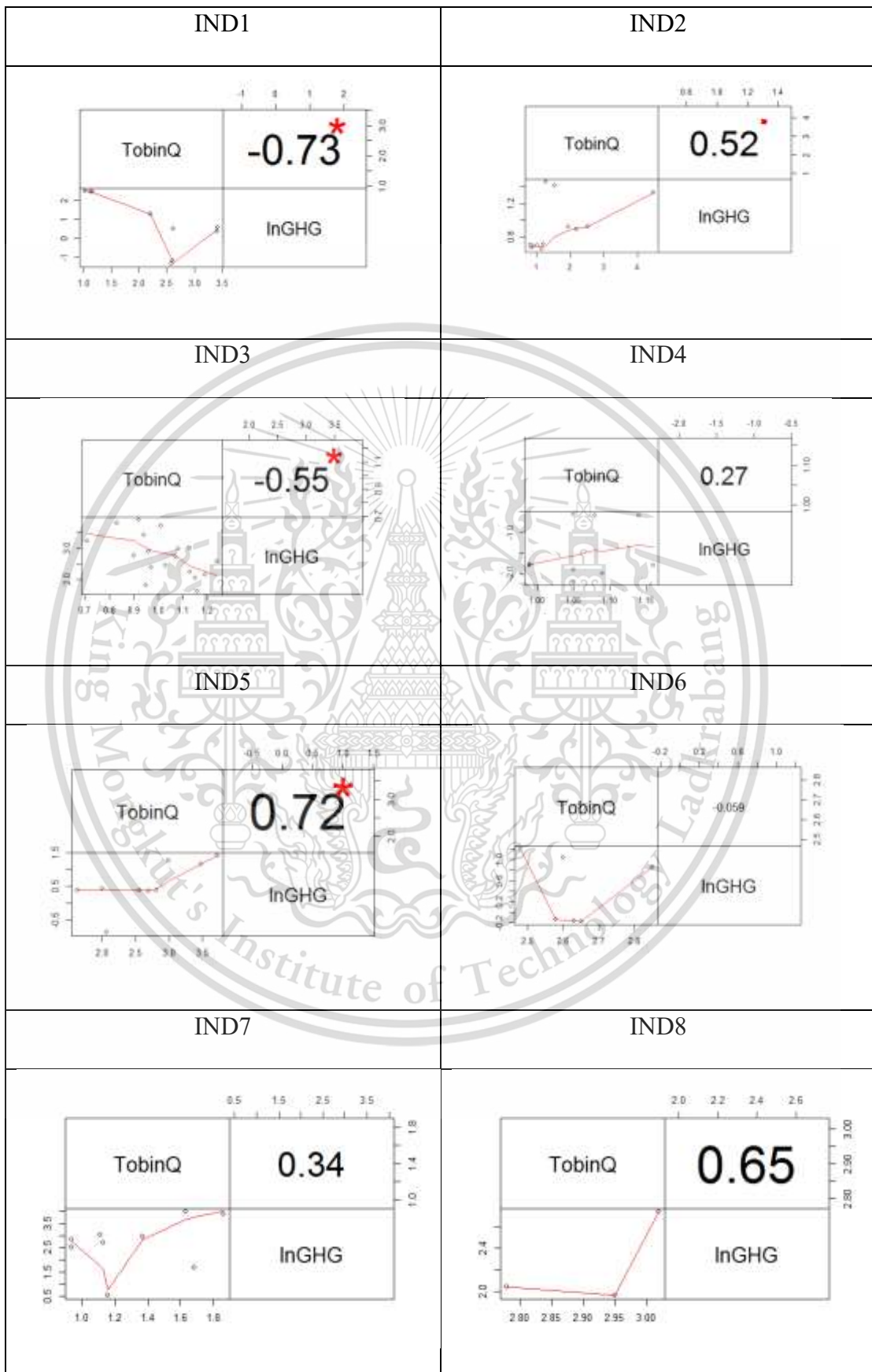
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Table C.2 Correlation between GHGs & ROE (continue)



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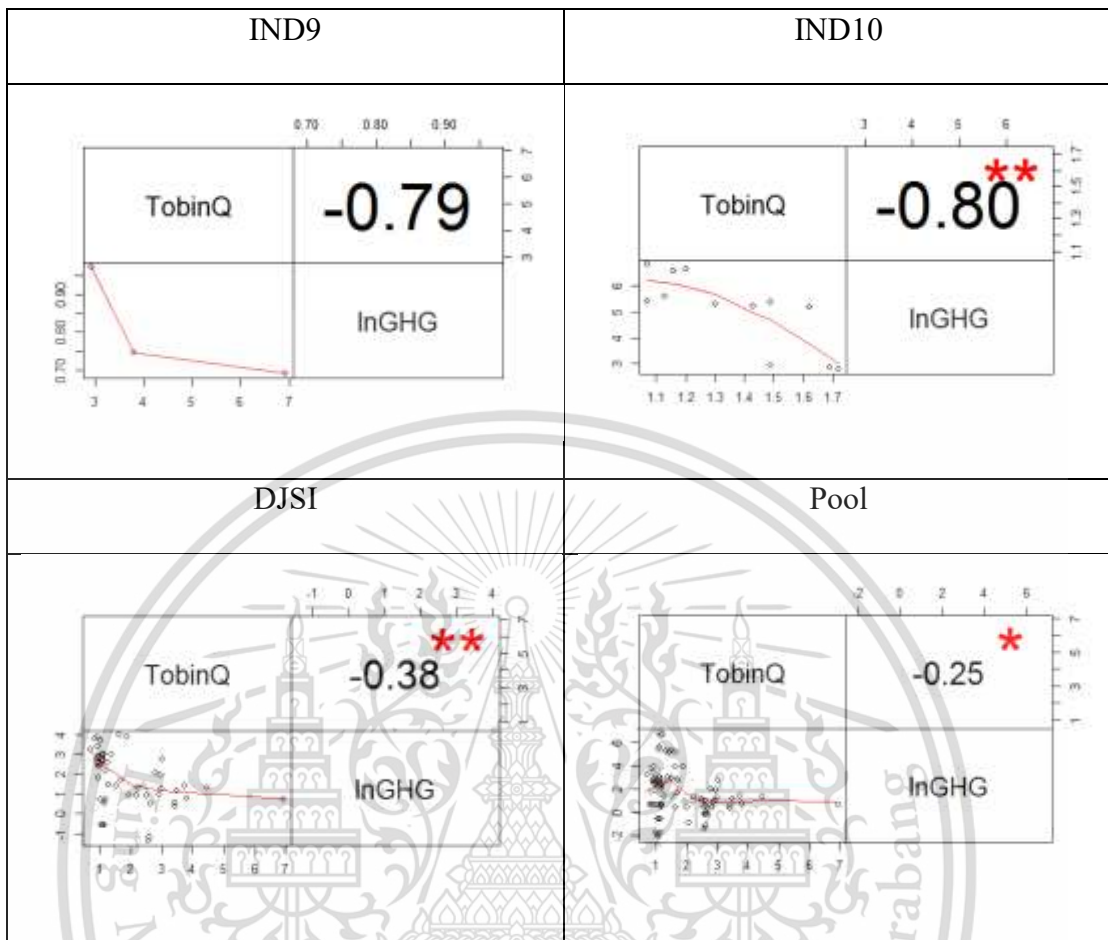
Table C.3 Correlation between GHGs & TobinQ (continue)



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Table C.3 Correlation between TobinQ & GHGs (Continued)



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AUC 2018

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SUSTAINABLE
DEVELOPMENT
GOALS IN ASIA

ABSTRACT BOOKLET

King Mongkut's Institute of Technology Ladkrabang



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"Sustainable Development Goals in Asia"

Abstract Booklet

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Sustainable Development Goals in Asia

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The Impact of Greenhouse Gas Emissions on Financial Performance of Thai Listed Companies for Sustainable Investment

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Abstract

Greenhouse Gas (GHG) emissions are the main contributors to global climate change. In 2015, the 21st session of the Conference of the Parties (COP21) issued the Paris Agreement that all nations rectify to take actions to combat climate change. Under the agreement, Thailand pledged to reduce GHG emissions 20-25% by 2030. Through this agreement, Thai government has promoted sustainable investment to reduce GHG. The Stock Exchange of Thailand (SET) launched Thailand Sustainability Investment (THSI) in 2015. THSI provides a list of companies with leading sustainability performance for investors. THSI assumes that sustainable companies might perform better compared to their peers that are not as sustainable. Thus, this paper examines the impact of GHG emissions on financial performance such as Return on Asset (ROA), Return on Equity (ROE) and Earning per Share (EPS) using multiple regression models and historic data of 31 listed companies in THSI scheme from 2014 to 2016. By testing the statistical significance, the results indicate that GHG emissions have positive significant correlation with EPS in energy, materials and utilities industries, whereas they do not have significant effects on ROA and ROE. It can be explained that investors might invest in companies with higher return of stock. The higher return may come from higher production which may result in higher GHG emissions. Therefore, it can be concluded that impacts of Paris Agreement to reduce GHG emissions might have limitations and challenges to sustainable companies in THSI.

Keywords: Greenhouse Gas Emissions; Financial Performance; Sustainable Investment

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Relationship between Environmental and Financial Performance of Thai Listed Companies for Sustainable Investment

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**Corresponding author's email: 59610055@kmitl.ac.th*

Keywords: Environmental Performance; Financial Performance; Investment; Sustainability.

Introduction

Recently, climate change is one of the most important global issues that gain interests of both public and private sectors including investors in stock markets around the world. In 2015, the 21st Conference of Parties (COP 21) on climate change in Paris issued the Paris Agreement that is aimed to address the need to limit the rise of global temperature. Per this agreement, Thailand pledged to reduce its GHG emissions by 7 - 20% by 2020. Thus, Thai government agencies including Stock Exchange of Thailand (SET) became even more proactive since then. As part of this effort, SET established Thailand Sustainability Investment (THSI) scheme in 2015 as a guideline for investors to choose to invest in sustainable companies. It also encouraged Thai listed companies to issue sustainability reports following the Global Report Initiative (GRI) and try to be listed in global sustainability indexes such as the Dow Jones Sustainability Index (DJSI). So far, fourteen (14) Thai companies are listed in the DJSI; this is the greatest number among all ASEAN countries. Thailand is also ranked 14th among the countries that listed companies disclose their sustainability reports with the average of 50% environmental disclosure (Russell, 2016). However, the relationship between Environmental Performance (EP) and Financial Performance (FP) of these firms remained questionable. In some cases, improving environmental performance may incur some costs even though the effort might provide good reputation to the companies and may attract more investors. Therefore, there is a need for a study to investigate the relationship between EP and FP. The results of the study can be used by the investors to choose to invest in sustainable companies.

Material and Methods

The study examined a total of 28 companies that are listed in both DJSI and THSI using the data from 2013 to 2016. The studied companies encompass 8 industries including resources/energy & utilities (11), agro & food industry (3), financials (4), industrials (3), property & construction (3), services (2), technology (1), and consumer products (1) that disclosed EP data. The data that represents EP includes greenhouse gas emissions (GHGs) and water consumption (Vincent et al., 2009; Wagner, 2005).

Three financial parameters used to represent FP include Return on Assets (ROA), Return on Equity (ROE), and Earning per Share (EPS) (Albertini, 2013). Relationship between EP and FP was evaluated using the following regression model:

$$FP_{i,t} = \alpha_i + \beta_n EP_{i,t} + \beta_p \omega_{i,t} + \varepsilon_{i,t}$$

Where $\omega_{i,t}$ represents control variables (Size is measured by the natural logarithm of total assets, Leverage (LV), and Dividend Yield (DY)); α_i is constant; β is coefficient; ε is the standard error term; i denote to firm; and t is year.

Results and Conclusions

Table 1 presents the Pearson's correlation matrix for the regression. The correlation between firm size and leverage is the highest at 0.645. To verify the possible multicollinearity issue, the Variance Inflation Factor (VIF) needs to be conducted. The VIF of firms' size at 1.89 and leverage at 1.98 are under threshold value of 10. Therefore, there is no multicollinearity issue in regression model. It means that this model is good to estimate the relationship among these variables.

Table 1. Correlation coefficients matrix between EP and FP indicators

	Water	GHGs	EPS	ROE	ROA	Size	DY	LV
Water	1							
GHGs	0.304	1						
EPS	0.105	0.394	1					
ROE	-0.029	0.076	0.389	1				
ROA	0.044	0.172	0.172	0.695	1			
Size	-0.021	0.142	0.499	-0.095	-0.451	1		
DY	0.079	0.289	-0.094	-0.413	-0.114	-0.119	1	
LV	-0.005	-0.112	0.166	0.008	-0.613	0.645	-0.313	1

Table 2 shows the relationship between EP and FP, which is different between water consumption and GHGs emission. The effects of water consumption are not statistically significant for all FP indicators, whereas GHGs have significant positive impacts on ROA, ROE, and EPS. Since GHGs are mainly produced from energy consumption, the data imply that the more GHGs the companies produce, the more energy is consumed by the company (e.g., via production and related activities), which would incur more revenue. This conclusion is in line with some studies done in Australia, which identified positive relationship between GHG emissions and FP of Australian listed companies (Galbreath, 2006; Wang et al., 2014). It should be noted that, out of 28 studied companies, 11 of them are in resource energy & utilities industry. Thus, it is reasonable that the results of the study show similar trend to the one conducted in Australia as its economy also relies heavily on resource industry.

Therefore, it is ironic that less environmental friendly companies perform better in terms of FP. This is probably due to the fact that there is no regulation to enforce carbon tax in Thailand yet. However, the study does not suggest companies not to concern about EP for reducing GHGs emission. Rather, all companies should continuously improve their EP for environmental and social responsibility and be prepared for possible future regulation reform to tackle climate change problem.

Table 2. Regression coefficients between EP and FP indicators

	ROA	ROE	EPS
Water	-5.30E-12 [2.588]	-4.00E-10 [4.859E-10]	2.01E-10 [5.657E-10]
GHGs	6.26E-08** [2.181E-08]	1.185E-07** [4.371E-08]	1.870E-07*** [5.089E-08]
Size	-0.7571 [0.5941]	-1.976 [1.190]	7.2950*** [1.386]
DY	-1.1620*** [0.2298]	-2.3930*** [0.4604]	-1.2070* [0.536]
LV	-16.7700*** [2.664]	0.4977 [5.339]	-12.7100* [6.215]
Constant	24.74 [2.588]	30.47 [5.186]	-21.82 [6.037]
No. of observations	100	100	100
No. of firms	28	28	28
R ²	0.5268	0.252	0.4032

Note:

1. "****", "***", and "**" indicate significance level when $p < 0.01$, $p < 0.05$, and $p < 0.1$, respectively.
2. The numbers in parentheses are the standard errors.

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