A DEVELOPMENT OF ENTERPRISE RISK MANAGEMENT MODEL THAT AFFECTS FIRM FINANCIAL PERFORMANCE FOR ENERGY EFFICIENCY SERVICES IN THAILAND

PIJAYA CHARTPOLRAK

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF

THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

IN INDUSTRIAL BUSINESS ADMINISTRATION

KING MONGKUT'S INSTITUTE OF TECHNOLOGY LADKRABANG

BUSINESS SCHOOL

KING MONGKUT'S INSTITUTE OF TECHNOLOGY LADKRABANG

2021

KMITL-2021-KBS-D-128-002

Dissertation Title	A Development of Enterprise Risk Management Model that Affects Firm Financial Performance for Energy Efficiency Services in Thailand
Student	Mr. Pijaya Chartpolrak
Student ID	62611005
Degree	Doctor of Philosophy
Program	Industrial Business Administration (International Program)
Year	2021
Dissertation Advisor	Asst.Prof. Dr. Sorasak Tangthong
Dissertation Co-advisor	None

ABSTRACT

This objective of this study is to develops an enterprise risk management model that combines Enterprise Risks (ER) and Contengent Variables (CoV), factors surrounding business context, that relates to Enterprise Risk Management (ERM), and consequently aftects Firm Financial Perfromance (FFP) for Energy Efficiency Service Companies (EESCs) in Thailand. This research relies on a quantitative approach, the Structural Equation Model (SEM), by designing questionnaires to survey opinions towards their risk perceptions from three respondents of all 203 EESCs population in Thailand , and employed documentary review to complete the results. The Cronbach's Alpha Coefficient of total questionnaire test set is 0.898. Questionnaires were sent to all EESCs for data collection from 2013 to 2018. Completed questionaries were returned and used based on simple random sampling method. The findings show that ER negatively related to the level of ERM implementation, CoV is positively related to the level of ERM development, the influence of ERM on FFP is positively supported , and indirect effects of ER an CoV, through ERM, on FFP is insignificant.

ACKNOWLEDGEMENT

This dissertation is accomplished with the courtesy of Assistant Professor Dr. Sorasak Tangthong, my advisor at King Mongkut's Institute of Technology Ladkrabang, for guiding, assisting, facilitating, and reviewing this research until completion, expertise and lecturers for auditing the quality of research instruments and providing valuable recommendation, Assistant Professor Dr. Sudaporn Sawmong, the Dean of KBS, as well as Assistant Professor Dr. Singha Chaveesuk, the president of Doctor of Philosophy in Industrial Business Administration (International Program) course, for providing me this auspicious opportunity for studying, Assistant Professor Dr. Nuttawut Rojniruntikul for guiding academic review, staff at BBL Asset Management Co., Ltd. for giving useful information, staff at Able Consultant Co. Ltd. for assisting me in pursuing of returned questionnaires, all respondents for contributing their information and devoting their time for this research questionnaires, and my friends for motivating me as always. I would like to express my deepest gratitude to your contribution and kindness and to all examiners who suggested revisions until this dissertation is satisfied.

Finally, I am highly grateful to my parents and all relatives for continuously supporting and encouraging me throughout my years of study. This accomplishment would not be achieved without them.

Pijaya Chartpolrak

TABLE OF CONTENTS

Page

TABLE OF CONTENTS (Continue)

Page

TABLE OF CONTENTS (Continue)

Page

LIST OF TABLES

Table **Page**

LIST OF TABLES (Continue)

Table **Page**

LIST OF TABLES (Continue)

Table **Page**

LIST OF FIGURES

Figure **Page**

LIST OF FIGURES (Continue)

Figure **Page**

CHAPTER 1

INTRODUCTION

1.1 Research Background and Problem Statement

Global warming is the current critical international agenda and the energy conservation or energy efficiency has been recognized worldwide as a key mechanism to mitigate the global warming crisis that various countries nowadays pay attention in order to prevent the crisis seriously because those countries do not only acquire benefits from energy conservation to alleviate the global warming, but also obtain other benefits from a number of actions. The International Energy Agency (IEA), the renowned world energy organization, named the energy efficiency as "The first fuel with large untapped potential", not "the hidden fuel" that was understood before in the past, (IEA, 2014, p. 18), and the benefits of energy efficiency is shown in the in Figure 1.1.

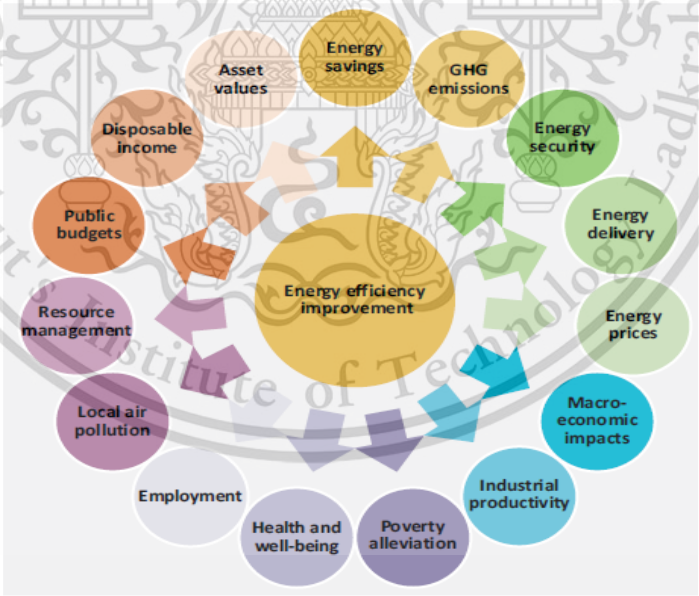

Figure 1.1 Capturing the Multiple Benefits of Energy Efficiency

Source: International Energy Agency (2014)

In order to reap the benefits from "The first fuel with large untapped potential ", Energy Efficiency Service Companies (EESCs), due to their agenda base platform, have been expected to be the key implementers for achieving the highest results (World Energy Council (WEC), 2013, p. 58).

IEA (2018a) summarized foreseen impacts in 2040 resulting from energy efficiency measures under the Efficient World Scenario in various aspects as follows:

Greenhouse: gas emission 12% lower than 2017 level;

Health: premature deaths related to indoor air pollution reduction by around one third compared to current level;

Household expenditures: could save USD 566 billion;

Energy security: reduction of net fossil import bill in key importing countries (China, EU, and India) by USD 679 billion.

IEA (2018a), p.16, also indicated EESCs as a business model to achieve the outcome.

ASEAN countries have also recognized the high importance of energy efficiency “The most cost-effective way for enhancing energy securities and in addressing image change and promoting competitiveness (ASEAN Centre for Energy (APAEC), 2015, p.30). ASEAN has set target to reduce energy intensity in ASEAN by 20% by 2020 and 30% by 2030 based on 2005 level (APAEC, 2015, p.32). EESC has been set as one of the enhanced private sectors in participation (APAEC, 2015, p.33).

For Thailand, energy efficiency has gained very high regards. It has been stipulated in current Thai Constitution, section 72(5), p.22, enacted in 2017 that “The state should take action to promote energy conservation and cost-effective use of energy.” (Office of the Council of State, 2017). Moreover, it has been set as the centerpiece of the five-core energy integration plans, so called Thailand’s Integrated Energy Blue Print (TIEB), i.e., Energy Efficiency Plan (EEP), Power Development Plan (PDP), Alternative Energy Development Plan (AEDP), Gas Plan, and Oil Plan. The EEP which has set a target for reducing energy intensity consumption by 30 percent in 2036 compared to 2010 (EEP, 2015, p.3), has envisaged fund for executing activities in targeted buildings and industries under the Plan for both public and private sector to be more than 0.15

trillion baht (EEP, 2015, p.16), and has specified EESCs to perform as the operation role under the EEP 2015 (EEP, 2015, p.4).

Although the energy efficiency service industry has been popularized out worldwide, as it has been recognized as a key mechanism in implementing global energy efficiency efforts, and has been exhibiting certain achievement in some extent (Hofer, Limaye, & Singh 2016, p. 1), the success has not yet been attained the top level expectation and the levels of success varied differently in each country because there existed many problems and hindrances, particularly in developing countries by replicating Western style model (IEA, 2015; Hofer, Limaye, & Singh, 2016, p.1). The problems and hindrances can be classified to 3 levels 1) country level: some are domestic issues in nature, and some are international similarities, 2) industry level: problems and hindrances vary with the scope of providing services, and 3) the level of development of each company: in addition, issues in all 3 levels could be generally found in many countries that have employed energy efficiency services by EESCs (Bertoldi & Boza-Kiss, 2017; Boza-Kiss, Bertoldi, & Panev, 2015; Hofer, Limaye, & Singh, 2016, p.1; IEA, 2015, p.13, Kindström, Ottosson, & Thollander, 2017, p.13; United Nations Economic Commission for Europe (UNECE), 2017, p.20-21).

Potential of energy efficiency investment are gigantic. IEA (2018 b, p.17, 123) estimated the global energy efficiency investment to be USD 584 billion from year 2018-2025 and will grow to USD 1.3 trillion from 2026-2040 under efficiency world scenario, to achieve 40% carbon emission reduction in line with the objectives of the Paris agreement on climate change.

For the ASEAN region, energy efficiency investment potential is quite promising. Energy Commission Joint Research Institute for Energy and Transport (2014) has preliminary estimated EESCs' market in 5 member countries where EESCs operation has been active i.e., Indonesia, Malaysia, Philippines, Singapore, and Thailand to be around 4,000, 400, 250, 739, and 500 respectively (Panev, Labanca, Bertoldi, Ribeiro Serrenho, Cahill, & Kiss, 2014), totaling to USD 5,989 million. ASEAN Development Bank Institute (2020) later has estimated the required investment in ASEAN countries from 2016 to 2025 to be USD 10,641 million.

The status of EESCs has been reported in ASEAN by ASEAN Centre for Energy (ACE) as the term of EESCs is already widespread in some ASEAN member countries, but there is no official document to clearly define it only used in the constrict definition for specific context. EESCs exist only in six member countries. Although, some country member states in ASEAN have initiated a number of supporting measures to foster EESCs' industry. In general, ASEAN EESCs are considered as in early stage and are needed more additional supports to achieve successful performance. Thailand is considered as the regional leader in providing regulatory support. EESCs' hindrances vary from one country to another depending on level of maturity of EESCs' development and role of market, and competition in the economies namely market familiarity, institutional and regulatory practices (ACE, 2017, p. 15, 22).

At business level, the service model of EESCs is classified into 3 types: 1) Shares Saving model performed under Energy Contract (EC), 2) Guaranteed Saving model performed under Energy Performance Contract (EPC) or Energy Savings Performance Contract (ESPC), and 3) Energy Supply model is performed under the Energy Supply Contract (ESC). Hofer, Limaye, & Singh (2016) stated that, Share Savings model and Guaranteed Saving model are most commonly used in non-European countries particularly United States, Canada, Japan, Korea, China, and Thailand. While the 3rd model, or the Energy Supply model has been more popular in Europe.

Based on those mentioned described aspects, it is logical appropriate to conduct research on problems, risks, and risk management that have been arisen, under Thai context, to answer the needs for more tapping on potential market for both public and private sectors which can be beneficial to Thai EESCs and beyond.

The hurdles of EESCs, which have been studied extensively around the world, can be summarized as follows. EESCs' business activities in respect to types of global customers differ from country to country. For countries with developed industry, the most important customer is the government sector and is often the catalyst for the development of the country's energy efficiency business in government buildings by providing legal and financial supporting measures. For industrial sector, EESCs' business in this area is often viewed as having high potential in developing countries and countries with transition economy. For energy efficiency service activities in

residential sector, most countries consider them less important because of low profit and there are legal issues that are binding between owners and tenants as well as decision making problems due to the large number of stakeholders i.e., condominium and apartment. And for the last sector, commercial buildings are becoming major new customers, especially in new developing countries such as Brazil or India (Bertoldi & Boza-Kiss, 2017; IEA, 2015; Hofer, Limaye, & Singh, 2016).

Problems and obstacles at the industrial level can be classified by four groups in relation to the type of customers that EESCs provides energy efficiency services as follows:

1) Government buildings: government agencies pose great cautious when outsourcing EESCs to operate because the administrative process is a heavy burden. Nevertheless, the upcoming projects will be large. In addition, the consecutive government budget allocation on expense category will be reduced when the energy saving becomes more effective, hence, the government's incentives for energy conservation are unpersuasive. If the government agencies are required to provide investment funds as an integral part of the Energy Performance Contract (EPC), the investment funds will be considered as a long-term credit provision and affecting the ceiling of borrowing budget. Moreover, there is also a problem with spending money in different budget categories. The money given to EESCs as investment comes from the investment budget, but the money earned from energy savings is in the expense budget and cannot be reinvested due to the wrong category of budget. Another problem is government regulations governing the procurement and auction opening. The government's purchasing regulations are rather based on the lowest prices of equipment and do not encourage to consider the savings that will be occurred throughout the life of equipment. In practice, this is not conducive to energy efficiency operations that require equipment having more energy efficiency with higher cost than equipment having lesser energy efficiency with lower cost. Therefore, the operation of the EESCs under the EPC was less likely to be done. Another major obstacle for EESC businesses in developing market countries is insufficient administrative competence. If the level for the satisfaction of the energy savings has not yet been established before implementation, the baselines (or references for calculating savings) are difficult to establish thus resulting in the deficit of actual savings;

2) Industrial factories: in the industrial sector, energy efficiency services proliferated less than the government building sector due to many problems in many countries. Large industrial customers, who can provide good profits to the EESC business, mostly have own capability in both technology and financing. Therefore, they do not necessarily rely on the EESCs because they can carry out themselves. Hence, EESCs operations are limited to energy saving on a per-device basis i.e., boiler, pump and etc. and they cannot provide energy efficiency services for the whole production process. One more problem is that the industrial sector requires shorter payback period on investment than payback period from energy saving obtained from energy efficiency operation. In developing market countries, the industrial sector prefers to replace older production processes with newer production processes, rather than resorting to energy efficiency operations with lesser saving results. In the meantime, EESCs tend to view that operating in the private sector is riskier than operating in the government sector because the private sector may relocate or go bankrupt before the end of the energy efficiency contract. For developing market countries where credit systems have not yet been well developed, the private sector exhibits high risk and thus EESCs turn to the public sector instead;

3) Residential sector: residential buildings and houses exhibit the most problems and the least operations by EESCs among all other sectors. The potential for energy conservation and the expected savings is low compared to the cost of operating energy efficiency. This is more pronounced especially for the case where the building has a large number of co-owners who causing difficulties in the operating procedures and increase the cost of operation. Another problem is that building owners do not trust the estimated energy conservation potential because they do not thoroughly understand the mechanisms of energy efficiency under the Energy Performance Contract. Residential owners with high disposal income are interested in energy conservation, but going on their own, not relying on EESCs' services as measures for energy conservation in buildings are easy to operate and incur affordable expenses. In addition, residential owners also view that the Energy Performance Contract (EPC) is too difficult to follow;

4) Commercial building sector: the problems and obstacles to EESCs business for the commercial building sector are similar to those of the residential sector. Building owners are not

fully aware of the possibility of the EPC or the knowledge of how to do the energy efficiency and they are not willing to hire any consultant that incurs high expenses. In some cases, owners of the building are obliged to provide energy efficiency themselves and, in some cases, they are reluctant to commit to a long-term contract. In the case when owners of a building have multiple buildings, they usually have sufficient money to carry out their own energy conservation efforts.

In addition, problems and obstacles from customers are the acceptance of energy efficiency services. International Energy Agency (2010, p. 11-12) (IEA) identified problems and obstacles from the big picture point of view. Although energy conservation technology is already commercially available and provides financial benefits, energy consumers and investors are less likely to give priorities to a little higher investment in exchange for using highly efficient equipment for energy conservation because the energy savings are hard to be noticed and difficult to be measured, thus making barrier to investment. Moreover, energy consumption deeply relates to economic activities subject to incentive structure, user behaviors, infrastructure design rules and regulations, construction practice criteria, and available funding in different cultures. These factors have also been existing barriers in the above four sectors. Another barrier that EESCs encountered before providing services is funding and financing. In developing countries, financial institutions see little importance for providing credit to EESCs on energy efficiency projects, unlike developed countries where financial problem is lesser, because financial institutions in developing countries see that risks from doing EESCs business are high due to a lack of understanding of EESC business and financial institutions in these countries do business in a conservative manner. Therefore, it is the norm to unextend credit to EESCs by financial institutions located in developing countries. Or if EESCs are able to obtain credits, they will be charged at high interest rates and fees. Moreover, nearly all of these aforementioned problems and barriers has still been persisting in EESCs business around the world, more or less similar in nature and impacts corresponding to maturity of markets of EESCs (ASEAN Centre for Energy, 2017; Bertoldi & Boza-Kiss, 2017; Boza-Kiss, Bertoldi, & Panev, 2015; Hofer, Limaye, & Singh 2016; IEA, 2015; Asia-Pacific Economic Cooperation, 2017; Liu & Noor, 2020; Silitonga, 2016; United Nations Economic Commission for Europe, 2017).

Energy efficiency service status in Thailand

Energy Efficiency Service Company (EESC) has been designated by Thailand Energy Efficiency Plan (2015-2036) as one of the key mechanisms to help achieve its ambitious goal in reducing energy intensity by one-third at the Plan's year end. Despite of its promising potential and various government's support mechanisms, Thai EESCs with 8 years (since 2012) of its official registered association under government's blessing, still struggle with barriers and risks. Some of which are universal and some are country specific which impeded their flourishing futures. This systematic study on exploring risks, the causes and effect, together with proper risk management solutions could be beneficial to EESCs' as well as stakeholders and interesting parties. Therefore, how the Enterprise Risk Management (ERM) system is capable to identify the causal factors, both internal and external, that have been affecting the EESCs performance from proceeding business.

Energy efficiency service in Thailand is categorized in two groups. The fee base energy consultant and the Energy Service Companies (ESCOs). The first group, the forerunner, was firstly established around 1992 and provided services on energy audit report and formulation of energy efficiency implementation plan for buildings and factories stipulated by The Energy Efficiency Act 1992. They registered under The Consulting Engineers Association of Thailand (CEAT) and the Consultant Database Center, Ministry of Finance). The second group reports to the Thai ESCO Association, the Federation of Thai Industries established in 2012. EESCs' definition differed by countries, this study adopted Thai context which state "A public or private entity who implements turnkey energy efficiency projects by taking all responsibilities in lieu of buildings or industries, covering design, construction, funding, installation, measurement and verification, saving guarantee, and compensation of unachieved saving. In general, EESCs practices 3 service models i.e., Energy Contract (EC) or shared saving, Energy Performance Contract (EPC) or guaranteed saving, and Energy Supply Contract (ESC) (WEC, 2008, 2013), but, in Thailand, some EESCs employed leasing contract as an alternative option (ESCO Information Center, 2013-2018). Energy Consultants and ESCOs sometimes worked as a synergic partner, as Energy Consultants performed the energy efficiency ground work such as primary energy auditing and feasibility study which are ESCOs' risky undertakings should ESCOs carried out by themselves and pending on customers

discretion which might decide not to proceed further action, resulting in ESCOs' financial loss (Hansen et al., 2009). In some cases, both parties shared information and staff for mutual benefit since some of the ESCOs are Energy Consultants' off shoot (noticeable from EESCs' shareholder lists and audited financial statements, and ESCO Annual Report, 2013-2018). In view of such phenomena, this study assesses opinions on EESCs activities from both parties in order to obtain the full panoramic view.

There are articles and researches indicated that various problems and obstacles found are risks to EESCs business from providing energy efficiency (risk identification). Some studies suggest solutions to each of the problems and obstacles that are causes of risks (or risk drivers) (De T'Serclaes, 2010; Federal Energy Management Program (FEMP), 2015; Garbuzova-Schlifter & Madlener, 2014; Kleindorfer, 2011; Sustainable Energy Authority of Ireland (SEAI), 2013; Thumann & Woodroof, 2009). Several studied also explored risks in various terms in tradition risk that views each risk class in isolation (silo-base approach). However, the aforementioned paper rarely and explicitly showed total risks in a holistic manner and integrate total risk to enterprise-wide risk management and very little of them concrete the use of enterprise risk management framework that are generally accepted standards as risk management guidelines.

There are several risk management approaches and frameworks, but the guidelines that have been established to be universally used and to be applicable to variety of businesses belong to The Committee of Sponsoring Organizations (COSO, 2017) and International Organization for Standardization (ISO 31000, 2018). The COSO approach came out first and has been adopted by those who use it as the guideline for enterprise risk management. There are examples of users in Thailand such as the Energy Conservation and Promotion Fund, The Stock Exchange of Thailand, and the Secretariat of the Senate, and etc.

The application of the risk management is based on principles and objectives to maximize the value of the business (Beasley & Frigo, 2007; Casualty Actuarial Society (CAS), Enterprise Risk Management Committee, 2003; COSO, 2004; Hoyt & Liebenberg, 2010; Pagach & Warr, 2011). Therefore, the importance of research problems is to collect problems and obstacles (or causes of risk), group them into appropriate risk categories, and integrate overall risks across the

entire organization and expresses linkages to the enterprise risk management in order to enhance the value of firm performance for energy efficiency service industry in Thailand by taking into account relevant factors into consideration. Not only risks influence the relationship between ERM and firm performance, but also contextual variables or contingent variables, such as on-going business status and surrounding environment, affect the relation between ERM and firm performance (Gordon, Loeb, & Tseng, 2009). These factors can weaken or strengthen the relationship depending on how the firm seriously manages risks and handle all relevant factors properly, effectively, and efficiently.

This research explored and selected a risk management concept and theory, that is universal and can be applied with the energy efficiency service business in Thailand, which is the enterprise risk management (ERM) because a proper risk management is able to mitigate uncertainties from proceeding business, to achieve the objectives set, and to add value to the business as ISO 31000 and COSO suggest that a good business should have. The benefits of risk management in relation to ERM guidelines are the increase of corporate equity value (Gordon, et al., 2009; Gupta, 2011; Lam 2001; Nocco & Stulz, 2006; Woon, Azizan, & Samad 2010, 2011), yield the positive performance of the organization (Arnold, Benford, Canada, & Sutton, 2015; Baxter, Bedard, Hoitash, & Yezegel, 2013; Subramaniam, Collier, Phang, & Burke, 2011), increase business competitiveness (Jalal, AlBayati, & AlBuainain, 2011; Jalal Karim, 2013; Kimbrough, 2006; Liu, 2011; Plat, 2004; Stroh, 2005; Walker, 2013), help business to achieve the goals of the organization (Damodaran, 2008; Espejo & Schwaninger, 1993; Espejo, Schuhmann, Schwaninger, & Bilello, 1996; Mintzberg, Bruce, & Lampel,2005), reduce profit fluctuation, strengthen financial status, and increase employees moral (Lam, 2001). ERM is also supported by a number of renowned institutions to apply to the organization, including credit rating agencies such as Standard and Poor's (S&P), Moody's Investors Service (Moody's) and The International Organization for Standardization (ISO) (Arena, Arnaboldi, & Azzone, 2010). There are also factors driving ERM adoption from corporate governance areas such as the Sarbanes – Oxley Act (SOX) (Arnold et al., 2015; Charoenkijjarukorn, 2013; Lundqvist, 2015; Martin & Power, 2007; Mikes, 2009). A survey result by Accenture consulting firm in 2013 revealed that nearly 98 percent of C-suite executives

agreed that ERM was more important to the organization than in the past two years (Sherman, Weston, Willey, & Mansfield, 2014). As for other supporting factors for the adoption of ERM from independent organizations, the credit ratings agencies such as S&P, Moody's, and Fitch have added the adoption of ERM system by companies under credit rating analysis as one of credit scoring factors (Gates, 2006; Liebenberg & Hoyt, 2003). The Stock Exchange of Thailand (SET) realizes the importance of ERM and supports the framework for ERM in accordance with the COSO approach, in collaboration with PricewaterhouseCoopers (PwC) to formulate an ERM guideline for listed companies in Thailand (PwC, 2004). In addition, according to the contingency theory, each company must find its organizational structure that suits itself and operate as much efficiently as possible (Laisasikorn & Rompho, 2014; Morgan, 2007).

Finally, from the research problems that EESCs in Thailand insufficiently have an appropriate enterprise risk management model that integrates the problems and obstacles as sources of risks in conjunction with their business context in order to find relationships and significant influences of risks and risk management to firm financial performance, this research proposes an integrated enterprise risk management model that groups relevant risk drivers (problems and obstacles) in to risk categories in relation to generally accepted academic studies and documents from practitioners, assesses impacts of risks and taking into account environment surrounding factors that affect ERM and consequently affect corporate performance in order to find solutions to mitigate problems and obstacles of EESCs and subsequently improve corporate performance and competition, including to be an example model to alleviate problems and obstacles of EESCs in ASEAN country members as well as other developing countries similar to Thailand.

1.2 Research Questions

1. What is the applicable enterprise risk management model for EESCs in Thailand?

2. What are the problems and obstacles that are considered as causes of risks or risk drivers that EESCs in Thailand have experienced?

3. What are the applicable risks categories in relation to Enterprise Risk Management concepts for EESCs in Thailand?

4. What are relevant factors of enterprise risk, contingent variables, and enterprise risk management that have affected the relationship between enterprise risk management and firm financial performance complying with empirical evidences?

5. Which variables that affected, in direct, indirect, and in total effect, to firm performance associating to the context of enterprise risk management for EESCs in Thailand?

1.3 Research Objectives

1. To review enterprise risk management definitions and frameworks for EESCs in Thailand

2. To conclude the problems and obstacles that are considered as causes of risks or risk drivers that EESCs in Thailand have experienced

3. To investigate applicable risks categories in relation to Enterprise Risk Management concepts for EESCs in Thailand

4. To develop a structural equation model of enterprise risk management and related variables that impacts firm financial performance, in relation to enterprise risk management, contingent variables, and firm financial performance theory, consistent with empirical data, for EESCs in Thailand

5. To study the effect (direct, indirect, and total effect) of Enterprise Risks (ER), Contingent Variables (CoV), and Enterprise Risk Management (ERM) to Firm Financial Performance (FFP) and to examine which characteristics of these factors that influence the successful ERM implementation and Firm Financial Performance.

1.4 Research Hypotheses

H1: Enterprise Risks has a relationship with Enterprise Risk Management.

H2: Contingent Variables has a relationship with Enterprise Risk Management.

H3: Enterprise Risk Management has a relationship with Firm Financial Performance.

H4: Enterprise Risks has an indirect relationship with Firm Financial Performance depending on the levels of Enterprise Risk Management.

H5: Contingent Variables has an indirect relationship with Firm Financial Performance depending on the levels of Enterprise Risk Management.

1.5 Research Conceptual Framework

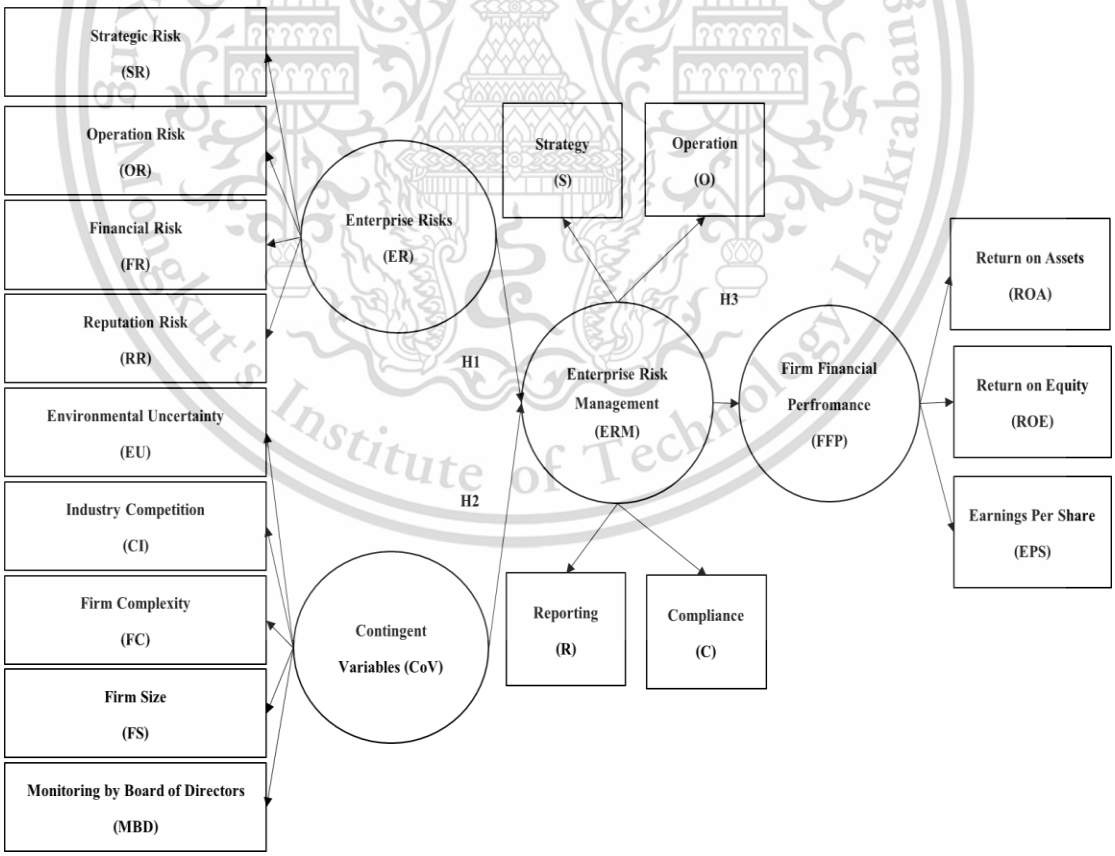

Figure 1.2 Research Conceptual Framework

1.6 Research Benefits

Findings obtained from this research according to the research objectives reveal the direct and indirect effect of Enterprise Risks, Contingent Variables, and Enterprise Risk Management to Firm Financial Performance. The result of this study is a structural equation model of enterprise risk management of EESCs in Thailand. Top executives and management of EESCs, financial institutions, and government agencies are able to take research results into their consideration for their policy and objective setting and enterprise-wide risk management in relation to energy service industry. In addition, this initial guideline model is an example model that can be extended to apply with ASEAN member countries and other developing countries similar to Thailand.

1.7 Scope of Research

This research covers the risk factors, by collecting the problems and hindrances or risk drivers, occurring in EEs both domestically and internationally, in order to develop an ERM model under the ERM framework and concept. The scope of ERM process in this research is a part of the risk assessment process which includes risk identification, risk assessment, risk analysis, and risk evaluation.

1.7.1 Scope of contents

This research is to study, compile, review of concepts, theories, literature, and various researches related to the development of structural equation model of causal factors that affect the enterprise risk management and then the firm financial performance of the energy efficiency service company in Thailand by studying the problems and obstacles, or risk drivers, that have been existing in business both domestically and internationally. These risk drivers were categorized into risk variables that impact the enterprise risk management, and then to the firm financial performance by controlling scope of contents in negative side effects because the negative side effects are important for EESCs to operate and continue their business (Kleindorfer, 2011). The

risk variables are combined with contingent variables in order to construct the conceptual research framework and to create research questionnaire that are distributed to respondents. Data collected from retuned questionnaire are analyzed and interpreted. The results of this study are preliminary guideline for further risk responses.

Concepts, contents, and theories

1. Problems and obstacles that EESCs around the world and Thailand have been facing (Ellis, 2010; Garbuzova-Schlifter and Madlener, 2014; Hansen et al. 2009; Hu and Zhou, 2011; Marino et al., 2010; Vechakij, 2015)

2. Risks concepts, risk categories especially downside risk (BCBS, 2017; Blach, 2010; CEBS, 2006; Comité Européen des Assurances & Groupe Consultatif Actuariel Européen (CEA & Groupe Consultatif), 2007; COSO, 2004, 2018; ISO 31000, 2018; SEAI, 2013; The Secretariat of the Senate, 2011, 2016; Edwards and Bowen, 2005)

3. Contingency variables that affect enterprise risk management (COSO 2004; Gordon et al., 2009; Panicker & Hiremath, 2016; Sithipolvanichgul, 2016)

4. Enterprise Risk Management (ERM) concepts, theories, and process (COSO 2004, 2017, 2018; ISO 31000)

5. Enterprise Risk Management measurement or Enterprise Risk Management Index (ERMI) (Gordon et al., 2009; Nan, 2015; Panicker & Hiremath, 2016; Sithipolvanichgul, 2016)

6. Firm financial performance measurement (Al-Manaseer, Al-Hindawi, Al-Dahiyat, & Sartawi, 2012; Al-Matari et al. 2014; Baxter et al., 2013; Bromiley, 1991; Laisasikorn & Rompho, 2014; Lin, Liao, & Chang 2011; Mirza & Javed, 2013; Santos & Brito, 2012)

1.7.2 Scope of population

Population are from 203 companies in energy efficiency service industry and respondents are from top three management levels in each company in three key areas of responsibilities i.e., 1) chief executive officers (CEO) / managing directors (MD), 2) chief financial officers (CFO)/ accounting or financial managers, and 3) chief operating managers/ project/ technical managers.

1.7.3 Scope of research study period

Data were collected from 2013 to 2018.

1.7.4 Area of Studies

Companies that provide energy efficiency services in Thailand

1.8 Definitions of Terms

1.8.1 Eenergy efficiency service (EESC) in Thailand

A public or private entity who implements turnkey energy efficiency projects by taking all responsibilities in lieu of buildings or industries, covering design, construction, funding, installation, measurement and verification, saving guarantee, and compensation of unachieved saving.

1.8.2 Risk

Risk is an event/(s) that is/(are) likely to endanger the success of the energy efficiency services in Thailand.

1.8.3 Risk management

Risk management is a systematic process in managing risky problems and obstacles that hinder the success of ongoing business according to contingency upon situations.

1.8.4 Enterprise Risks (ER)

Enterprise Risks is the overall effects of all events that are likely to harm business achievement in providing energy efficiency services. It consists of 4 main risk categories according to the concept of Enterprise Risk Management (ERM), which are 1) Strategic Risk (SR), 2) Operation Risk (OR), 3) Financial Risk (FR), and 4) Reputation Risk (RR).

Note: However, this initial definition will be changed to reflect findings from this research results by dropping RR out to only 3 observed variables that will be remained under ER (please see section: Implication and Recommendations on Chapter 5).

Strategic Risk (SR) is defined as incidents or external factors associating with events or factors in business that have any opportunities to damage the growth of the business or the value of the business to deviate from the original objectives or strategies that have been laid.

Operational Risk (OR) is defined as incidents that are likely to cause errors or failures in working process within the organization or inadequacy from risk drivers pertaining internal work processes, human resource management, the use of information technology, procurement in the supply chain, and compliance with existing regulations.

Financial Risk (FR) is defined as the incidents that have are likely to cause damage to the financials relating to business as a result of financial creditability of the company, the ability to pay the debt of the company or the debtors of the company, market prices, and economic conditions such as fluctuations in exchange rates or currency, commodity prices, interest rates, inflation, financial costs, and liquidity of assets, and available cash flows.

Reputation Risk (RR) is defined as incidents that are likely to adversely affect the reputation, attitude, image, credibility, or confidence towards the company from the point of view of any stakeholders, and may thus resulting in damage to the revenue of the business, supply chain, or acquired capital.

1.8.5 Contingent Variables (CoV)

Contingent Variables is defined as factors that may affect Enterprise Risk Management and then affecting to the firm financial performance. CoV consists of 5 observed variables which are 1) Environmental Uncertainty (EU) which comprises of Market factor or Coefficient of Variation of Sales (Market CV), Technological aspect or Coefficient of Variation of Capital Expenditures and R&D (Tech CV), and Income or Coefficient of Variation of Net Income before Taxes (Income CV), 2) Industry Competition (CI), 3) Firm Complexity (FC), 4) Firm Size (FS), and 5) Monitoring by Board of Directors (MBD).

Note: However, this initial definition will be changed to reflect findings from this research results by dropping EU and CI out to only 3 observed variables that will be remained under CoV (please see section: Implication and Recommendations on Chapter 5).

Environmental Uncertainty (EU) is defined as any changes or variability in environmental factors outside the organization that affect difficulties in doing business. EU components comprise of 3 factors such as

1) Market factor or Coefficient of Variation of Sales (Market CV)

2) Technological aspect or Coefficient of Variation of Capital Expenditures and R&D (Tech CV)

3) Income or Coefficient of Variation of Net Income before Taxes (Income CV)

Industry Competition (CI) is defined as intense level of competition in the industry and it is determined by the concentration of market share which is calculated from sales of the companies in the same industry.

Firm Complexity (FC) is defined as the numbers of business segments within the company.

Firm Size (FS) is defined as the total assets of the company.

Monitoring by Board of Directors (MBD) is defined as proactive participations of the Board of Directors and this character results in required successful risk management.

1.8.6 Enterprise Risk Management (ERM)

Enterprise Risk Management is defined as the process of integrated and systematic setting approach of management of risks that EESCs have been exposing to. The risk management approach consists of specification of causes of risks, risk assessment, and risk response by taking into account the likelihood of severity, impacts, and the relationship between each pair of risks that are harmful to value of the business and profits in order to control the overall business risks under appropriate and acceptable risk level accordance with the policy framework and strategic objectives set.

The measurement of achievement in enterprise risk management is the Enterprise Risk Management Index (ERMI), which comprises of 4 components which are 1) Strategy (S), 2) Operation (O), 3) Reporting (R), and 4) Compliance (C).

Strategy (S) is defined as company positioning in the market compared to competitors. The consideration of the level of success in strategic planning of the company can be done by considering two factors which are comparison of the standard deviation of sales compared to the standard deviation of the overall sales of the industry, and the diversification of the company to reduce all existing risks.

Operation (O) is defined as the success level of the efficiency of the output compared to the use of inputs or resources of the company. The determination of the success level consists of the efficiency of utilizing all assets of the company for generating income, and the efficiency of hiring employees of the company in order to generate income.

Reporting (R) is defined as the level of the quality of the financial statements that reflects overall risks of failures to the company. The reliability of the financial report can be considered from opinions of the company's auditors and the creative accounting.

Compliance (C) is defined as the level of success of a company that can reduce the risks of failures, and the level of adding value to the business, complying with laws, rules, regulations, agreements, and contracts. The evaluation of the successful compliance is determined by the ratio of auditor fees compared to the average total assets, and the net penalty ratio compared to the average total assets.

1.8.7 Firm Financial Performance (FFP)

Firm Financial Performance is defined as the latent variable that reflects firm financial performance and value of firm, or equity exploited, as a result of employing enterprise risk management. FFP consists of 3 indicators which are 1) Return on Assets (ROA): Average net profit per average total assets, 2) Return on equity (ROE): the average net profit per average shareholders' equity, and 3) Earnings per share (EPS): the average net income per numbers of ordinary shares in each year.

Return on Assets (ROA) is defined as net profit over the average of total assets of the company.

Return on equity (ROE) is defined as net profit over the average of total shareholders' equity of the company.

Earnings per share (EPS) is defined as net profit over the outstanding numbers of ordinary shares of the company.

1.9 Summary

Energy Efficiency Service Company (EESC), which provides energy efficiency services, is one of the main mechanisms of the ASEAN Energy Cooperation Action Plan in achieving the goal of reducing energy intensity by at least 8 percent in 2015 compared to 2005 and this plan potentially create opportunity for the market of EESC business in ASEAN to expand more. Thailand also values EESCs and EESCs in Thailand has the highest potential among ASEAN member countries. However, at the same time, EESCs in Thailand have been facing various problems and obstacles which are the causes of risks to the entire industry. The successful enterprise risk management is therefore important in reducing the risks and obstacles, and encouraging EESCs to achieve their business objectives as planned. This research therefore focuses on the identification of risk factors according to the various sources of risks, and the presentation of a model of causal factors that affect enterprise risk management and then leading to the financial performance of EESCs.

CHAPTER 2

LITERATURE REVIEW

This chapter reviews related literatures on energy efficiency services pertaining the background of EESC business, definition of EESC, status and problems faced expose to EESC, both internationally and nationally that lead to risk identification and enterprise risk management modeling and conceptual research framework. This chapter consists of the following topics.

2.1 General Information of Energy Efficiency Service Company Industry

2.2 Enterprise Risk Management Theories and Concepts

2.3 Enterprise Risks

2.4 Enterprise Risk Management Measurement

2.5 Contingent Variables

2.6 Firm Financial Performance

2.7 Hypotheses development

2.8 Research Conceptual Model

2.9 Summary

2.1 General Information of Energy Efficiency Service Company Industry

Energy efficiency service business was originated in France, around one century back, by Champagne General de Chauffage (IEA 2011), a district heat supplier company under the name of Chauffage. Later on, Scallop Thermal, a division of Royal Dutch Shell Company, brought this concept to the United State in1970, and further expanded to worldwide under Energy Service Company (ESCO) name which implemented energy efficiency program.

Precise and commonly accepted definition of ESCO has not been established. Its definition varies by countries. For example, the European Union defines as “Energy Service Provider which means a natural or legal person who delivers services or other energy improvements measures in final customers facilities or premised” (The 2012 energy efficiency directive, 2012, amending 2018).

In the United States of America, ESCO is defined as Energy Service Company “which design, build and arrange financing for projects that save energy, reduce energy costs, and decrease operation and maintenance cost at their customers facilities (U.S. Department of Energy Efficiency, 2017).

In Asia Pacific, Economic Cooperation Country (APEC) defined ESCO as “A type of Energy Service Provider that receives performance based on compensation depending on energy saving achieved (International Institute for Energy Conservation (IIEC) & MP Ensystems, 2017).

In ASEAN, official document to clearly define ESCO does not exist, ESCO terms has been used in a narrow definition for some specific context (ACE, 2017, p. 21).

In Thailand, the Department of Alternative Energy Development and Energy efficiency (DEDE) who is the ESCO’s Sponsor, defines “Service Provider” as an entity which implements energy management under any energy efficiency contracts between the service recipients (factory or building owners), Service Provider (ESCO) and financial institutions (in case the Service Provider is well competence, it can act as service provider and financier altogether). The Service Provider will carry out auditing, accessing, designing, financing, and installing equipment to improve buildings or factories for reducing energy and production cost under the 4-10 years contract term.

The definition stated in the website of ESCO Information Centre, Institute of Energy for Industry, The Federation of Thai Industries, the ESCO registrar, as “Public or Private organization or entity doing business on turnkey energy efficiency projects by taking responsibility for all duties in lieu of factory or building owners covering project design, construction permit, fund securing application (if any), installation, measurement and verification of energy saving. The ESCO shall guarantee saving and compensate for the shortfall.

In real practice, energy efficiency business in Thailand did not limited to ESCO only, but it extended to other fee-based energy efficiency related entities which were established around 1992, before the emergence of ESCO, to audit, establish energy target and plan as well as prepare annual energy consumption report of designated buildings and factories as mandated by the Energy Conservation Promotion Act 1992. Some of these data and information were later updated and upgraded by factories and buildings to be used as baseline for in implementing EPC. These companies registered as Energy Efficiency Consulting Engineer with the Consulting Engineers Association of Thailand (CEAT) and the Consultant Database Centre Ministry of Finance. These companies are forefront of ESCOs as well as acting ESCOs in due course. To obtain a complete view of ESCO business in Thailand, this research combined companies that were registered as either Service Provider (ESCO) or Energy Efficiency Consulting Engineer, or both together and names them all as Energy Efficiency Service Company (EESC) and adopts the definition under Thai context which states that "A public or private entity who implements turnkey energy efficiency projects by taking all responsibilities in lieu of buildings or industries, covering design, funding, construction, installation, measurement and verification, saving guarantee, and compensation for the short fall saving".

2.1.1 Energy efficiency service models

EESCs provide services under 3 models

1) Energy Contract or Share Saving (EC)

EESCs share saving with establishment and provide or secure fund for the implementation and take all risks in lieu of clients. The contract specifies ratio of saving received by EESCs and their clients during each period of contract duration. The EESCs' revenue over the timeframe covers provided fund and anticipated return on investment.

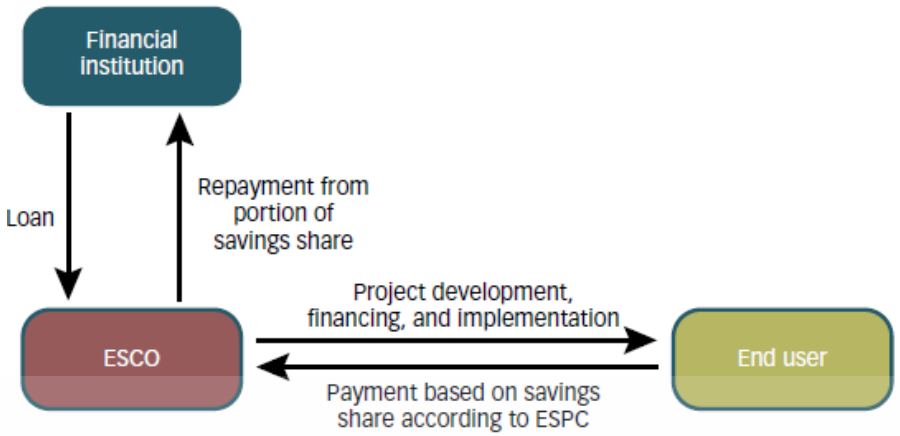

Figure 2.1 Share Saving Model

Source: International Energy Agency (2011), p. 26, Limaye (2009), Sarkar & Moin (2018)

2) Energy Performance Contract or Guarantee Saving (EPC)

EESCs receive payment only on the amount of saving during the period guaranteed by EESCs under the contract term. Establishment provides the implementation fund, normally loan from financial institution. EESCs guarantee the saving performance under some conditions such as efficiency energy saving, financial saving, and operating condition. EESCs also specify the measurement and verification protocol to be used under the contract and term of payment when the agreed saving is satisfied.

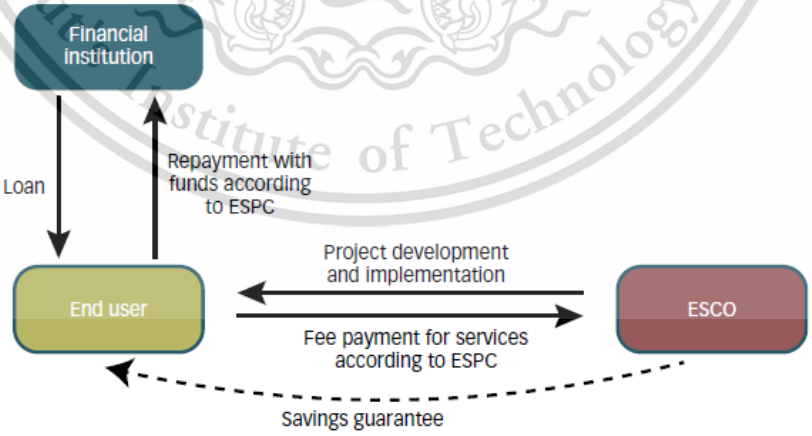

Figure 2.2 Guarantee Saving Model

Source: International Energy Agency (2011), p. 26, Limaye (2009), Sarkar & Moin (2018)

3) Energy Supply Contract (ESC)

EESCs provide integrated service on energy supply and operation, under the original Chauffage concept by acquiring energy and equipment for the establishment, performing operation and maintenance, aiming at optimum energy efficiency and lowest cost under the energy supply contract, and being responsible for the investment and operation fund. Under this model, EESCs sell energy which can be steam, heat, cooling, electricity, etc. to the establishment at predetermined price and are responsible for the equipment investment and operation expenses. The establishment owns machineries and equipment. EESCs receive additional service fees from the establishment and the amount calculated from energy prices in the receipt with 3-10 percent discount from available market prices. The duration of contract normally lasts 10-30 years.

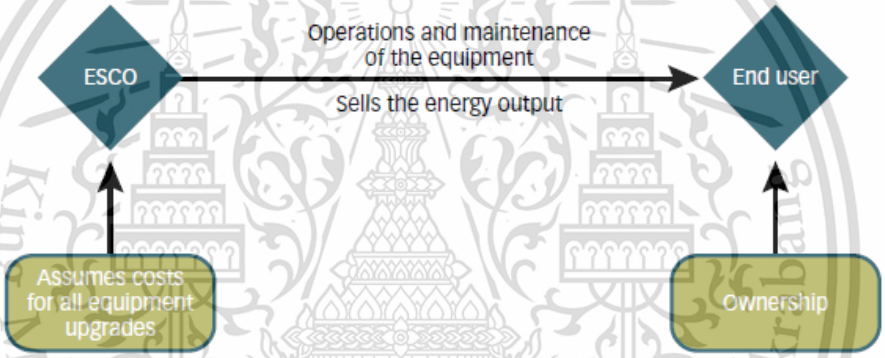

Figure 2.3 Energy Supply Contracting Model

Source: International Energy Agency (2011), p. 26, Limaye (2009), Sarkar & Moin (2018)

The first two models are popular in the United State and propagated to other countries under the name of Energy Performance Contract or EPC. The third model which was adopted from French Chauffage concept is the European general practice. In Thailand, all contracts are found and EC is the most adopted.

2.1.2 EESC's status in selected countries worldwide

Although many countries around the world have recognized the important role of EESCs in cost effective energy efficiency delivery and the potential energy efficiency investment to be increasing, which IEA has estimated to rise from USD 584 billion between year 2018-2025 to USD 1.3 trillion between 2040 (IEA, 2018; Singh, 2018), they have not been able to achieve their full

potential (IEA, 2014) due to persisted barriers, even in the USA and other countries where EESCs' market has been well established.

The information, on this paper, related to status of EESCs in the selected countries was adopted criteria used by The European Commission DG Joint Research Centre (EU JRC) and cover both EESCs in well developed markets as well as developing markets for the benefit of comparison, for international and regional (Panev et al., 2014).

For the ASEAN region, the status of EESCs has been reported by the ASEAN Centre for Energy as "The terms of energy service company are already widespread in some ASEAN member countries, but there is no official document to clearly defines it, only used in the constricted definition for specific context". EESCs exist only in six member countries. Thailand is considered the regional leader in providing regulatory support for EESCs' development. EESCs' barriers vary from one country to another depending on the stage of EESCs' development role of market and competition in the economy. Although, EESCs' participation has been viewed as central role in supporting energy supply and services, it has encountered a number of obstacles. In general, EESCs are still in the early stage of development and need sustainable support to successful accomplishment (ASEAN Centre for Energy (ACE), 2017).

The details of EESCs' status of some selected countries are summarized in the following tables, data available between 2011-2016 (ACE, 2017; Panev et al., 2014).

Table 2.1 EESCs's Status in Japan

List	Description
Market	
- Status	Stagnation
- Potential	USD 20 billion
- Investment size	USD 374 million
EESC association	Yes
Typical projects	Industry and buildings
Type of contract	Shared saving, Guarantee Saving

Table 2.2 EESCs's Status in India

List	Description
Market	
- Status	Significant growth
- Potential	USD 2.8 billion
- Investment size	USD 140 million
EESC association	Yes
Typical projects	Industry and public sector
Type of contract	Shared saving, Guarantee Saving

Table 2.3 EESCs's Status in China

List	Description
Market	
- Status	Growth
- Potential	USD 14.5 billion
- Investment size	USD 8.25 billion
EESC association	Yes
Typical projects	Industry, building and renewable energy
Type of contract	Shared saving, Guarantee Saving

Table 2.4 EESCs's Status in Indonesia

List	Description
Market	
- Status	Developing
- Potential	USD 4 billion
-Investment size	Not available
EESC association	Yes
Typical projects	Industrial sector, single technology
Type of contract	Guarantee Saving

Table 2.5 EESCs's Status in Philippines

List	Description
Market	
- Status	Not yet mature
- Potential	USD 250 million
-Investment size	Not available
EESC association	No
Typical projects	Industrial and commercial sector
Type of contract	Share saving and Energy Supply Contract

Table 2.6 EESCs's Status in Malaysia

List	Description
Market	
- Status	Not yet mature
- Potential	USD 400 million
-Investment size	Not available
EESC association	Yes
Typical projects	Industry and building
Type of contract	Share saving and Guarantee Saving

Table 2.7 EESCs's Status in Singapore

List	Description
Market	
- Status	Developing
- Potential	USD 450 million
-Investment size	Not available
EESC association	Yes
Typical projects	Industry and building
Type of contract	Share saving and Guarantee Saving

Table 2.8 EESCs's Status in Thailand

List	Description
Market	
- Status	Growing
- Potential	USD 500 million
-Investment size	USD 100-200 million
EESC association	Yes
Typical projects	Industry
Type of contract	Guarantee Saving

Table 2.9 EESCs's Status in Vietnam

List	Description
Market	
- Status	Beginning
- Potential	Not Available
-Investment size	USD 312 million
EESC association	None
Typical projects	Demonstration project
Type of contract	Share saving

2.2 Enterprise Risk Management Theories and Concepts

2.2.1 Risks

Risk comprises of events, probability, and then combined to impact, and the direction of the impact can be either negative or positive, or both. (Corsican, 2014; Edwards & Bowen, 2005; Holton, 2004; ISO 31000, 2018; Kuratko & Welsch, 2001, p. 212; Rowe, 1977; SEAI, 2013; Shimpi, 2001; Skipper, 1997). The negative impact can be thought of as threats while the positive impact can be thought of as opportunity. This study investigates events, risk drivers, or barriers that generated threats or negative impacts to EESCs industry in Thailand.

The following table summarizes definitions of risks from various researchers.

Table 2.10 Definition of Risk

Definition of Risk	Researchers
Risk is a probability event with the negative outcomes.	Rowe (1977)
Risk does not have a universal definition. One way to express it is by noticing vary results.	Skipper (1997)
Risk is the degree of uncertainty and the likelihood of losses relating to the outcome of an action.	Kuratko and Welsch (2001)
Risk is like the blood that feeds the organization and the management responsible for various functions has to face whatever happens.	Shimpi (2001)
The risk is in the exposure to uncertain results.	Holton (2004)
Risk is prevailed and can be perceived and inevitable.	Edwards and Bowen (2005)
Risk is any factors, events, or influences that are detrimental to the success and proceeding of the project in terms of cost and quality.	SEAI (2013)
Risk refers to any event or action that may occur under uncertain circumstances and it is able to affect, damage (both in monetary and non-monetary terms), cause failure, or reduce the opportunity to achieve organizational objectives and goals successfully in the aspect of strategy, operation, financial, and legal/regulatory compliance, or create positive impact: measured by the impact and likelihood of the event.	The Secretariat of the Senate (2011, 2016)
Risk is the effect of uncertainty on firm purposes and its effect can be positive and negative deviation from what is expected.	ISO 31000 (2018)

From definitions of risks found in several literatures, the definition of risk in the research is as follows.

"Risk is an event/(s) that is/(are) likely to endanger the success of the energy efficiency services in Thailand."

However, there is a word named "uncertainty" which its context is similar to risk. Both risk and uncertainty have things in common that is we are unable to know what event will occur in advance and the difference is that, for risk, we can predict the probabilities of an individual event that may occurs, but for the uncertainty we are unable to know the probability of each event that may occur (Knight, 1921).

2.2.2 Enterprise Risk Management

Miller, Kurunmäki, & O'Leary (2008, p. 944) opined that uncertainty refers to a wider range of events than risks and the risk is part of that uncertainty. Callon et al. (2009) proposed a method for separating risk from uncertainty by dividing the uncertainty into three groups similar to Knight's view. The first group is uncertainties with known probability distribution. The second group is uncertainties which the probability distribution is not directly known, but it can be inferred by statistical principles. The third group, known as Knightian uncertainty, is uncertainties in which the probability of an event cannot be calculated because the probability distribution cannot be determined at all. Therefore, the uncertainties in the first two groups are considered as risk while the uncertainties in the third group are not.

Henry Fayol introduced the concept of risk management in business management strategies in 1916. Gallagher (1956) later published the idea to the public in 1956 under the article "Risk Management: A new Phase of Cost Control". Risk management has been in an uptrend since mid-1990s due to several factors including: economic reasons and changes in the competitive environment, which tend to be more uncertain and complex (Chapman & Ward, 2003; Floricel & Miller, 2001; Giddens, 2003; Miller, 1998; Rahman & Kumaraswamy, 2002).

ERM, that are new contexts replacing silo-based risk management, may also have different names such as "business risk management", "strategic risk management", "holistic risk

management", "integrated risk management", "corporate risk management", or "enterprise-wide risk management" (Golshan & Rasid, 2012).

Verbano and Venturini (2013) classified prevailing risk management concepts from various literatures into 9 groups as following.

1) Enterprise risk management (ERM) is the process of determining how to manage risk exposure in integrating manner systematically throughout the organization, including risk identification, risk assessment, and risk response by taking into account the likelihood, the significance level of impact, and the interrelating effect between each pair of risks that may affect firm value and profits in order to control risks under acceptable levels within policies and objectives set.

2) Strategic risk management (SRM) is the process of identifying and evaluating strategic risks that impede the achievement of financial and operational goals. The strategic risk types to consider are technology risk, personnel risk, competitiveness risk, project risks, etc. (Chatterjee, Wiseman, Fiegenbaum, & Denvers, 2003). The SRM is suitable for strategic management in senior levels.

3) Financial risk management (FRM) is the process of adding economic value by applying financial methods to manage risk levels such as interest rate risk, liquidity risk, inflation risk, credit risk, etc. (Crockford, 1986). FRM focuses on managing only one aspect of the business's financial risk.

4) Insurance risk management (IRM) is a pure risk management where there is a potential for losses solely arising from the environment, society, people, and types of technology by collecting statistical data from past events to calculate insurance premiums (Gahin, 1967). Insurance risk management is more suitable for the insurance industry than the EESC industry.

5) Project risk management (PRM) is a process that consists of an objective identification process, identification of the source of risk, risk analysis, and risk response with a balanced view of risk and opportunity (Thevendran & Mawdesley, 2004) over the life of the project. Risks include technological, organizational, contracting, finance, economics, and political risks. Most of PRMs are related to construction projects and are used only for companies that have income from

construction mainly. PRM is only a part of ERM because construction companies are exposed to risks that are beyond project risk and that affect the achievement of all company objectives (Zhao, Hwang, & Low 2013) and PRM are limited to the achievement of project objectives. (Liu et al., 2011).

6) Engineering risk management (EnRM) is management, planning, design and operation in engineering that are complex and continuous. It is a proactive approach to solving problems based on technical and operational factors (Regan & Patè-Cornell, 1997) and therefore it does not cover enterprise-wide risk management.

7) Supply chain risk management (SCRM) is the development and collaboration with business partners involving in the supply chain to manage risks and uncertainties such as logistics, finance, information, relationships, and innovation (Norman & Lindroth, 2002). However, SCRM is part of the ERM and is classified at the process level.

8) Disaster risk management (DRM) is a holistic and flexible management of community supervision by issuing measures to reduce the risk of disasters such as natural disasters, terrorism, epidemics and accidents (Garatwa & Bollin, 2002). DRM has very little business involvement.

9) Clinical risk management (CRM) is a clinical quality and safety management used to identify causes of patient safety risks and to search for prevention and control of those risks. CRM relates to human, organizational, and technological involvement (Walshe & Dineen, 1998). CRM aims to improve the safety and quality of patient care and to reduce the costs of risks of healthcare organizations (Verbano & Turra, 2010). CRM has almost no connection with EESCs' business.

Therefore, in this research paper, ERM approach was selected as the scope of study and theory because it can cover the enterprise-wide risks by taking into account the impact of various risks as well as it is suitable for application at the organizational level and at the broader ESSC industry.

There were more than 80 risk management frameworks globally (Olson & Wu, 2015). Risk and Insurance Management Society (RIMS) (2011) studies risk management information, especially corporate risk management from more than 20 million references, and suggested that six of them were widely used as risk management standards and were considered as best practices.

These standards were well accepted worldwide as they were prepared by an international, regional or national organizations such as 1) SOLVENCY II of Risk Management for Insurance Industry from European Union, 2) ISO 31000 Risk Management, 3) Open Compliance Ethics Group (OCEG) "Red Book" Governance, Risk Management and Compliance GRC Capability Model from the United State of America, 4) BS31000 code of practice for Risk Management from England, 5) COSO Enterprise Risk Management from the United State of America, and 6) FERMA A Risk Management Standard from Federation of European. The objectives of these standard are concluded as following.

1) For improving the ability to achieve or exceed the set criteria by supporting decisions and activities in identifying important issues of uncertainty

2) For control and compliance purposes to follow rules and laws for insurance or transfer the risk through control and compliance processes based on historical information about loss and almost loss

3) For supervision operations that can then be used when applying for obtaining standards and for serving as evidences to present that the supervision is consistent with the needs of the organization

Such standards and practices are often conceptualized with few recommendations for practical operations and the standards are similar in majority with few differences. The elements of these standards will be utilized or adapted for each organization. The unique characteristics of each standard are as follows.

1) SOLVENCY II is a regulatory standard for insurance companies in the European Union. It identifies the need for financial assets, registered capital, governance, risk management, and disclosure of information and transparency Therefore, this standard is limited in use for insurance companies in the European Union.

2) ISO 31000 is a framework guideline for translating risk events to the impact of risks and risk management that affects organizational objectives. It attempts to forecast difficult and challenging events. It focuses more directly on risk management as a strategic discipline in decision making to risk adjustments rather than compliance with regulations.

3) Open Compliance and Ethics Group (OCEG) “Red Book” or GRC Capability Model is an integration between governance, risk management, and compliance capabilities that address Principled Performance or performance against objectives, risk arising from uncertainties, and compliance with both mandatory and voluntary requirement by especially utilizing information technology resources for achievement. Risks are assigned to have a limited role by focusing on identifying and limiting risks that have the potential to adversely affect to organizational objectives.

4) BS 31100 standard is very similar to ISO 31000 standard because it is an adopted version of ISO 31000.

5) COSO focuses on the level of responsibility of the executive committee and senior levels. In this regard, the executive committee and senior levels do not only have to support risk management, but also play as a key role to directly involve in the ERM processes. It also emphasizes on the importance of contemplating risks in terms of the strategy-setting process and in driving performance.

6) Federation of European Risk Management Associations (FERMA) standard is not designed to establish processes or conditions for enterprise risk management. Rather, it describes the essential aspects of the risk management framework and perspective on European issues. For the best practice of the self-regulated organizations, the organization can realize both upside and downside risks to create value for the organization and its shareholders.

It can be seen that standardized and international risk management frameworks that open to be applied with a wide variety of industries are COSO-Enterprise Risk Management and ISO31000-Risk Management.

The COSO Enterprise Risk Management (COSO ERM)

The Committee of Sponsoring Organizations of the Treadway Commission (COSO) was established by a special organization consisting of committees that work on the development of internal control systems from various associations representing the boards of directors of five professional institutions in the United States such as The American Institute of Certified Public Accountants (AICPA), The Institute of Internal Auditor (IIA), The Financial Executives Institute

(FEI), The American Accounting Association (AAA), and Institute of Management Accountants (IMA).

The COSO guidelines for risk management in the United States of America are governed by the Sarbanes-Oxley Act (SOX) applicable to US listed companies. In Japan, adopted versions of COSO ERM are governed by the Japanese Sarbanes Oxley (J-SOX) and in Europe, they are governed by European Sarbanes Oxley, which has similar regulatory principles as SOX (Charoenkijjarukorn, 2013).

COSO's risk management procedures are applicable with for-profit or non-profit organizations. In Thailand, there are organizations that adopt the COSO ERM framework including Energy Conservation and Promotion Fund and the Stock Exchange of Thailand, and etc. The development of the COSO ERM model is based on the concept of internal control which helps organizations achieve their policies and objectives by mitigating risks that may arise and promote enhancement of firm value and performance (COSO, 2017).

ISO 31000 ERM

ISO 31000 ERM framework belongs to the International Organization for Standardization (ISO), located in Geneva, Switzerland. For Thailand, Thai Industrial Standards Institute, Ministry of Industry, have been adopted this framework and principles under the standard name "TIS 31000-Principles and Guidelines for Risk Management" by translating from the original English version. It can be applied with both public and private organizations with all sizes and types of businesses, but have to be applied specifically with each business without requiring certification. This standard is particularly suitable for manufacturing factories.

From the two standard risk management frameworks, it can be seen that the EESC business in Thailand is more suitable to be apply with the COSO standard as it is more relevant. This is because there are other important domestic agencies referring to COSO's risk management framework, such as the Stock Exchange of Thailand that is the main institution used to raise fund from equity, covering the private sector. The Secretariat of the House of Representatives also used it as a guideline for the internal audit purposes in the government sector, and etc. In addition, the Stock Exchange of Thailand and the Ministry of Finance recommend the listed companies

(including commercial banks in Thailand) and state enterprises to use COSO framework as a guideline for risk management (Khanthavit, 2008).

This study employs enterprise risk management system to identify the crucial factors, both internal and external, that affect the EESCs performance from proceeding business in the past. There are three concepts underpinned ERM i.e., 1) internal control (The Committee of Sponsoring Organizations of the Treadway Commission, COSO) 2) corporate and auditing accountability, responsibility, and transparency (Sarbanes–Oxley Act of 2002), and 3) strategic planning (COSO, 2004). The objective of risk management is not to eliminate risk entirely, but to improve and enhance efficiency to an organization (Sheffi, 2007). The application of ERM is to increase competitive advantage to business (Jalal et al., 2011; Jalal Karim, 2013; Kimbrough, 2006; Liu, 2011; Platt 2004; Stroh, 2005; Walker, 2013), achieve goals and objectives of an organization (Damodaran, 2008; Espejo & Schwaninger, 1993; Espejo et al., 1996; Gaultier-Gaillard, Louisot, & Rayner, 2009; Mintzberg et al., 2005), reduce earning variability, stabilize firm performance, encourage employees (Lam, 2001), and maximize firm value (Beasley & Frigo, 2007; CAS, 2003; COSO, 2004; Hoyt & Liebenberg, 2010; Pagach & Warr, 2011). The deployment of ERM in real business sectors closed to EESCs characteristics are Small and Medium Enterprise (SME) in Republic of Ghana (improve the success in business risk management) (Abotsi, Dake, & Agyepong, 2014), oil refinery (Mackay & Moeller, 2007), and energy relating industry for risk identification (often use higher than other sectors) (Colquitt, Hoyt, & Lee, 1999; Kleffner, Lee, & McGannon, 2003).

Enterprise Risk Management can be viewed in two perceptions: 1) academics and 2) organizations relating to business. Those definitions are summarized in the following table.

Table 2.11 ERM Definitions under Academic Perception

ERM Definition	Researchers
ERM has transformed silo-base risk management approach, ad hoc, and narrow perspectives to integration, continuation, and a holistic perspective.	Barton, Shenkir, & Walker (2002)
ERM is the concept that an entity uses to identify and measure risks that arise, including operations and competition, and to consolidate all risks under a single framework as opposed to silo-base risk management.	Harrington, Niehaus, & Risko (2002)
ERM is a management process in which company executives identify and assess risks that impact on firm value and create firm-wide risk management strategies.	Meulbroek (2002)
ERM requires a firm-wide approach to manage risk across the company by identifying, assessing and controlling risks.	Kleffner et al. (2003)
ERM facilitates the organization in integrating enterprise-wide risk in a holistic approach and enhances proactive management strategies in addition to the staunchly passive approach.	Liebenberg and Hoyt (2003)
ERM is a firm-wide risk management system, not isolated by independent departments. It has been structured to help manage the business goals that are to increase the asset value of the firm through debt and equity management.	Verbrugge et al. (2003)
ERM is a structured approach. Principles are established to help executives understand and manage uncertainty by integrating all the risks of a business in a holistic view.	Sobel and Reding (2004)

Table 2.11 (Continue)

ERM Definition	Researchers
ERM is a process influenced by the Board of Directors, executives and others. It is applied by strategic planning across the organization. It is designed to identify events that risks can be managed in order to achieve organizational objectives.	Moeller (2007), p. 50
ERM is a comprehensive and holistic standard and approach for the entire organization to manage risks.	Pagach and Warr, (2010), Mikes (2009)
ERM is a process that the Board of Directors use to formulate strategies, identify events that affect the company, assess and manage risks, and as a guarantee of the company in achieving the goals and objectives of the organization.	Romney and Steinbart (2012)

Table 2.12 ERM Definitions in the View of Organizations Relating to Business

ERM Definition	Researchers
ERM is a complex and multifaceted process of optimizing the appropriate risk taken for each organization.	Holton (1996)
ERM is a systematic approach for interrelationship management in order to minimize the variation, to mitigate the inherent risks, and to increase the positive synergies.	Deragon (2000)
ERM is a systematic and integrated approach to manage all risks that an organization faces.	Dickinson (2001)
ERM is the assessment and determination to address the risks, arising from all sources, that exhibit a threat to business objectives set, or an opportunity to seek a competitive advantage.	Miccolis, Hively and Merkley (2001)

Table 2.12 (Continue)

ERM Definition	Researchers
ERM is a rigorous process for assessing and finding thought of managing risks from all sources that endanger the strategic objectives of an organization.	Miccolis (2003)
ERM is a management process, influenced by firm's Board of Directors, management, and other persons, applied with strategy set out for the entire organization, designed to identify events that may occur or affect the firm in order to manage risk under an acceptable level, to provide reasonable assurance in relation to objective achievement of the firm.	COSO (2004)
ERM is the mean by which an entity is confident that all risks are taken into account i.e. the group of expectations of the management committee, shareholders and the Board of Directors regarding acceptation or rejecting to risks, the group of approaches to avoid situations that may incur losses beyond acceptable levels, method of translating costs and benefits into risks and rewards, an approach that support fulfillment to the basic responsibilities of the management committee and senior managers, a smart tool and system for mitigating excess risk, and the language used in communication to maintain a risk management approach.	S&P (2008)

Table 2.12 (Continue)

ERM Definition	Researchers
ERM is a structured, consistent and continuous process across the whole firm for identifying, appraising, deciding on responses to and reporting on opportunities and threats that influence the achievement of firm's purposes.	IIA (2009)
ERM is a strategic business discipline that supports the achievement of a firm's purposes by seeking all risks and managing the total risk impact that combines interrelated effects of all risks.	RIMS (2011)
ERM is a process of identifying and prioritizing critical risks that an organization is facing, quantifying their impact on financial and strategic purposes, and implementing financial and organizational solutions to address them.	CAS (2019)

Bromiley et al. (2015) summarized opinions of various ERM commentators that there are three associable issues: 1) managing all risks together as a portfolio. (Bromiley et al., 2015) was more effective than managing various risks in isolation (Markowitz, 1952); 2) strategic risks must be incorporated into existing risk factors such as risks that create liabilities and accidents; 3) Risk must not be viewed as a solely eliminated problem, but to add that risk is an opportunity (Bromiley et al., 2015; Collier, 2009) where a business can seek a competitive advantage that is the expertise in managing specific risks, while others have the disadvantage and cannot accept those risks.

The ERM definitions from these literatures mention similar meaning about process, operation, assessment, management, control, and monitoring regarding risks in holistic view, and bringing risks under acceptable levels and firm policies specified by board of directors, executive boards, and shareholders in order to achieve objective strategically. Relying on conclusion of Bromiley, McShane, Nair, & Rustambekov (2015), Markowitz (1952), and Collier (2009) combining with previous perceptions and definitions regarding ERM, this study defines enterprise risk management (ERM) for EESCs as

"The process of integrated and systematic setting approach of management of risks that EESCs have been exposing to. The risk management approach consists of specification of causes of risks, risk assessment, and risk response by taking into account the likelihood of severity, impacts, and the relationship between each pair of risks that are harmful to value of the business and profits in order to control the overall business risks under appropriate and acceptable risk level accordance with the policy framework and strategic objectives set."

The modeling of causal factors affecting the ERM for the EESC business will be useful in making strategic decisions for achieving the organization's objectives, and in setting guidelines for the operation effectively in order to reduce the effects of risk events, to add value to shareholders and other stakeholders, and to lead to the success of the industry (Global Association of Risk Professionals (GARP), 2008; Page & Meyer, 2000; Shaw, 2010).

2.2.3 Enterprise Risk Management Process

The COSO-ERM 2004, Enterprise Risk Management - Integrated Framework, concept defines a top-down approach in the management hierarchy (COSO 2004, p. 86) based on the perception of organizational management which responsibilities are delegated in an orderly manner through the organizational hierarchy (COSO, 2004, p. 85) by assuming that everyone in the organization involves in responsibilities of the organization's vision, mission, and objectives. The company assesses the success of its staff based on their assigned duties and leadership that can be determined and measured similar to risk drivers, but COSO-ERM does not address uncertainty management.

COSO has established a risk management framework to demonstrate the relationship and coherence between the achievement of organizational objectives and goals in 4 areas, 8 components of risk management approach, and in relation to the 4 levels of organization as played in a 3-dimensional format as follows.

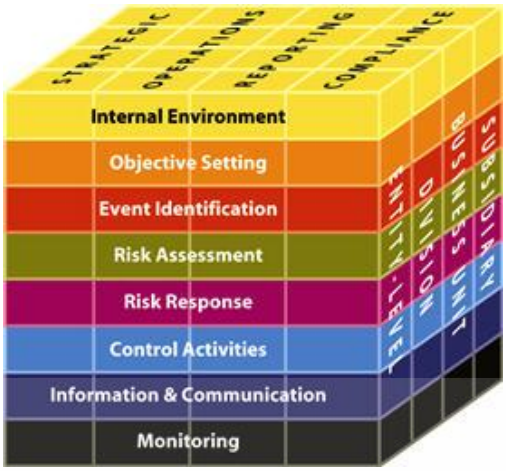

Figure 2.4 COSO ERM 2004 Framework

Source: COSO (2004)

Following the COSO 2004, the COSO-ERM 2017 framework, Enterprise Risk Management - Integrating with Strategy and Performance, emphasizes the relationship between risk and value and focuses on the integration of ERM in strategic planning and embedding it throughout an organization with 5 components that align to the business life cycle and 20 supporting principles that collectively explain the ERM framework as illustrated by the following picture.

Figure 2.5 COSO 2017 ERM Framework

Source: COSO (2017)

According to the COSO risk management framework, this study defines the definition of risk, addresses activities and events that may be the causes of risks in EESC industry from literature review, set level of risk impact into 5 levels (subject to respondents' opinions in the research questionnaire, identifies risk drivers with reliable references to support, synthesizes a research conceptual framework model, assesses the risks impact by combining their interactive effects in the research model, concludes results, and suggest solutions by taking into account the achievement in 4 areas**:** Strategic, Operations, Financial Reporting, and Compliance, in relation to top management level and business division such as the accounting and finance function and the operation level**.** This research limits the scope of study at risk assessment and the research recommendation is a part of risk response. The firm performance and internal and external environment are also incorporated with the conceptual model as the integration parts.

2.3 Enterprise Risks

Dickinson (2001) defined enterprise risk as "the extent to which the outcomes from the corporate strategy of a company may differ from those specified in its corporate objectives, or the extent to which they fail to meet these objectives (using a ``downside risk'' measure)".

Naumoff and Shipley (2007) described enterprise risks by 3 factors such as strategic risk, financial risk, and reputation risk for energy efficiency play in risk and risk management.

Based on the definition of risk and ERM in this study, Enterprise Risks is the overall effects of all events that are likely to harm business achievement in providing energy efficiency services.

2.3.1 Risk management model

A model is the result of a structure or a system that is created from an initial object or original process and then is projected over and over again (De Vos 2003; Cooper & Schindler, 2001). The new model can be different from the prototype for the purpose of the creator to use (De Vos, 2003). For the risk management model, interactions among risk factors are incorporated into

the model (Lynch, 2003, p. 17) that was recreated in response to the specific risk management solutions by developing pre-existing risk models (Daniell, 2000, p. 6).

To create a risk management model in relation to the COSO ERM guidelines, risk drivers or causes of risks are categorized into each applicable risk category to help the management perceive the holistic picture of the risk at the corporate or entity level. These risk categories at the entity level are referred to as the fundamental risk categories, meaning that they cannot be categorized to a higher level of risk (Proctor, McKibben, & Oliva, 2008). Items below the fundamental risk category are causes of risks that relates to each fundamental risk category (Kmec, 2011). The group of risk events can be classified into internal factors, namely those that the organization can control, for example: infrastructure, people, processes, systems, and technology, and external factors that cannot be controlled by the organization i.e., economic conditions (i.e., exchange rate and interest rate), business conditions, competition, customer demand, applicable laws and regulations, the development of technology, environment, politics, and society (O'Donnell, 2005).

2.3.2 Risk Classification

In risk identification process, risk drivers are grouped under organization chart and business activities (Rao & Goldsby, 2009) depending on appropriateness (Association of Insurance and Risk Managers (AIRMIC), The Public Risk Management Association (ALARM), & Institute of Risk Management (IRM), 2010). In general, risk categories are ranged from three to five risk classes for a firm (Panjer, 2006).

CAS (2003) categorized risks into four categories: 1) strategic risk means damages to i.e. reputation (e. g., brand or trade mark deterioration, fraud, and lack of public appreciation), competitive advantage, customer demand, demography, social trends, innovative technology, capital adequacy, and trends in law and politics; 2) financial risk consists of the prices (of the asset value, interest rate, exchange rate, commodities, etc.), liquidity (cash flow, call risk, opportunity cost, etc.), reliability (such as default on debt and downgrade of credit rating, etc.), inflation rate or purchasing power, and hedging; 3) operational risk consists of business operations (e.g. human

resources, product development, productivity, efficiency, failure in production or service, distribution channel management, supply chain management, and business cycle), empowering employees (e.g. leadership, adaption to the change, etc.), information technology (such as relevance and availability), business reporting (such as budget and planning, accounting information, provident fund, investment appraisal and taxation); 4) hazard risk consists of fire damage, property damage, wind storm, disaster, theft, crime, personal injury, business interruption, disease, disability, and claims.

Lam (2003), who previously served as Chief Risk Officer at GE Capital, categorized risks into three groups 1) strategic risk (e.g., legal risk Patents and environment); 2) operational risk (e.g., customer and merchant insurance); 3) economic risk refers to the risk associated with the firm solvency (e.g., credit, assessment of the company's investment risk, currencies, and interest rates, etc.) which have elements of a sources of risks similar to financial risk.

Lajili and Zéghal (2005) used disclosure information on risk management in annual reports of companies listed on the Canadian Stock Exchange (as a part of the TSE 300 Index) ended December 1999, totaling 228 companies and grouped risk classes into the following risk categories**:** Financial risk is the risk arising from currency, interest rate, credit, financial instruments value; Market risk includes competition risk and loss of customers; Environmental risk; Government regulation risk; Operational risk is the risk arising from technical failure, labor disputes, natural disasters, human error, loss of certain key employees, and insufficient resources; Supplier risk; Natural resource risk i.e. low quality of reserves and low supply; Technology risk i.e. rapid technological change; Weather risk; Seasonality risk; and Cyclicality risk.

The Committee of European Banking Supervisors (CEBS) (2006) described the implications of various aspects of risks in the Pillar2 guidelines (a revision of supervision on required capital known as Basel Capital Accord or Basel II) that required financial institutions to reserve sufficient capital to accommodate the risks or damages that may occur in the Annex I as follows**:** 1) Strategic risk covers existing risks and potential future risks that affect profit and capital due to changes in the business environment combined with wrong decisions, improper responses after making a decision, or a lack of response to changes in the business environment. 2)

Operational risk is the risk that results in loss due to inadequacy or failure of internal operating processes i.e., from people and systems or arising from external events from i.e., legal risks, IT risks, and human integrity.; and 3) Reputation risk is existing risks and potential future risks affecting profit and capital due to a bad image in the perception of customers, contractors, investors, or the regulators.

Skipper and Kwon (2007) describes risk management in the insurance business in relation to four types of risks: strategic risk, financial risk, operational risk, and hazard risk.

World Energy Council (2008, p. 63) concluded that EESCs in general faced risks in terms of technical risk, financial risk, operational risk, credit risk, and etc.

Moeller (2007, 2011) categorized risks into four categories: strategic risk, operational risk, (including process-related risks, compliance, and human resource management), financial risk (including risks related to money management, reliability, and security trading), and information risk (referring to the risk associating with information on financial, operational, and the use of information technology).

Subramaniam et al. (2011) studied the effects of perceived business uncertainty, external consultants and risk management on organizational outcomes by from members of the Chartered Institute of Management Accountants in the UK and classified risks into operational risk, financial risk, environmental risk, technological risk, reputation risk, and other risks.

Canadian Institute Chartered Accountants (2012) distinguished different types of risks into strategic risk, financial risk, operational risk, leadership risk, non-conformity risk, unforeseeable risk, and reputation risk.

Elliott (2013) expressed the goal of ERM as the holistic management of all corporate risks which are strategic risk, operational risk, financial risk, and hazard risk.

Ai, Bajtelsmit, & Wang (2014) has categorized the risks for construction business into four categories: project risk, operational risk, financial risk, and physical hazard risk. They viewed project risk and financial risk as both opportunity and threat, while operational risk and physical hazard risk are one-sided risk of loss.

Ben-Amar, Boujenoui, & Zéghal (2014) explained that companies experienced with a total of 16 different risks and can be categorized into 3 large groups: strategic risk, financial risk, and operational risks. Sub-risks are grouped into 3 main categories as follows:

1) strategic risk covers market risk, weather risk, seasonality, government regulation, political risk, and cyclicality;

2) financial risk covers currency risk, credit risk, interest rate risk, and the value of financial instrument risk;

3) operation risk covers environment risk, natural resources, operation risk, suppliers, and technology.

Gaudenzi, Confente, and Christopher (2015) surveyed data from a sample of multinational companies operating in Italy. These companies are in the manufacturing and service sector including Manufacturing & Production, Health Care, Services, Information and Communication Technology (IT & Telecommunication), and Construction & Real Estate. They categorized risks into 5 key categories: Macro-environment risk as the cause of external and hard-to-predict risk factors (i.e. politics, regulations, natural disasters, and market demand), Financial risk, Operational risk, Supply chain risk (i.e. the lack of integration within the supply chain and design, the need for flexible processes, and insufficient supply), and Other risks including causes of risk that cannot be categorized into other groups (i.e. human resource issues and intellectual property (ISO 31000, 2018)). They systematically combined impacts of all 5 risk factors into Reputational risk for assessment in the form of risk exposure.

Sprčić, Kožul, and Pecina (2015) described that ERM is a combination of activities and strategies that the company have to specify, measure, utilize, control, and monitor the different types of risk exposure such as strategic risk, financial risk, operational risk, reporting risk, and compliance risk to add business value to stakeholders.

From literature review on risk classification under ERM, this study concludes that there are four to five major risk categories able to be grouped together i.e., strategic risk, operational risk, financial risk, reputation risk, and other risks.

1) Strategic Risk (SR)

Miller and Bromiley (1990) defined strategic risk as the threat of bankruptcy of the business. It can be measured by firm's investments in capital, investments in research and development, or from financial leverage. High investment value will affect the uncertainty of profit. Advances in external technology can also affect the profitability of previously invested funds and limit the resources that can be used to further invest in the future.

Bell, Marrs, Solomon, & Thomas (1997) opined that business risks represent threats to an organization's ability to carry out business activities effectively according to established procedures, including the creation of value to customers to accomplish the objectives that were strategically planed.

Slywotzky and Drzik (2005, p. 80) defined strategic risk as the sequence of external events and trends of external events that can damage the growth of the business and its value.

Johnson, Scholes, & Whittington (2006, p. 369) explained that strategic risks are either the opportunities or consequences of strategy failures.

Ben-Amar et al., (2014) suggested that strategic alternatives are an important factor in creating a risk management strategy. Top management and the Board of Directors have to develop a better corporate strategy plan to be able to anticipate risks in advance for good corporate governance and to increase the efficiency of company management.

From literature review, strategic risk (or business risk, Ben-Amar et al., 2014) means events from external factors together with events from internal factors having probability that undermine business growth or firm value detract from the initial objectives or onset strategies (Bell et al., 1997; Ben-Amar et al., 2014; Johnson et al., 2006; Slywotzky & Drzik, 2005; Miller & Bromiley, 1990). External factors are laws, regulations, economics, social (Aon Risk Solutions, 2013; Bateman & Snell, 2012; COSO 2004; Hitt, Duane, & Hoskisson, 2014; Kim & Mauborgne, 2004; Slywotzky & Drzik, 2005), market and customers' demand, technology and industry change, and competitors (Slywotzky & Drzik, 2005). Internal factors are project proceeding, business management, risk management, strategic pursuance after making decision, lacks of monitoring, and

lacks of responses or prevention in due course (Aron, Clemons, & Reddi 2005; Jones, Santori, & Ingram, 2006; Lenckus 2006; Miller & Bromiley, 1990).

The definition of SR in this research summarized from above literatures is as follows.

Strategic Risk (SR) is defined as incidents or external factors associating with events or factors in business that have any opportunities to damage the growth of the business or the value of the business to deviate from the original objectives or strategies that have been laid.

Risk drivers from outside the organization are such as laws, regulations, economy, society, market and customers' needs, technology, industry, and competitors.

Risk drivers from internal business are project operations, business management, risk management, pursuing strategies that has been decided, the lack of monitoring, the lack of appropriate responses, or the lack of business protection in time.

2) Operational Risk (OR)

Peccia (2001, p. 15) construed that operational risk is the potential for losses due to people, processes, technology and dependence on external environment.

Basel Committee on Banking Supervision (BCBS) (2017) defined operation risk as "Operational risk is defined as the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events.". This definition includes legal risk, but excludes strategic and reputational risk.

From literature review, operation risk means events having probability that cause failures to internal working process or insufficiency. The risk divers of events are from internal operation, human resource management, use of technology or information technology, supply chain management, or operation management to comply with relevant regulation (BCBS, 2017; Committee of European Banking Supervisors (CEBS), 2006; Crouhy, Galai, & Mark, 2014; Gaudenzi et al., 2015; Jüttner, 2005; Lam, 2000; Merna & Al-Thani., 2008; Moeller, 2007, 2011; Peccia, 2001a, 2001b; Wagner & Bode, 2008).

The definition of OR in this research summarized from above literatures is as follows.

Operational Risk (OR) is defined as incidents that are likely to cause errors or failures in working process within the organization or inadequacy from risk drivers pertaining internal work

processes, human resource management, the use of information technology, procurement in the supply chain, and compliance with existing regulations.

3) Financial Risk (FR)

Blach (2010) defined financial risk in two folds 1) in broader sense**:** financial risk means changes in the financial status of the company, the volatility of the company's cash flows, firm performance and value that are influenced by market mainly e.g., interest rate, exchange rate, commodities, and security prices, and 2) in a narrow sense**:** including capital structure risk, liquidity risk, and insolvency risk (or long-term stability risk).

From literature review, financial risk means events having probability that cause damages to business financial. The risk drivers or events are credit worthiness of business, debtors' credit, and variability of market prices and economics e.g., exchange rate, commodity prices, interest rates, inflation, financial costs, liquidity of assets, or cash flow. (Blach**.** 2010, CAS, 2003; Charles, 2004; Gaudenzi et al**.**; Jorion 2007; Kloman, 2010; Miller & Bromiley, 1990)

The definition of FR in this research summarized from above literatures is as follows.

Financial Risk (FR) is defined as the incidents that have are likely to cause damage to the financials relating to business as a result of financial creditability of the company, the ability to pay the debt of the company or the debtors of the company, market prices, and economic conditions such as fluctuations in exchange rates or currency, commodity prices, interest rates, inflation, financial costs, and liquidity of assets, and available cash flows.

4) Reputation Risk (RR)

Another risk category that can be categorized is Reputation Risk. The definition of reputation risk begins with the definition of "reputation" as the result of past actions that the company's stakeholders view and there may be differences in each observer. Reputation assessments are based on the financial, social and environmental impact to the company (Barnett, Jermier, & Lafferty, 2006; Lange, Lee, & Dai, 2011; Walker 2010). There are empirical evidences revealed that companies with positive reputation tend to have good financial performance and non-financial companies benefited from positive reputation more than the financial institution

companies (Deephouse, 2000; McGuire, Schneeweis, Branch, 1990; Raithel & Schwaige, 2014; Roberts & Dowling, 2002).

Scott and Walsham (2005, p. 311) presented the academic work on a reimagining of the reputation risk concept by defining reputation risk as static and qualifying reputation as an organization's asset. The new definition of Scott and Walsham (2005) was influenced by the globalizing knowledge economy that drove the organization's reputation risk. They see reputational strategy as a key to serve as a strategic boundary object that connects communities, society, and organizations. In the era of the globalizing knowledge economy, businesses face the challenge of building relationships by creating stakeholders' confidences. The extent to which the boundary is connected is continuously changing in terms of social responsibility and politics. Reputation risk management cannot be ignored by being inactive.

Keh and Xie (2007) studied relationship of reputation to customer trust and to customer identification that led to customer purchase intention, price premium, and customer commitment from 351 customers of three different B2B service firms in China. A is computer network service providers (203 respondents). B is document translators (68 respondents). C is merchandisers (80 respondents). The study showed that relationship between reputation and customer trust was positive as well as relationship between reputation and customer identification. The high regard of reputation of companies affected customers' belief that companies were capable and honest in doing business. Apart from that, customers were willing to associate in dealing business in order to gain business acceptance in return. In addition, reputation was important in supporting business connection and prevent uncertainty in Chinese culture. The consequence of the decrease in uncertainty strengthened customer purchase intention, price premium, and customer commitment. The customer trust had a greater influence on customer purchase intention than willingness to pay a higher price (price premium) while customer identification had a greater influence on price premium than customer purchase intention.

Naumoff and Shipley (2007) cited risk definition for energy efficiency from website bankersonline.com that "reputation risk is the current and prospective impact on earnings and capital arising from negative public opinion." The effect of reputation risk is on the firm's ability

to find new or continue relationships. The firms may expose to litigation, financial loss, or a decline in their customer bases. Reputation risk exposure prevails throughout the organization and includes the responsibility to act with caution in dealing with its customers and the community.

Wang, Berens, & van Riel (2012) studied the reputation of the organization from two independent factors such as trustworthiness and attractiveness in the perception of investors and identified their impacts on lower financial costs and flexibility of capital structure. The trustworthiness and attractiveness are measured by data obtained from Reputation Institute (RI), a consultant firm that rates reputation of companies in 29 countries around the world. There are approximately 60,000 respondents a year. The researchers sampled 424 companies in 25 industries from 22 countries. Fifty percent of respondents are from the United State of America, thirty percent of which are from Europe, and twenty percent of which from other regions. The measurement for financial cost and flexibility of capital structure is from data on financial statements over the past 3 years from 2006-2009 such as Market Value Leverage, Market-to-Book Ratio, Profitability, Asset Tangibility, and Net Sales. This study shows that trustworthiness, viewed as intangible resources, can increase business competition in leads to lower financial costs. In the meantime, attractiveness decreases uncertainty of firm capability and increase advantage in flexibility of capital structure by having variety of options in raising funds. Another conclusion is that the firm that have high trustworthiness does not necessarily have high attractive and vice versa. Moreover, an emotional factor can influence the investor's decision making besides from rational factor alone. The study encourages management to create reputation while taking costs into consideration.

Accenture and Oxford Economics (2013) explained that the importance of reputation risk management has been growing in energy and utilities companies in proceeding their business in the eyes of social media and unconventional pressure groups. Operational risk failures also contributed to reputational risk. Many firmed realized these challenges by extending the role of the risk management function into operational and reputational risk.

In this study, the reputation risk (intangible sources of risks) is added in addition to conventional risks i.e., strategic risk, operational and financial risk (COSO, 2018 p. 5) as a complement to cover the remaining aspects of risks.

The definition of RR in this research summarized from above literatures is as follows.

From literature review, reputation risk means events having probability that negatively affects reputation, attitude, perception, credit, and confidence towards business form the view of stakeholders, thus resulting in damage to business in terms of revenue, business proceeding, supply chain, and acquisition of capital (Accenture and Oxford Economics, 2013; CEBS, 2006; Comité Européen des Assurances & Groupe Consultatif Actuariel Européen (CEA & Groupe Consultatif), 2007; Connell & Voola, 2007; Dollinger, Golden, & Saxton, 1997; Eberl and Schwaiger, 2005; Gatzert & Schmit, 2016; Gaultier-Gaillard et al., 2009; Graham & Bansal, 2007; Keh & Xie, 2007; Naumoff and Shipley, 2007; Scott & Walsham, 2005; Shane & Cable, 2002; Turban & Cable, 2003; Van den Bogaerd & Aerts, 2015; Walsh, Bartikowski, & Beatty 2012; Walsh, Mitchell, Jackson, & Beatty 2009; Wang et al., 2012; Yoon, Guffey, & Kijewski, 1993).

Reputation Risk (RR) is defined as incidents that are likely to adversely affect the reputation, attitude, image, credibility, or confidence towards the company from the point of view of any stakeholders, and may thus resulting in damage to the revenue of the business, supply chain, or acquired capital.

In order to group the risk drivers into proper and relevant risk categories, this study explores variety of risk classification from several literatures and materials, as concluded in the following table as sub- risk classes, and found that the classification of risks does not closely conform to theoretical and traditional categories perceived by enterprise risk management, thus creating difficulties in confirming and exploiting them as measured variables according to ERM frameworks.

Researchers who mentioned regarding all types of relevant risks (ER) for EESCs are shown in the following table.

Table 2.13 A Summary of Variety of Risks Found in Global EESCs from Literature review

No	Types of Risks	Description	Researchers
1.Strategic Risk			
1.1	business risk	Risk arising from customers or market needs, behaviors, and acceptance in the use of EESCs' services in energy saving projects, and competition in the EESC industry	Hu and Zhou (2011), Marino, Bertoldi, Rezessy, and Boza-Kiss (2010)
1.2	policy risk	Risks arising from the change of government regulations, government policies, and politics	Garbuzova-Schlifter and Madlener (2014), Internal Energy Agency (2010), SEAI (2013), Shang, Zhang, and Liu (2008), Wang and Chen (2008)
1.3	technology risk	Risks arising from technology changes, selection, use of equipment, and the effectiveness and efficiency of technology	Ellis (2010), Hu and Zhou (2011), Internal Energy Agency (2010), Mills, Kromer, Weiss, and Mathew (2006), SEAI (2013), Wang and Chen (2008)

Table 2.13 (Continue)

No	Types of Risks	Description	Researchers
2.Operation Risk			
2.1	human resource risk	Risks arising from the lack of EESCs' staff with sufficient knowledge, expertise and experience	Garbuzova-Schlifter and Madlener (2014), SEAI (2013)
2.2	technical & operational risk	Risk arising from of technology failure, maintenance and repair risks, inaccurate or unacceptable measurements and saving results	Ellis (2010), FEMP (2015), Hansen (2006), Internal Energy Agency (2010), Marino et al. (2010), SEAI (2013), WEC (2008)
3.Financial Risk			
3.1	finance risk	The risk arising from financial costs such as exchange rates, inflation, energy prices, wages, construction, installation and equipment prices, actual savings, or payment of counterparties	FEMP (2015), Garbuzova-Schlifter and Madlener (2014), Hansen (2006) Hu and Zhou (2011), Internal Energy Agency (2010) WEC (2008)
3.2	financing risk	Risks arising from acquisition of funds and debt guarantees	Hansen (2006) Hu and Zhou (2011), Shang and Liu (2008), Wang and Chen (2008), WEC (2008)

Table 2.13 (Continue)

No	Types of Risks	Description	Researchers
3.3	project risk	The risks arising from the implementation of energy saving projects and their impact on the project costs and revenues including inadequate assessment of the project risks and feasibility, inaccurate saving estimation, delays in contract preparation and management, procurement and ordering of equipment, installation and construction, design and contractor commissioning	Garbuzova-Schlifter and Madlener (2014), Hansen (2006), Hansen et al. (2009), Internal Energy Agency (2010), SEAI (2013), Vechakij (2015)
4.Reputation Risk			
4.1	reputational risk	Any activities that negatively affects the EESCs' reputation from the view of relevant stakeholders i.e., customers or financial institutions, and etc.	Accenture and Oxford Economics (2013), Naumoff and Shipley (2007), SEAI (2013)

However, this study concludes both common (similar findings from non-Thai reference literatures) and country-specific (as referred directly by Vechakij and interviewing with Vechakij and Achawangkool by Hansen) barriers and problems (risk drivers) and categorized them based on the above four risk definitions with criteria that each problem and obstacle is selected with at least 3 supporting articles (except at least 1 supporting article in the case of Thailand) and found 37 risk drivers in total, as illustrated in Table 2.14. All risk drivers are used in questionnaire as question items for respondents from EESCs to rate their impacts.

2.3.3 Problems and obstacles of EESCs in global business

Problems and hindrances of EESCs can be both common and differences in relation to regions, countries, and economics.

Howard (2003, p. 7-9) mentioned the global common hindrances as follows.

1) Financial problems. As EESCs bear responsibilities on performance quality which was recorded in company financial account and exhibited unimpressive financial performance, the financial institutes are unwillingly to extend large loan to EESCs to acquire energy equipment and fund operation expenses throughout period of contracts. Therefore, EESCs will lack fund to implement new projects, especially for small and medium companies that have already used up their collateral.

2) Risk from acquiring funds from financial institutes due to unfamiliarity with Guarantee Saving Contract. The unfamiliarity resulted in stringent loan approval, due to doubts on the following risks.

The saving performance depends on EESC service ability, but financial institutes take responsibility to pay short fall saving throughout guarantee period whether EESCs still in operation or not. As a result, the risk of financial institutes is high if EESCs performance does not fulfill. Efficiency of equipment and quality of operation also effect saving.

Lengthy periods of contracts are another concern of financial institutes as EESCs can be out of business before contracts end thus resulting in loss of loan repayment.

Technology risk. As contracts demand high saving on long duration, EESCs' proposals on new higher efficiency technologies without long track record evidences may create discrepancy of saving between proposals and reality and result in EESCs' compensation for the shortfall.

Period of loan repayment. Financial institutes prefer short period repayment while EESCs prefer long period.

To cover these risks, financial institutes trimmed down the loan amount and attached stringent conditions, such as high interest rate, more collaterals, hence EESCs suffer from the lack of liquidly and high financial cost.

Kleindorfer (2011) studied risk management, problems and obstacles in implementing energy efficiency projects in developing countries (by using the classification criteria such as Per Capita Income or Per Capita Gross National Product. The study found that there were 4 major problems and obstacles namely 1) a lack of rationality and feasibility assessment in financing projects, 2) a lack of good organizational management for implementing projects, 3) a lack of perspective on project risks, and 4) management did not realize the true value of the projects. The method for measuring risks arising from problems and obstacles in item 3 consists of 2 dimensions 1) external factors measured by energy intensity and 2) internal factors measured by the level of complexity of contracts and organizations. The researcher proposes a risk management framework which is the objective of this article 1) setting strategic objectives and performance evaluation methods, 2) identification of causes of risks, 3) risk assessment, and 4) mitigation and prevention of risks, and 5) project preparation and monitoring.

2.3.4 Problems and obstacles of EESC in Thailand

Obstacles of EESCs in Thailand partly resulted from customers' incomprehension of EESCs. Even though the financial institutes may know EESCs considerably well, through government introduction, but their direct financial assistance to EESCs was not impressive and mostly carried out under government co-financial scheme. To enhance better understanding, government also provided non cash assistance such as public communication, marketing events and etc. (Hansen et al., 2009, p. 167-181).

Vechakij (2015) and Hansen et al. (2009, p. 167-181) categorized EESCs hindrances in to four main concerns as follows.

1) Technical: due to unfamiliarity with energy efficiency projects, lack of confidence in new technology, lack of personnel, bad experience on former projects, unimpressive performance resulted from unqualified EESCs or contract, few local manufactured equipment, difficulty and high cost, in case of import equipment, in management, operations, and maintenance.

2) Financial: due to financial institutes' inaccessibility, limited fund, concern on liquidity and limited resources. Customers allocated their budgets, mainly to other high prioritized activities

rather than energy efficiency. EESCs have to assist financial institutes in energy efficiency project evaluation.

3) Unavailability of managerial time to initiate new projects and supervise the ongoing projects.

4) Customers have no policy to invest in non-core business with no budget to engage high quality consultants, and lack of internal competency to manage energy efficiency projects.

Hansen et al. (2009, p. 179-181) concluded that EESCs required technology, engineering, marketing, technology, closely monitoring projects, and contract management skills, EPC and law comprehension, measurement and verification, financial and accounting management, and operation skills to handle problems and obstacles of EESCs in Thailand.

From literature review, it can be concluded that problems and hindrances which pose risks and significantly generate effects to the studied EESC business are numerous, but they can be classified into four main categories which can be similar or different in characters as shown in below Table.

Table 2.14 Risk Identification for the EESC Industry Concluded from Literature Review

ER	Risk drivers (EESCs' problems and barriers)	References
Strategic Risk (SR)		
SR1	Customers had limited insight into the energy efficiency technology and credit ability of ESCOs' prior undertaking such as data originality, limitation, conditions, etc., which lead to concerns regarding EESCs' exploitation.	1,2,3,4,5,6,7,8
SR2	Customer top executives required a high return on investment projects for energy efficiency, or there is no policy on the latter.	1,2,3,4,5,7,8
SR3	Negative attitudes of customers' operation staff toward EESCs' employment due to fear of work interference or job uncertainty.	2,4,5
SR4	Small customers lacked interest in EESCs' employment due to limited financial resources, non-sizeable savings, and less financial attractiveness for energy efficiency projects.	2,4,5,6
SR5	Small customers did not have enough staff and knowledge to oversee and verify EESCs' performance.	2,8
SR6	EESCs' proposals were derived from a different basis. It is difficult for customers to compare, evaluate, and decide.	5,6,7,8
SR7	Customers collaborated under a moral obligation, while EESCs expected full collaboration under contract obligation.	1,2,3,4,5,6,7
SR8	High net worth customers had technical and financial competency and thus were likely to implement plans by themselves.	2,3,5
SR9	Customers required highly experienced third-party inspectors or consultants to ensure fairness in savings and costs.	1,2,3,4,5,6,7,8
SR10	Public policies on supporting EESCs lacked clarity and continuity.	1,2,3,4,5,6,7,8

Table 2.14 (Continue)

ER	Risk drivers (EESCs' problems and barriers)	References
SR11	Public fiscal tax and financial support were ambiguous, but unanswerable to EESCs' needs.	1,2,3,5,6,7,8
SR12	Public procurement regulations awarded bidding on the lowest price basis, not on lifecycle cost.	1,2,3,4,5,6,7,8
SR13	New technologies with better efficiency and return emerged continuously. Hence, reaping the maximum benefits of projects was unlikely.	1,2,3,4,5,6,7
SR14	Trustworthy proven evidence based on continuous and long-time operation rarely existed, thus posing risks on saving evaluations and guarantees.	1,2,3,4,5,6,7
Operation Risk (OR)		
OR15	EESCs absence of unified and simplified measurement and verification standards rendered sophisticated and costly expeditions.	1,3,4,5,6,7,8
OR16	Inadequate qualified staff to execute deals and monitor projects en masse, particularly in SMEs, which are numerous and costly.	2,4,6,8
OR17	EESCs' absence of unified and simplified measurement and verification standard rendered sophisticated and costly expeditions.	1,3,4,5,6,7,8
OR18	EESCs' disability on measurement and verification accuracy led to unacceptable results by customers.	1,2,3,4,5,6,7,8
OR19	Improper use and maintenance or equipment failure rendering lower than expected savings.	1,2,3,6,7,8
OR20	Discrepancies on guarantee issues between EESCs and technology suppliers.	1,3,6

Table 2.14 (Continue)

ER	Risk drivers (EESCs' problems and barriers)	References
OR21	EESCs' high reliance on external technologies resulted in high costs and complicated management structures.	3,8
OR22	EESCs difficulty in accessing customers' real energy usage information led to inaccurate and uncertain saving estimations.	1,2,3,4,5,6,8
Financial Risk (FR)		
FR23	Customers intentionally withheld payment to EESCs.	1,2,3,5,6,8
FR24	Long-term payment nature of energy projects was unattractive to customers and financial institutes.	1,2,3,4,5,8
FR25	EESCs needed long terms and large funding amounts, hence exposure to high and fluctuating cost changes, i.e., interest rates or bank guarantee fees.	1,4,5
FR26	Regulated or subsidized energy prices distorted saving and payback periods.	2,3,4,5,6,7
FR27	Accounting rules rendered compliance difficulties in book entry and tax management for obtaining tax privileges, i.e., capital expenditures (Board of Investment) or expenses (Department of Revenue).	1,3,5
FR28	Financial institutes lending criteria are based on securities rather than project financing. Thus, EESCs with limited collaterals faced difficulties in gaining credit lines.	1,2,3,4,5,6,8
FR29	EESCs with small registered capital hardly were qualified to bid on large-scale projects.	1,3,5,6,7,8

Table 2.14 (Continue)

ER	Risk drivers (EESCs' problems and barriers)	References
FR30	EESCs' operating cash flow was inadequate, and access to funding sources was limited.	1,2,3,4,6,7,8
FR31	EESCs' excessive lead time in project and contract preparation caused extra unforeseen expenses.	3,4,5,7,8
FR32	EESCs' saving estimation error, or customers' energy consumptions, deviated from the baseline, and relocation or stopping operations was detrimental to financial performance.	1,2,3,4,5,6,7,8
FR33	EESCs' delayed project operation brought extra burden on expenses, project costs, and overhead costs later.	7,8
Reputation Risk (FR)		
RR34	Customers were unfamiliar with roles and the importance of EESCs in materializing significant energy saving.	1,2,3,4,5,6,7,8
RR35	Financial institutes possessed limited information and staff who understood EESCs' business and presumed EESCs to be a high-risk business.	1,2,3,4,5,6,7,8
RR36	EESCs' past performance record and reputation in view of customers were under par.	1,2,4,5,6,7

RR37	Failures of some EESCs in the past tarnished the ESCO industry reputation.	2,3,5,6,7,8

Table 2.14 (Continue)

World	Developing countries	EU	Russia	China	Thai
1. Hansen et al. (2009) 2. WEC (2008)	3. Ellis (2010) 4. Internal Energy Agency, (2010)	5. Marino et al., (2010)	6. Garbuzova-Schlifter and Madlener (2014)	7. Hu and Zhou (2011)	8. Vechakij (2015)

2.4 Enterprise Risk Management Measurement

Enterprise Risk Management can be measured by the Enterprise Risk Management Index (ERMI). ERMI is an index that measures the level of successful enterprise risk management (Gordon et al., 2009; Nan, 2015; Panicker & Hiremath, 2016). It indicates the level of adoption of ERM or the successful level of ERM adoption. It also measures the achievement level of firm

objectives in 4 dimensions that are strategic, operations, financial reporting, and compliance with applicable laws and regulations (COSO 2004).

$$\text{ERMI (ERM Index)} = \sum_{k=1}^{2}\text{Strategy}_k + \sum_{k=1}^{2}\text{Operation}_k + \sum_{k=1}^{2}\text{Reporting}_k + \sum_{k=1}^{2}\text{Compliance}_k$$

Each dimension comprises of 2 measured variables totaling 8 dependent indicators. The higher the index value as well as each component, the more success for a firm in achieving goals and objectives.

2.4.1 Strategy (S): Strategy measures the firm market share acquisition and systematic risk (uncontrollable external factors) diversification compared with competitors in the same industry as they designate attaining for top level goals and missions. The two sub-indicators are explained as follows:

Strategic effectiveness1 (S1): This indicator measures the competitive strategy in gaining market share in the same industry (Ai, Brockett, Cooper, & Golden, 2011; Porter, 2008). This is the ratio between deviation of sales of a firm compared with average sales of the same industry and standard deviation of sales of the industry.

S1 is the Sales standard deviation (Sales SD)

$$\text{Strategic effectiveness1: } S1 = \frac{\text{Sales}_i - \mu\text{Sales}}{\sigma\text{Sales}}$$

where

Sales$_i$ is the sales of company i for each year,

μSales is the average sales of an industry for each year,

σSales is the standard deviation of sales of all companies in the same industry.

(Gordon et al., 2009; Nan, 2015; Panicker & Hiremath, 2016)

Strategic effectiveness2 (S2): This indicator measures the diversification of firm risks compared with the competitors in the industries. A firm able to diversify risk exposure better than competitors can reduce return volatility to its shareholders (Nocco & Stulz, 2006; Hoyt & Liebenberg, 2010; Tufano, 1996; Thompson, 1984). This indicator reflects firm performance and financial risks through beta (systematic risk measurement) calculation.

S2 is the measurement of the risk diversification of the company (measured by β) so that firm specific risks (controllable risks) disappear and only undiversified or systematic risk of the firm is compared to the average systemic risk of the whole industry.

S2 is the company risk diversification compared to industry.

Strategic effectiveness2: $S2 = \frac{\Delta\beta_i - \mu\Delta\beta}{\sigma\Delta\beta}$

where

$\Delta\beta_i$ is the change of systematic risk (measured by β) between in previous year t-1 and year t or $-(\beta_{i\,t} - \beta_{i\,t-1})$,

$\mu\Delta\beta$ is an average industry $\Delta\beta$ in year t,

$\sigma\Delta\beta$ is a standard deviation of $\Delta\beta$ for all companies in the same industry (Gordon et al., 2009; Nan, 2015; Panicker & Hiremath, 2016),

Due to the fact that most EESCs in Thailand are private firm and non-listed, therefore this study uses β for private firm formula (Damodaran, 2012) as follows:

β private firm = βunlevered (1 + (1 - tax rate1) (Industry Average Debt/Equity)

β unlevered = βlevered / (1 + (1 - tax rate2) (Debt/Equity))

where

βunlevered is the β of unleveraged companies (without debts), in energy sector, listed on The Stock Exchange of Thailand (SET). βlevered is the β of leveraged companies (with debts), in energy sector, listed on The Stock Exchange of Thailand (SET).

Tax rate1 is the tax rate of non-listed juristic person (EE) registered in Thailand.

Tax rate2 is the tax rate of juristic persons listed on SET.

Industry Average Debt/ Equity is the mean of ratio between debts and equity of all companies, in energy sector, listed on SET.

Debt/Equity is the ratio of debt to equity for each EE.

Therefore, Strategy (S) is defined as company positioning in the market compared to competitors. The consideration of the level of success in strategic planning of the company can be done by considering two factors which are comparison of the standard deviation of sales compared to the standard deviation of the overall sales of the industry, and the diversification of the company to reduce all existing risks.

2.4.2 Operation (O): Operation measures the efficiency for a firm in generating output compared to resources input. The measurement of operational efficiency was from a concept of efficiency in internal operation of business that compares ratios between input and output (Banker, Data, & Kaplan, 1989). The higher the efficiencies, the lesser the risks of failures (Gordon et al., 2009). The successful level comprises of two sub-factors which are

Operation efficiency1 (O1): The efficiency of utilizing assets to generate revenue, or the asset turnover ratio (Kiymaz, 2006).

The high ratio indicates that the company is efficient in utilizing company assets.

O1 (Total assets turnover ratio) = Sales/Average Total Assets

where

Sales is the net revenue for year t,

Average Total Assets is the average total assets between year t and t-1

(Gordon et al., 2009; Nan, 2015; Panicker & Hiremath, 2016).

The using of average of total assets instead of total assets at the end of year reflects the utilization of total assets at the beginning of the year towards total assets at the end of year.

Operation efficiency2 (O2): The efficiency in utilizing employees to generate revenue, or the employee turnover ratio (Gordon et al., 2009).

Operation efficiency2 : O2 (Employee turnover ratio) = Sales/ Average Number of Employees

where

Sales is the net revenue for year t.

Average Number of Employees is the average total employees between year t and t-1. (Gordon et al., 2009; Kiyamaz, 2006; Nan, 2015; Panicker & Hiremath, 2016)

Therefore, Operation (O) is defined as the success level of the efficiency of the output compared to the use of inputs or resources of the company. The determination of the success level consists of the efficiency of utilizing all assets of the company for generating income, and the efficiency of hiring employees of the company in order to generate income.

2.4.3 Reporting (R): Reporting measures quality level of financial statement reliability that reflects overall risk exposure that causes failures to business. ERM can enhance effective and quality of report relating to risks (Lam, 2003). A firm reported to have poor reliability of financial reporting also has poor performance, high risk of failure, and decreased firm value (COSO 2004). Reliability of financial reporting can be determined by two sub-indicators which are auditor opinions (Gordon et al., 2009; Nan, 2015; Panicker & Hiremath, 2016) and accounting manipulation (Dechow, Sloan, & Sweeney, 1995; DeFond & Jiambalvo, 1994; Defond & Subramanyam, 1998; Gordon et al., 2009; Jones, 1991; Nan, 2015; Panicker & Hiremath, 2016).

Reporting reliability1 (R1) in financial statement comprises of 3 attributes as follows:

(1) Material control weakness. Value is 0 if there is no comment in audited financial report, or -1 otherwise.

(2) Auditor opinions. There are 4 types of opinions which are unqualified opinion, qualified opinion, disclaimer opinion, and adverse opinion. Value is 0 for unqualified opinion, or -1 otherwise (qualified opinion, disclaimer opinion, and adverse opinion).

(3) Restatement. Value is 0 if there is no restatement mentioned, or -1 otherwise.

R1 = Material Control Weakness + Auditor Opinion + Restatement

The range of R1 is between -3 to 0. The value of 0 means that the financial statement is the most reliable, and scores lower than zero means financial statement is lesser reliable. (Gordon et al., 2009; Nan, 2015; Panicker & Hiremath, 2016).

Reporting reliability2 (R2): Accounting manipulation can be determined by ratio between normal accruals and total accruals. The difference between total accruals and normal accruals is abnormal accruals or discretionary accruals which is assumed as creative accounting and less reliable than normal accruals (DeFond & Jiambalvo, 1994; Defond & Subramanyam, 1998; Jones, 1991). The high ratio indicates high reliability of financial statement.

$$R2 = \frac{|\text{Normal Accruals}|}{|\text{Normal Accruals}| + |\text{Abnormal Accruals}|}$$

where

AA is short for Abnormal Accruals (discretionary accruals).

NA is short for Normal Accruals (non-discretionary accruals).

NA = TA – AA

TA is the total accruals of an EE company.

$$TA_{it} / A_{it-1} = \alpha[1/A_{it-1}] + \beta_{1t} [\Delta REV_{it} / A_{it-1}] + \beta_{2t} [PPE_{it}/A_{it-1}] + e_{it}$$

where t is the year in focus.

TAijt is total accruals for firm i in industry j, or the difference between earnings before extraordinary items minus cash flow from operation.

Aijt-1 is total assets for firm i in industry j for year t-1.

ΔREV_{ijt} is the change of net revenue for firm i in industry j in year t.

PPE_{ijt} is the gross property, plant, and equipment for firm i in industry j at the end of year t.

e_{ijt} is the error term of linear regression for firm i in industry j for year t or AA in other word.

(Gordon et al., 2009)

Therefore, Reporting (R) is defined as the level of the quality of the financial statements that reflects overall risks of failures to the company. A company with a low reliability of financial reporting will reduce the level of performance and the value of the business. The reliability of the financial report can be considered from opinions of the company's auditors and the creative accounting.

2.4.4 Compliance (C): Compliance designates a successful level for a firm in decreasing overall risk of failure, increase performance as well as firm value by complying with applicable laws, regulations, agreements, or contract obligations. There are two sub-indicators to evaluate the success in compliance:

Compliance1 (C1): The proportion of auditor's fee to net revenue. Auditors usually quote their fees based on sales, complexity of transactions and business as these factors positively correlate to auditor effort, services, and quality in auditing financial statement (Gordon et al., 2009; Nan, 2015; Panicker & Hiremath, 2016). A high-quality standard auditor firm usually charges auditor fees at premium.

Compliance1 (C1) is the auditor's fees to net revenue and scaled by average total assets.

C1 = Auditor Fees/Average Total Assets

where

Auditor Fees is the auditors' fee for year t,

Average Total Assets is the average total assets between year t and t-1.

(Gordon et al., 2009; Nan, 2015; Panicker & Hiremath, 2016)

The use of average of total assets instead of total assets at the end of year reflects the utilization of total assets at the beginning of the year towards total assets at the end of year.

Compliance2 (C2) is the net settlement in gain or loss over total assets. Gordon et al. (2009) proposed the ratio between the actual net settlements to total assets in relation to concept of Shavell (1982) in the extent to which the disputes are ceased if and only if net settlement is reached. Therefore, actual net settlement in gain or none penalty indicates successful enterprise risk management in compliance aspect, and vice versa.

C2 = Net Settlement Gain (Loss) / Average Total Assets

where

Net Settlement is the actual net settlement for year t.

Gains mean net settlement was received as revenue (positive firm performance), while losses (negative firm performance) mean net settlement was paid as expenses to counterparties by EESCs.

Average Total Assets is the average total assets between year t and t-1.

(Gordon et al., 2009; Nan, 2015; Panicker & Hiremath, 2016)

The use of average of total assets instead of total assets at the end of year reflects the utilization of total assets at the beginning of the year towards total assets at the end of year.

Therefore, Compliance (C) is defined as the level of success of a company that can reduce the risks of failures, and the level of adding value to the business, complying with laws, rules, regulations, agreements, and contracts. The evaluation of the successful compliance is determined by the ratio of auditor fees compared to the average total assets, and the net penalty ratio compared to the average total assets.

2.5 Contingent Variables

Not only is appropriate enterprise risk management system for a particular organization affected by causes of risks, grouped into risk categories, but also vary by contingent variables (or control variables) influence enterprise risk management framework to firm financial performance (COSO 2004; Gordon et al., 2009; Panicker & Hiremath, 2016). Therefore, contingent variables for an organization in this study means factors that may affect Enterprise Risk Management and then affecting to the firm financial performance. There are five common factors: environmental uncertainty, industry competition, firm size, firm complexity, and monitoring by board of directors (Gordon et al., 2009; Panicker & Hiremath, 2016; Sithipolvanichgul, 2016).

2.5.1 Environmental Uncertainty (EU)

Environmental uncertainty creates difficulties for a firm in predicting future events outside companies, managing risks, generating earning, and creating firm value. There are many studies connecting environment uncertainty to earning volatility or firm performance (Chenhall & Langfield-Smith, 1998; Chenhall, 2003; Gordon et al., 2009; Liebenberg & Hoyt, 2003; Luft & Shields, 2003; Panicker & Hiremath, 2016; Sithipolvanichgul, 2016; Tymon, Stout, & Shaw, 1998) and EU is defined as any changes or variability in environmental factors outside the organization that affect difficulties in doing business, and they negatively impact on the value of the business and their causes are from unpredictable future events, thus resulting in firm performance.

Environmental uncertainty is measured by 3 aspects of changes in a firm's external environment. (Gordon et al., 2009; Kren, 1992) (1) Market indicated by Coefficient of Variation of Sales: Market CV), (2) Technology indicated by Coefficient of Variation of Capital Expenditures and R&D: Tech CV, and (3) Income indicated by Coefficient of Variation of Net Income before Taxes: Income CV). EU combined the 3 indicators by using the following formula.

$$EU = \log\left(\sum_{k=1}^{3} CV(X_k)\right)$$

$$CV(X_k) = \frac{\sqrt{\sum_{t=1}^{3} \frac{(Z_{k,t} - \bar{Z}_k)^2}{3}}}{|\bar{Z}_k|}$$

$Z_{k,t} = (X_{k,t} - X_{k,t-1})$, $X_{k,t}$ = uncertainty k in year t, $CV(X_k)$ = coefficient of variation of uncertainty k, t= 1,2,3 to represent years 2013-2015, k = 1,2,3 are Market, Technology, and Income.

$\bar{Z}_k$ is the mean of change in uncertainty k over for the past years of observations. The absolute value is imposed in order to avoid negative value that turns an uncertainty event into opposite certainty event.

2.5.2 Industry Competition (CI)

Industry competition reflects competition in gaining market share or sales, benefits from cost effectiveness, and risks of not maintaining profits above sustainable level when compared with

rivals in the same industry. CI is defined as intense level of competition in the industry and it is determined by the concentration of market share which is calculated from sales of the companies in the same industry. The higher the competition in an industry means the higher the need to adopt enterprise risk management system, and more risks towards earning volatility. (Gordon et al., 2009; Panicker & Hiremath, 2016; Sithipolvanichgul, 2016).

Industry competition is calculated by one minus the Herfindahl-Hirsman Index (HHI). HHI is applied for measuring industry concentration. The higher the industry concentration means the higher the competition. HHI = sum of squared all market shares for each companied in an industry. Market shares = $Sales_i$ / Total Sales of the Industry.

2.5.3 Firm Complexity (FC)

Complexity of a firm, determined by business units and transactions, create difficulties and risks to management within organization, integration of information, and excessive expenses for controlling and monitoring business units. (Bodnar, Tang, & Weintrop, 1999; Doyle, Ge, & McVay, 2007; Ge and McVay, 2005; Gordon et al., 2009; Panicker & Hiremath, 2016; Sithipolvanichgul, 2016). The complexity of a firm positively correlates to the need for enterprise risk management system (Gordon et al., 2009; Panicker & Hiremath, 2016; Sithipolvanichgul, 2016).

Firm complexity is defined and measured by the numbers of business segments within a company. The larger the business units mean the more complexity, the more difficulties in management, and the more need for enterprise risk management. (Doyle et al., 2007; Ge and McVay, 2005; Gordon et al., 2009).

2.5.4 Firm Size (FS)

Not only firm size relates to enterprise risk management (COSO 2004), but also performance of a firm (Beasley, Pagach, & Warr, 2008; Gordon et al., 2009; Liebenberg & Hoyt, 2003). Therefore, FS is defined as company size. A large firm has potential benefits in obtaining the economies scale and requires adoption for higher level of enterprise risk management (Beaseley et al., 2008; Hoyt & Liebenberg, 2010; Lin, Wen, & Yu, 2012). There are 2 applicable variables

which are market value or total assets (Gordon et al., 2009). Because most EESCs are non-listed, this study uses total assets.

FS = ln (Total Assets)

This study applies natural logarithm to total assets to control firm's size effect because Gordon., et al. (2009) and Cater (2006) found that the firm's size negatively relates to firm's value.

2.5.5 Monitoring by Board of Directors (MBD)

Active participation from company's board of directors influences the success of enterprise risk management within an organization (COSO, 2004; Gordon et al, 2009; Grace, Leverty, Phillips, & Shimpi, 2015; Sobel & Reding, 2004). Company's board of directors have important role in encouraging the adoption of enterprise risk management strategy (Kleffner et al., 2003). MBD is defined as proactive participations of the Board of Directors and this character results in required successful risk management. Therefore, monitoring by board of directors is positively related to successful enterprise risk management (Gordon et al., 2009; Panicker & Hiremath, 2016).

MBD = numbers of directors/ln (sales)

Taking on natural logarithm to sales is to control scale effect (Gordon et al., 2009).

Other contingent variables

Apart from factors that Gordon et al. (2009) proposed above, Sithipolvanichgul (2016) has proposed other contingent factors i.e.

Firm Leverage (Geringer, Tallman, & Olsen, 2000; Tallman & Li, 1996) measured by

-Long Term Debt/(Total Liability + Shareholder Equity) and

-Book Value of Equity/Market Value of Equity (Hoyt & Liebenberg, 2010)

Most EESCs are non-listed so the data are not available. Sithipolvanichgul (2016) found that it insignificant affected FFP.

Reputation measured by numbers of years since inception of the company. Sithipolvanichgul (2016) found that it insignificant affected FFP.

Sale Growth (Hoyt & Liebenberg, 2010) Sithipolvanichgul (2016) found that it insignificant affected FFP.

Economic Factor measured by

1) Δ% GDP of each sector of industry (Sithipolvanichgul, 2016) (available on the Bank of Thailand website)

2) Δ% GDP / Δ% ROA (McNamara & Duncan, 1995)

Sithipolvanichgul (2016) found that Economic Factor significantly affected the FFP. However, data for EESCs are not available.

2.6 Firm Financial Performance

Enterprise risk management provides integrated framework that involves objective achievement to an organization and maximize firm value as well as shareholder value by setting strategy and objectives to obtain an optimal balance between growth and return goals and related risks, and efficiently and effectively uses resources in pursuit of the firm's objectives (Beasley et al., 2008; COSO, 2004; Hoyt & Liebenberg, 2010; ISO 31000, 2018; Pagach & Warr, 2011). Enterprise risk management helps reduce overall risk exposure of a firm thus leading to higher firm performance (Ellul & Yerramilli, 2013; Florio & Leoni, 2017; Nocco & Stulz, 2006), increases firm and shareholder value (Bowen et al., 2006; Gordon, et al., 2009; Gupta, 2011; ISO 31000, 2018; Lam 2001; Nocco & Stulz, 2006; Woon, et al., 2011), and has positive impact to firm performance (Arnold et al., 2015; Baxter et al., 2013; Subramaniam et al., 2011).

Although ERMI can be used to measure the level of success of ERM in strategy, operation, reporting, and compliance, but did not directly connect to firm financial performance indicators. There are fairly some researches, that studied the relationship between ERM and firm performance and market performance, based on empirical evidences, illustrated relationship between ERMs and

firm performance (Baxter, Bedard, Hoitash, & Yezegel, 2013; Farrell & Gallagher, 2014; Florio & Leoni, 2017; Hoyt & Liebenberg, 2010; McShane, Nair, & Rustambekov, 2011). Florio and Leoni (2017) argued that those researches are rare because of the difficulty in explaining a direct relationship between ERM and performance. A simple explanation is that a good business performance is a result of the reduction in risks (Ellul & Yerramilli, 2013; Nocco & Stulz, 2006). Therefore, the researcher has added more indicators that are used to measure the financial performance to investigate the effect of the level of ERM in Thailand EESCs industry to firm financial performance as confirmed by empirical evidences.

In this study, firm financial performance is based on accounting-based measurement because almost EESC companies in Thailand are non-listed. In addition, accounting-based measurement takes into account internal operation profit generated by organizational resources while market-based measurement is affected by external factors that are most indirectly relate to firm management and cannot be directly observed. Therefore, Firm Financial Performance (FFP) is defined as the latent variable that reflects firm financial performance and value of firm, or equity exploited, as a result of employing enterprise risk management. (Baxter et al.,2013; Bromiley, 1991; COSO, 2004; Ellul & Yerramilli, 2013; Fisher & Hall, 1969; Florio & Leoni , 2017; Gordon et al., 2009; ISO 31000, 2018; Laisasikorn & Rompho, 2014; Mirza & Javed, 2013; Nocco & Stulz, 2006; Santos & Brito, 2012; Zou & Hassan, 2015).

Al-Matari, Al-Swidi, and Fadzil (2014) explained that measuring an organization's financial performance based on accounting figures (Accounting-based measurement) is a measure of the profitability of a company in comparison with a benchmark that is the rate of return on average capital costs. They concluded the use of financial ratios for firm performance measurement that, out of 19 ratios (Return on Assets: ROA, Return on Equity: ROE, Return on Sales: ROS, Return on Investment: ROI, Profit Margin: PM, Operating Cash Flow: OCF, Earnings per Share: EPS, Operation Profit: OP, Growth in Sales: GRO, Return on Capital Employed: ROCE, Expense to Assets: ETA, Cash to Assets: CTA, Sales to Assets: STS, Expenses to Sale: ETS, Labor Productivity: LP, Cost of Capital: COC, Return on Revenue: ROR, Profit per Employee: PPE,

Return on Fixed Assets: ROFA), ROA was used 46 percent and ROE was used 27 percent from several literatures.

Mirza and Javed (2013) studied the factors affecting the firm financial performance on 60 non-financial companies listed on the Karachi Stock Exchange 100 (KSE 100-index), Pakistan over the period of five years (2007-2011) and found that Risk Management (consists of 2 variables: 1) business risk measured by standard deviation of ROA and 2) financial risk measured by standard deviation of share price changes), Ownership Structure (measured by 2 variables: 1) major shareholder ≥ 10 percent and 2) blockholding), and Inside Ownership have significant positive effect on an ROE because proper risk management can increase corporate profits and lead to higher dividend payouts.

The financial performance indicators are selected in this study as they related to enterprise risk management in relevant literatures as follows:

2.6.1 Return on Assets (ROA)

This is the ratio between net profit and average total asset value. (Al-Matari et al. 2014; Baxter et al., 2013; Bromiley, 1991; Laisasikorn & Rompho, 2014; Lin, Liao, & Chang 2011; Mirza & Javed, 2013; Santos & Brito, 2012).

ROA = Net Profit/The average of Total Assets

2.6.2 Return on Equity (ROE)

This is the ratio between firm net profit and the common equity. (Al-Matari et al., 2014; Bromiley, 1991; Laisasikorn & Rompho, 2014; Lin et al., 2011; Santos & Brito, 2012).

ROE = Net Profit/The average of Total Shareholders' Equity

2.6.3 Earnings Per Share (EPS)

This is the ratio between net profit and the numbers of common shares for each year (Al-Matari et al., 2014; Laisasikorn & Rompho, 2014; Al-Manaseer, Al-Hindawi, Al-Dahiyat, & Sartawi, 2012; Junarsin 2011; Tsegba & Ezi-Herbert, 2011; Lin et al., 2011).

EPS = Net Profit/ The outstanding numbers of common shares

2.7 Hypothesis Development

2.7.1 Scope of variables

The variables used in this research were studied, reviewed, compiled, and collected from ERM concepts, theories, literatures, and related researches from various sources, in both domestic and international sources, and then are summarized into variables for this study as follows.

2.7.1.1 Exogenous latent variables: 2 variables

1. Enterprise Risks (ER) comprises of 4 observed variables which are:

1) Strategic Risk (SR);

2) Operational Risk (OR);

3) Financial Risk (FR);

4) Reputation Risk (RR).

2. Contingent Variables (CoV) comprises of 5 observed variables which are:

1) Environmental Uncertainty (EU);

2) Industry Competition (CI);

3) Firm Complexity (FC);

4) Firm Size (FS);

5) Monitoring by Board of Directors (MBD).

2.7.1.2 Mediator/Intervening construct variable: 1 variable

Enterprise Risk Management (ERM) comprises of 4 observed variables which are:

1) Strategy (S);

2) Operation (O);

3) Reporting (R);

4) Compliance (C).

2.7.1.3 **Endogenous Latent Variable**: 1 variable

Firm Financial Performance (FFP) comprises of 3 observed variables which are:

1) Return on Assets (ROA);

2) Return on Equity (ROE);

3) Earnings Per Share (EPS).

2.7.2 Initial hypothesis development

In order to confirm whether determinants of ERM and representative indicators of FFP are in line with results from reference literatures and pertaining theories, or not, and to discover relationship between ERM and FFP found in EEs industry in Thailand, this study uses structural equation model to explore results. The initial SEM hypotheses are as follows:

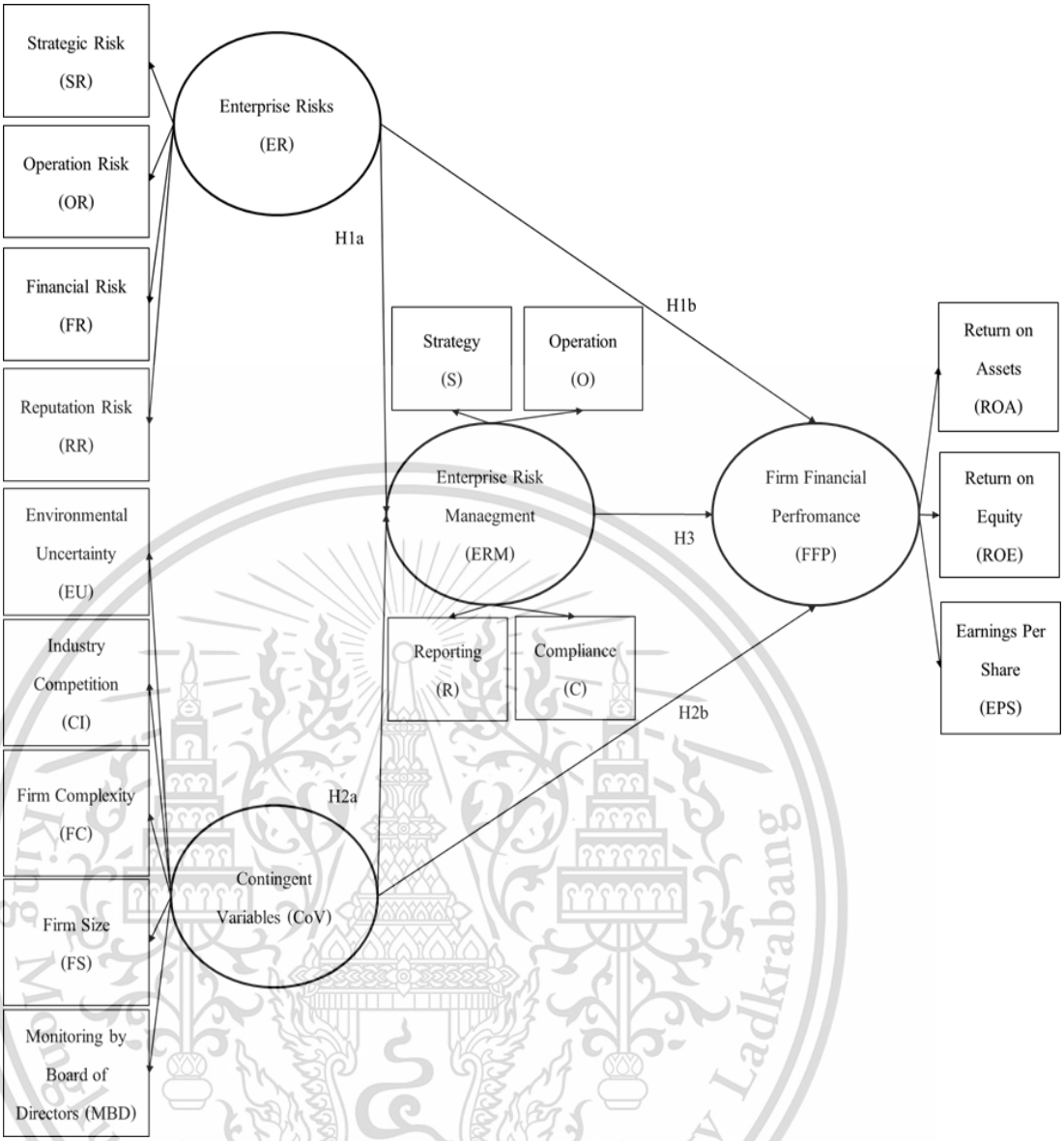

Figure 2.6 Initial Conceptual Framework

H1a: Enterprise Risks has a relationship with Enterprise Risk Management.

H1b: Enterprise Risks has a relationship with Firm Financial Performance.

H2a: Contingent Variables has a relationship with Enterprise Risk Management.

H2b: Contingent Variables has a relationship with Firm Financial Performance.

H3: Enterprise Risk Management has a relationship with Firm Financial Performance.

H4: Enterprise Risks has an indirect relationship with Firm Financial Performance depending on the levels of Enterprise Risk Management.

H5: Contingent Variables has an indirect relationship with Firm Financial Performance depending on the levels of Enterprise Risk Management.

After all SEM hypotheses were established, relationships between each pair of latent variables have to be supported by relevant studies from literature review to ensure that the economic reasons do exist and endorsed by theories. The supported relationships between each pair of latent variables are described in detail the following sections.

2.7.3 Relationship between ER and ERM

As some parts of risk COSO ERM risk identification process, COSO (2012) exemplified risk categories i.e., financial, operational, strategic, and compliance and sub-category i.e., market, credit, liquidity, etc. In addition, they depicted criteria for assessing impacts of risk events including financial, reputational, regulatory, health, safety, security, environmental, employee, customer, and operational impacts. COSO (2018) manifested environmental, social and governance (ESG) related risks particularly apart from conventional strategic, operational or financial risks.

The Committee of European Banking Supervisors (CEBS, 2006, Annex 1) describes various aspects of risks under its Pillar 2 guidelines, a revision of regulatory requirements of capital, known as the Basel Capital Accord or Basel II that requires financial institutions to reserve capital adequacy (mange risks) to accommodate risks or damages that may occur as follows. Strategic risk involves existing risks and potential future risks that affect profit and capital due to changes in the business environment combined with wrong decisions, abusive practices after making a decision, or a lack of response to changes in the business environment. Operation risk is the risk resulting from loss due to inadequacy or the failure of internal events i.e., operating processes, staff, systems, and etc. or arising from external events i.e., legal risks, IT risks, and human integrity. Reputation risk is existing risks and possible future risks that affect profit and capital due to negative images perceived by stakeholders i.e., customers, contractors, investors, or the regulators.

International Energy Agency (2010) studied problems and barriers to scaling up investment in private sectors that provided energy efficiency services and analyzed the impact of risks associated with energy saving projects. This research conducted during 2008-2009 comprised

of the survey research approach, that selected samples of 17 out of 25 private and public financial institutions in the emerging market countries and new emerging G20 countries such as China and India, and the semi-structured interview approach, that explored opportunities and hurdles from United State of America, Europe, China, and India that included 45 energy efficiency service companies, managers, staff of domestic and international financial institutions, government agency staff and independent consultants. Examples of financial institutions are World Bank, International Finance Corporation (IFC), European Bank for Reconstruction and Development (EBRD), JP Morgan, Deutsche Bank, and Climate Change Capital Ltd. (CCC). The study found that risks associated with energy saving projects are divided into five main categories for local investors and one for foreign investors as follows. Operational risk refers to the failure of the technology while in use. Technical and project risk means a difficulty in practice such as quantitative assessment of energy savings and the uncertainty of actual energy saving results. Monitoring risk refers to the uncertainty of people who are inadequate in implementing the technology and measuring the actual energy saving results. Regulatory risk is the uncertainty of energy prices in the market, combined with the government's energy pricing policy. Financial risk is defined as the uncertainty of energy prices combined with the payment capability of counterparties. In addition, investors' risks arising from emerging market (EM) countries are also found that is Sovereign risk because EM countries has a lower credit rating than developed countries, including fiscal policy pertaining tax benefits, the abrupt change in regulations, the control of interest rate ceiling while debts issued by EESCs were rated below the investment grade. Therefore, many risk aspects influence risk management and risk responses by EESCs.

Garbuzova- Schlifter & Madlener (2014) studied key risk drivers and potential risk categories of energy efficiency projects under Energy Performance Contract (EPC) provided by Energy Service Companies (ESCOs) and by Energy Service Providing Companies (ESPCs) in Russia from 3 focus sectors such as 1) 1) industrial factories, 2) residential and commercial buildings (mainly residential buildings), and 3) government sectors. The researcher distributed questionnaires on web sites from February to April 2014 to 162 ESCO business professionals and received responses from 38 companies (23.5% responding rate). Most companies did not directly

hire risk managers or supervisors, but they actually did risk assessment on energy efficiency projects. The results of the study revealed that there were 22 causes of risks for industrial factories and they were classified into eight risk groups as follows: risks of project preparation and execution phases; contractual risks; technical and operational risks; financial risks; client's risks, human and behavioral risks, political and regulatory risks, and market risks. The highest risk was from high interest rates that were classified under market risk because financial institutions lacked of expertise in assessing the return on project investment and project duration especially long project duration during highly volatile market conditions. The least influencing risk driver was from energy supply in abnormal situation that was categorized under technology and operational risk.

Zou and Hassan (2015) studied practicality and potential Value of Enterprise Risk Management in the Manufacturing Sector in China in three aspects 1) the impacts of ERM on the relationship between different kinds of risk and the whole risk portfolio, 2) the influence of ERM on components of risk structure, and 3) the function of ERM in correlation with risk portfolio and firm performance. The researchers used the Key Risk Indicators (KRIs) as independent variables such as strategic risks, operational risks and financial risks and used the Key Performance Indicators (KPIs) as dependent variables such as Firm Size, Return on Assets, Tobin's Q, Market Position, Weight Average Cost of Capital, Sales Growth, Stock Price, Volatility and Value Change. The research population is 1,601 listed public firms in the manufacturing industry in China, and the sample size of 335 manufacturing firms during 2003 – 2012, with the Multiple Indicator Multiple Causes (MIMIC) statistics. The results show that ERM could reduce the relevant kinds of risks to overall risks of the portfolio, and the interactions between risk categories are minimized as well as ERM makes the risk structure more significant to firm's performance. Thus, the firm can benefit from risk portfolio and realizes profit potentials.

ISO 31000 (2018) emphasizes that the successful risk management requires the involvement of senior management and the integration of risk management from all parts in organizational activities and relies on an understanding of business structures and context that differ depending on the businesses' objectives, goals and complexity. In risk identification process,

tangible and intangible sources of risk, whether or not their sources are under control by the firm, have to be considered.

Therefore, Enterprise Risks in this research comprises of four groups, under ERM risk identification framework and relevant researches, such as Strategic Risk, Operation risk, Financial Risk, and Reputation Risk that directly affect Enterprise Risk Management and indirectly impact Firm Financial Performance.

H1: Hypothesis 1

The higher the impacts of enterprise risks on proceeding business, the higher the need for the enterprise risk management. In other words, the firm needs more rigorous risk management to handle entire risks, that may increase, of the firm.

H1: Enterprise Risks (ER) has a relationship with Enterprise Risk Management (ERM).

This study synthesizes the relationship between ER or risk drivers as components of ERM from reviewed literatures listed in Table 2.15.

2.7.4 Relationship between CoV and ERM

It is necessary for the design and implementation of enterprise risk management plans and frameworks to consider varying requirements specific to the organization, objectives, context, structure, business operations, procedures, functions, products, services, projects, practices, evolution of the market, new challenges faced by the firm, and complexity of economic systems (ISO31000, 2018). The context under ISO 31000 (2018) refers to external and internal factors that the firm has to take into consideration when managing risk. The external factors include external stakeholders, surrounding environment, and external variables that affect the firm's objectives. Internal factors include internal stakeholders, governance approaches, relationships with counterparties, the firm's capabilities, culture, and standard.

COSO (2004) recommends to take contingency factors into consideration in conjunction with properly applying ERM system for a particular organization because the contextual variables i.e., a firm's size, complexity, industry, diversity culture, management style, and other

characteristics will affect the effectiveness and efficiency of ERM implementation, even similar firms manage enterprise risks differently.

In relation to the study by Gordon et al., 2009, the implication from this study proposed to take five contextual variables surrounding the firm into consideration in conjunction with the implementation of an ERM system such as Environmental uncertainty, Industry competition, Firm size, Firm complexity, and Monitoring by board of directors.

Nan (2015) assessed Enterprise Risk Management performance and analyzed the status of ERM in China based on Entropy Weight/Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method. The researcher collected data from 509 non-financial companied listed in Shanghai Stock Exchange (SSE), China, during 2012. Most of them were large-sized and medium-sized state-owned enterprises. Independent variables are Strategy, Operation, Reporting, and Compliance. Dependent variable is ERM Performance (ERMI). The result revealed that the overall level of ERM performance among Chinese companies was relatively low and varied largely and differently.

Panicker and Hiremath (2016) conducted a research on an empirical analysis of Enterprise Risk Management Index (ERMI) on organizational turnarounds and its impact on information technology sector performance by analyzing data of Indian IT companies, existed during 2005-2013 (9 - 10 years), listed on Bombay Stock Exchange (BSE) that employed enterprise risk management (ERM) and event study. The sample consists of 30 Indian IT firms which 15 firms are in large cap and 15 firms are in mid cap. This study includes Environmental uncertainty, Industry competition, Firm complexity, Firm size, and Monitoring by Board of Directors (MBD) as contingent variables. The findings showed that firms with positive performance had properly adopted ERM in accordance with their business regardless of firm size or assets, thereby enhancing the trust of stakeholders on IT firms.

In addition, a company with a larger market value exhibited higher ERMI. In other words, adopting ERM would benefit companies with larger market cap sizes.

Sithipolvanichgul (2016) used control factors consisting of firm's size, firm's leverage, reputation, industry effects, sales growth, environment uncertainty: technology, market uncertainty,

as well as economic factors to investigate the relationship between ERM performance and firm performance and found that factors that influenced the firm's value were firm's size and economic factors and the relationship was statistically positive with a high level of ERM implementation.

Therefore, the firm that have implemented effective and efficient ERM system will be able to tolerate contingent factors.

H2: Hypothesis 2

The higher the influences of contingent variables, that depend on the firm's positions and environment factors surrounding the firm, the higher the need for more rigorous enterprise risk management.

H2: Contingent Variables (CoV) has a relationship with Enterprise Risk Management (ERM).

The literatures that studied or mentioned influence of CoV to the relationship between ERM and FFP are from reviewed literatures listed in Table 2.15.

2.7.5 Relationship between ERM and FFP

COSO (2004) publication was to help organizations to maximize stakeholder value and to optimally balance growth and return goals and relevant risks by implanting ERM. Later COSO (2017) emphasized on the alignment between value enhancement or performance and enterprise risk management, integration of ERM, and to understand the impact of risk on performance.

Gordon et al. (2009) studied relationship between enterprise risk management and firm performance with contingency perspective as mentioned in 2.7.2. The sample comprises of 112 US companies listed in US exchange, representing 22 industries, that implemented ERM activities which were disclosed in 10Ks and 10Qs forms filed to the US Securities and Exchange Commission. Data were retrieved from financial statements, of year 2005, which were stored in the Electronic Data Gathering Analysis (EDGAR) database and were calculate to financial ratios as measured variables.

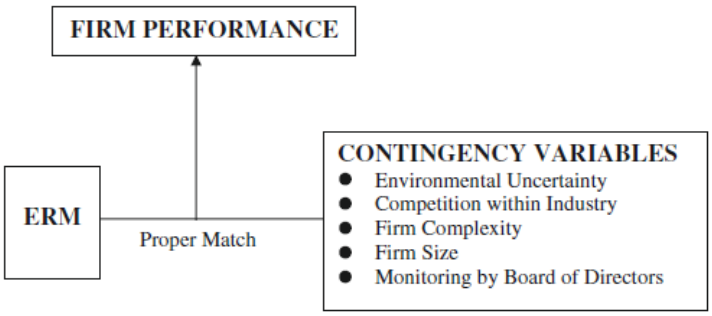

Figure 2.7 ERM and Contingency Variables That Impact Firm Performance Model

Source: Gordon et al. (2009)

Independent variables are 1) ERMI measured by Strategy, Operation, Reporting, Compliance, 2) Contingency Variables measured by environmental uncertainty, industry competition, firm size, firm complexity, and board of directors' monitoring. Dependent variables are Firm Performance measured by one-year excess stock market return (Pi = Ri- [Risk free rate + βi x (Market Return - Risk free rate)]). The results shows that the relationship between ERM and firm performance is contingent upon the appropriate match between ERM and the following five factors affecting a firm: environmental uncertainty, industry competition, firm size, firm complexity, and board of directors' monitoring. And ERM Index is a reasonable measurement of ERM success.

Quon, Zeghal, and Maingot (2012) conducted a research on the relationship between enterprise risk management and firm performance and investigate situations during financial and economic crisis in Canada from a sample of 156 non-financial companies listed in the Standard & Poor's (S&P) Toronto Stock Exchange (TSX) Composite Index from 2006-2009. Independent variables are the average levels of risk exposure and consequences of economic and market risks that were reported by companies by using content analysis of their annual reports, particularly the Management Discussion and Analysis (MD&A) and the Notes to the Financial Statements. Dependent variables are Operational Performance (measured by changes in Sales), Accounting Performances (measured by changes in EBIT margins), and Financial Market Performance (measured by Tobin's Q). The results showed that the firms' earnings were very volatile and business performance changed dramatically during the financial crisis and economic recession, thus

disintegrating the success of ERM to improve firm financial performance because risk management strategies increased insignificantly. And ERM insignificantly predicted business performance.

Laisasikorn and Rompho (2014) studied the relationship between the successful Enterprise Risk Management System together with the Performance Measurement System and the Financial Performance of Thai Listed Companies to examine whether the success of ERMS and PMS does truly enhance the financial performance of an organization. Independent variables are 1) Enterprise Risk Management System (ERMS) and 2) Performance Measurement System (PMS). Dependent variables are the Firm Performance measured by ROA, ROE and EPS. The population is 520 Thai companies listed in SET. The sample comprises of 101 Thai listed companies. Data were collected before 2013. Statistical tool is SEM. The study found that the success of the ERMS and PMS showed a weak positive correlation with the financial performance due to various uncontrollable factors such as the economic condition or political situation. However, financial performance can be measured by ROA, ROE and EPS. In addition, the successful ERMS supported successful PMS and vice versa.

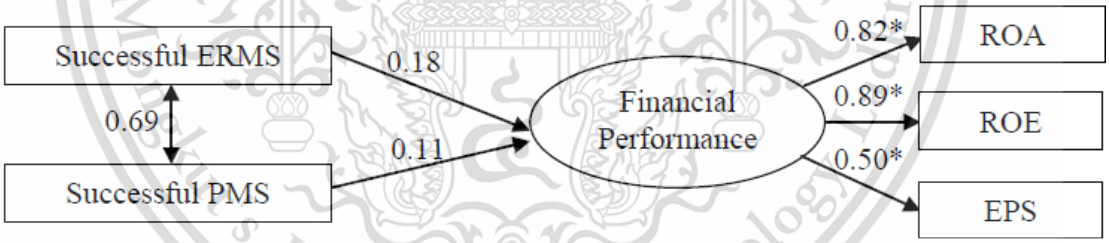

Figure 2.8 Results from the Test Model of ERMS, PMS, and Financial Performance

Source: Laisasikorn and Rompho (2014)

Agustina and Baroroh (2016) studied the influence of Enterprise Risk Management upon the firm value mediated through its financial performance as an intervening variable from banking companies listed in Indonesia Stock Exchange, with a sample of 30 companies and their 53 annual reports during 2011-2013, based on linear regression and path analysis statistical tools. Independent variables are ERM measured by 106 items including the supervisions of the board of commissioners and directors, human resources, organization, procedural policies and limits, establishment,

inherent risk, and tolerance risk, policies and procedures, limits, risk identification processes, risk measures, risk monitoring, risk controls, management information systems, and management control systems. Mediator is Firm Performance (or profitability) measured by ROE. Dependent variables are Firm Value measured by Price Per Book Value (PVB). The results showed that ERM insignificantly influenced the firm value and profitability. Profitability exhibited significant and positive relationship to the firm value. Financial performance was unable to mediate the relationship between ERM and the firm value. The explanation is that that the adoption of ERM by Indonesian Banks was by regulations, but not by seriously pursued.

Sithipolvanichgul (2016) developed risk management measurement in accounting Practice and investigated relationship between Enterprise Risk Management and Firm Performance. The study proposed a reliable ERM measurement method, tested whether firms that adopt ERM actually improve financial performance, and determined the influential factors of ERM implementation. The independent variables are the ERM measured by ERM Scoring. Control Variables measured by firm's size, firm's leverage, reputation, industry effects, sales growth, environment uncertainty, and economic factors. Dependent variables are Firm Performance measured by ROA, ROE and Tobin's Q. The population is 518 Thai companies listed in Stock Exchange of Thailand. The sample consists of 87 listed companies. The data collection period was in the year 2013. The researcher used PCA, PLS, and Clustering Analysis statistics to cross check results among them. The results showed that the implementation of ERM could improve firm performance in terms of Tobin's Q, ROE and ROA. Firm's size and economic factors exhibited statistically positive relationship with a high level of ERM implementation. Companies with lower ERM scores exhibited more revenue volatility than those who had well implemented ERMs. Furthermore, technology and growth were positively related to ERM in the scoring system.

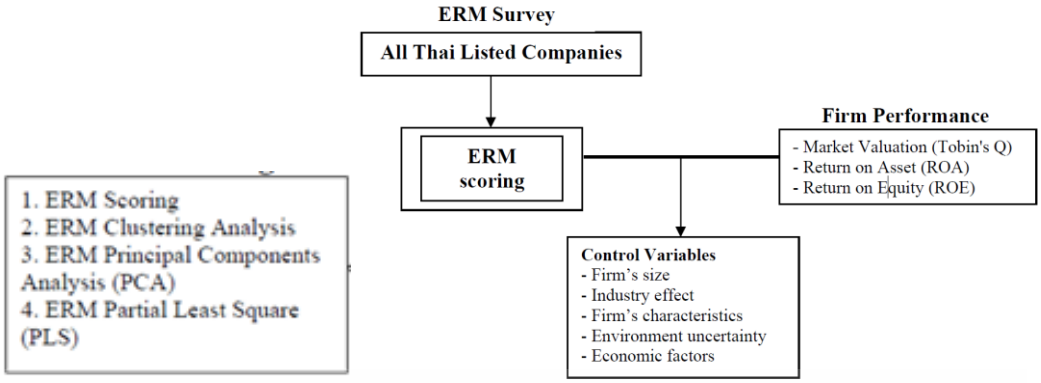

Figure 2.9 Linkages between ERM and Firm Performance

Source: Sithipolvanichgul (2016)

Florio and Leoni (2017) conducted a research on enterprise risk management and firm performance to investigate whether a relationship exists between the extent of implementation of enterprise risk management (ERM) systems and the performance. Independent variables 1)ERM measured by existence of Chief Risk Officer, Risk Committee, Risk Committee report to BoD, Risk Assessment Frequency, Risk Assessment Level, Risk Assessment Method, ERM Score, and ERM Advanced. Control variables are BoD size, BoD independence, Size, and Leverage. Dependent variables are Firm Performance measured by ROE, ROA, and Market Value: Tobin's Q. The population is non-financial companies listed on the Milan Stock Exchange, Italy. The sample is 462 firm-year observations, which represent around 80% of Italian listed non-financial companies. Data were collected during 2011-2013. The statistical tool is multivariate OLS regression clustered by firm, while controlling for CG and firm specific factors. The results are that Firms with advanced levels of ERM implementation presented higher performance, both as financial performance and market evaluation. Successful ERM systems leaded to higher performance by reducing risk exposure and the reverse causality between ERM and performance was not presented in short term.

ISO 31000 (2018) also supports ERM as a process to integrate risks of all sources for the objective of improving stakeholders' short-term and long-term value.

Therefore, many researches and practice standards support that effective, efficient, and proper implementation of ERM system can enhance firms' value and performance.

H3: Hypothesis 3

If entire risks of the firm are managed more successful and properly align with contextual factors surround the firm, the relationship between ERM and performance of the firm will improve more. In other words, the more the stringent enterprise risk management, the higher the firm performance.

H3: The Enterprise Risk Management (ERM) has a relationship with Firm Financial Performance (FFP).

The literatures that studied or mentioned the relationship between ERM and FFP are from reviewed literatures listed in Table 2.15.

2.7.6 Relationship between ER and FFP, and CoV and FFP

There are two major reasons why there are the absences of direct relationships between ER and FFP as well as CoV and FFP. Firstly, the researcher investigated many studies from abroad and Thailand, and widely traced reliable academic journals back for the past 20 years, and barely found references to support both direct relationships in relation to real business context. Secondly, the researcher concluded that the non-inclusion of the two direct relationships is from the true economic point of view, rather than including them from the statistical point of view, because enterprise risks and contingent variables are able to indirectly affect the firm financial performance through business management and risk responses by human only.

According to hypothesis testing by SEM statistical theory, therefore, the indirect influences of ER to FFP and CoV to FFP depend on the level of ERM such that the effects from ER and CoV on FFP are stronger (strengthened) with increasing values of ERM.

H4: Hypothesis 4

H4: Enterprise Risks has an indirect relationship with Firm Financial Performance depending on the levels of Enterprise Risk Management.

H5: Hypothesis 5

H5: Contingent Variables has an indirect relationship with Firm Financial Performance depending on the levels of Enterprise Risk Management.

Table 2.15 Latent and Observed Variables Table

Latent variables (4)	Observed variables (16)	Researchers
(ER) Enterprise Risks		Ai et al. (2012), AIRMIC, Alarm, and IRM (2010), Ben-Amar et al. (2014), Canadian Institute Chartered Accountants (2012), CAS (2003), Chapman (2006), Connell and Voola (2007), Cormican (2014), COSO (2004), Edwards and Bowen (2005), Ellis (2010), FEMP (2015), Garbuzova-Schlifter and Madlener (2012, 2013, 2014, 2016), Gaudenzi et al. (2014), Hansen et al. (2009), Holton (2004), International Energy Agency (2010), ISO 31000 (2009), Kuratko and Welsch (2001), Lajili and Zéghal (2005), Lam (2000), Marino et al. (2010), Moeller (2007), Naumoff and Shipley (2007), Rowe (1977), SEAI (2013), Shimpi (2001), Skipper (1997), Skipper and Kwon (2007), Sprčić et al. (2015), Subramaniam et al. (2011), Vechakij (2014), WEC (2008)
	Strategic Risk (SR)	Aon Risk Solutions (2013), Aron et al. (2005), Bateman and Snell (2012), Bell et al. (1997), Ben-Amar et al. (2014), COSO (2004), Fan and Yuan (2016), Hitt et al. (2014), Jones et al. (2006), Kim and Mauborgne (2004), Lenckus (2006), Miller and Bromiley (1990), Naumoff and Shipley (2007), Slywotzky and Drzik (2005)
	Operation Risk (OR)	BCBS (2017), CEBS (2006), Crouhy et al. (2014), Gaudenzi et al. (2014), Jüttner (2005), Lam (2000), Merna and Al-Thani (2008), Moeller (2007, 2011), Peccia (2001a, 2001b), Wagner and Bode (2008)
	Financial Risk (FR)	Blach (2010), CAS (2003), Charles (2004), Gaudenzi et al. (2014), Kloman (2010), Miller and Bromiley (1990), Naumoff and Shipley (2007)

Table 2.15 (Continue)

Latent variables (4)	Observed variables (16)	Researchers
	Reputation Risk (RR)	BCBS (2009), CEA and Groupe Consultatif (2007), CEBS (2006), Connell and Voola (2007), Dollinger et al. (1997), Gatzert and Schmit (2016), Gaultier-Gaillard et al. (2009), Graham and Bansal (2007), Keh and Xie (2007), Naumoff and Shipley (2007), Scott and Walsham (2005), Shane and Cable (2002), Turban and Cable (2003), Van den Bogaerd and Aerts (2015), Walsh et al. (2009), Walsh et al. (2012), Wang et al. (2012), Yoon et al. (1993)

Table 2.15 (Continue)

Latent variables (4)	Observed variables (16)	Researchers
(ERM) Enterprise Risk Management		Barton et al. (2002), CAS (2019), COSO (2004), Deragon (2000), Dickinson (2001), Harrington et al. (2002), Holton (1996), IIA (2001), Kleffner et al. (2003), Liebenberg and Hoyt (2003), Meulbroek (2002), Miccolis et al. (2001), Mikes (2009), Moeller (2007), Olson and Wu (2010), Pagach and Warr (2010), RIMS (2011), Romney and Steinbart (2012), S&P (2008), Sobel and Reding (2004), Verbrugge et al. (2003)
	Strategy (S)	Ai et al. (2012), COSO (2004), Gordon et al. (2009), Hoyt and Liebenberg (2010), Nan (2015), Nocco and Stulz (2006), Panicker and Hiremath 2016, Porter (2008), Thompson (1984), Tufano (1996)
	Operation (O)	Banker et al. (1989), COSO (2004), Gordon et al. (2009), Kiymaz (2006), Nan (2015), Panicker and Hiremath (2016)
	Reporting (R)	COSO (2004), Dechow et al. (1995), DeFond and Jiambalvo (1994), Defond and Subramanyam (1998), Gordon et al. (2009), Jones (1991), Lam (2003), Nan (2015), Panicker and Hiremath (2016)
	Compliance (C)	COSO (2004), Dechow et al. (1995), DeFond and Jiambalvo (1994), Defond and Subramanyam (1998), Gordon et al. (2009), Jones (1991), Nan (2015), Panicker and Hiremath (2016)

Table 2.15 (Continue)

Latent variables (4)	**Observed variables (16)**	**Researchers**
(CoV) Contingent Variables		COSO (2004), Gordon et al. (2009), Panicker and Hiremath (2016), Sithipolvanichgul (2016)
	Environment Uncertainty (EU)	Chenhall (2003), Chenhall and Langfield-Smith (1998), Gordon et al. (2009), Liebenberg and Hoyt (2003), Luft and Shields (2003), Panicker and Hiremath (2016), Sithipolvanichgul (2016), Tymon et al. (1998)
	Industry Competition (CI)	Gordon et al. (2009), Panicker and Hiremath (2016), Sithipolvanichgul (2016)
	Firm Complexity (FC)	Bodnar (1999), Doyle et al. (2007), Ge and McVay (2005), Gordon et al. (2009), Panicker and Hiremath (2016), Sithipolvanichgul (2016)
	Form Size (FS)	Beasley et al. (2008), Gordon et al. (2009), Haka, Gordon, and Pinches (1985), Hoyt and Liebenberg (2010), Lawrence, Lorsch, and Garrison (1967), Liebenberg and Hoyt (2003), Lin et al. (2012), Myers, Gordon, & Hamer (1991), Panicker and Hiremath (2016), Shields (1995), Sithipolvanichgul (2016)
	Monitoring by Board of Directors (MDB)	COSO (2004), Gordon et al. (2009), Grace et al. (2015), Kleffner et al. (2003), Panicker and Hiremath (2016), Sobel and Reding (2004)

Table 2.15 (Continue)

Latent variables (4)	**Observed variables (16)**	**Researchers**
(FFP) Firm Financial Performance		Agustina and Baroroh (2016), Arnold et al. (2015), Baxter et al. (2013), COSO (2004), Fisher and Hall (1969), Florio and Leoni (2017), Gordon et al. (2009), ISO 31000 (2018), Laisasikorn and Rompho (2014), Mirza and Javed (2013), Quon et al. (2012), Sithipolvanichgul (2016), Zou and Hassan (2014)
	Return on Assets (ROA)	Al-Matari et al. (2014), Baxter et al. (2013), Bromiley (1991), Laisasikorn and Rompho (2014), Lin et al. (2011), Mirza and Javed (2013), Santos and Brito (2012)
	Return on Equity (ROE)	Al-Matari et al. (2014), Bromiley (1991), Laisasikorn and Rompho (2014), Lin et al. (2011), Santos and Brito (2012)
	Earnings Per Share (EPS)	Al-Manaseer et al. (2012), Al-Matari et al. (2014), Junarsin (2011), Laisasikorn and Rompho (2014), Lin et al. (2011), Tsegba and Ezi-Herbert (2011)

2.8 Research Conceptual Model

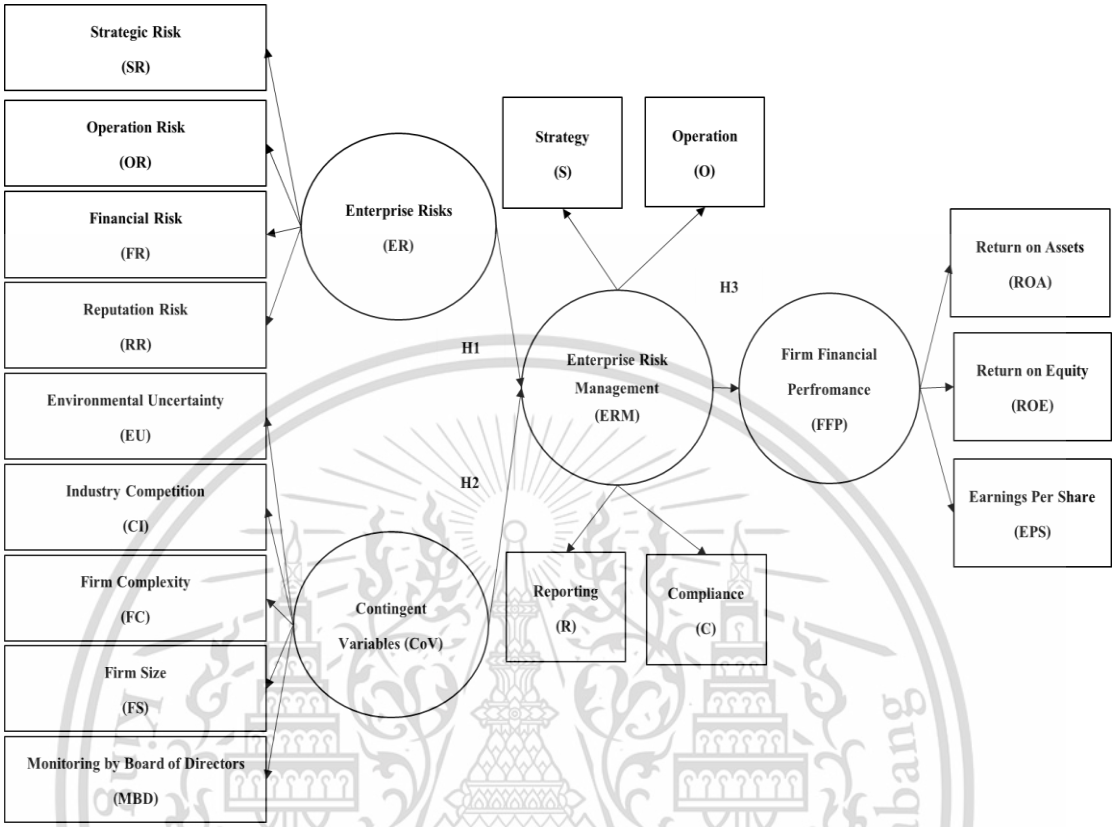

Figure 2.10 Proposed Research Conceptual Model

The conceptual framework of ERM system, which is expected to affect Firm Financial Performance, comprises of four constructed variables and sixteen measured variables. The Enterprise Risks (ER), constructed variables, comprises of four risk indicators i.e., Strategic Risk (SR), Operation Risk (OR), Financial Risk (FR), and Reputation Risk (RR). Contingent Variables (CoV) has five variables i.e., Environmental Uncertainty (EU), Industry Competition (CI), Firm Complexity (FC), Firm Size (FS), and Monitoring Board of Directors (MBD). Enterprise Risk Management (ERM) includes four measured variables i.e., Strategy (S), Operation (O), Reporting (R), and Compliance (C). Firm Financial Performance is indicated by Return on Assets (ROA), Return on Equity (ROE), and Earnings Per Share (EPS). The ER is expected to have a significant relationship with ERM. The CoV is expected to influence ERM. The ERM is expected to affect FFP. The direct relationships between ER to FFP and CoV to FFP are barely endorsed.

2.9 Summary

From the literature review, it is found that the risks faced by EESC businesses are both internal and external. Main categories of risks, in accordance with the concepts of ERM, are strategic risk, operation risk, financial risk, and reputation risk. In addition, ERM must also incorporate contingent factors in order to achieve risk management objectives. Therefore, the risk management model presents a risk identification process by specifying problems and hindrances, or causes of risks and types of risks that influence the success of ERM to evaluate the opportunity, the degree of severity, and the subsequent impact on the business. The results lead to the risk assessment process by analyzing causes, relationships between various factors of significant risks. The researcher can then develop the research hypotheses which lead to the research methodology in the next chapter.

CHAPTER 3

RESEARCH METHODOLOGY

For the development of model of causal factors that impact enterprise risk management and firm financial performance for energy efficiency services in Thailand, the researcher designed the research methodology that comprises of details as follows.

3.1 Research Design

3.2 Research Variables

3.3 Population and Samples

3.4 Research Instrument

3.5 Data Collection

3.6 Statistical Data Analysis

3.7 Summary

3.1 Research Design

This study employs a quantitative approach and use questionnaire as a tool to collect opinions to various problems and obstacles relating EESC business in Thailand from respondents in order to form model that incorporates concepts and opinions towards risk categories according to ERM theories that combine the severities and probabilities of occurrences of all risk drivers into impacts from all risks. The impacts from all risk categories, together with contingent variables, affect the ERM and then consequently relate to firm performance at the end. The researcher analyzed data from collected questionnaires by using SPSS for descriptive statistics and AMOS Version 21 for the analysis of Structural Equation Model (SEM), concluded relationship between each pair of variables in the conceptual research model. Population is 203 EESCs with 3 representative respondents who worked in senior levels or managers, following journal article on providing energy services conducted by Kindström, Ottosson, & Thollander (2017) for thorough

understanding of EESCs business, responsible for major area of risks in an organization such as engineering operations, finance or accounting, and top management i.e., chief executive officers or managing directors, totaling to 609 people. Three are three stages of the research process elaborated as follows.

Stage 1: Firstly, general information was studied and collected from secondary data by using data from the literature review, concepts, relevant research theories, text books, academic journals, articles, and online media documents. Secondly, various variables and relationships of influencing variables, obtained from the literature review i.e., related researches that were published in international journals, and studying from both local and abroad dissertations, were synthesized. Fourthly, the conceptual research model was developed and it leaded to questionnaire design that properly contained measured and latent variables according to the research model with meaningful quality. Finally, after synthesizing concepts, research theories, and various body of knowledges, there are 4 latent variables and 16 empirical variables for this research.

Stage 2: Quantitative research was employed for gathering quantifiable data from questionnaires, as a research tool, that were replied from respondents who were sampled from EE population, and from financial statement of EESCs. Statistical parameters were then calculated, by SPSS software program Version 21, and analyzed for data analysis and descriptive statistics. Structural Equation Modeling (SEM), performed by AMOS Version 21, showed the causal relationship between variables and confirmed the goodness of fit between empirical data and the theoretical model.

Stage 3: Documentary review, performed by documentary review method, was used to ascertain the conformity of the above quantitative results and actual situations, and to confirm the consistency of the definitions, meanings, and variables with the literature review in order to complete this research report and conclusion. The reviewed documents are books that subsume interviews of the past situation, recommendations, opinions towards risks in different aspects, and

solutions to the problems and obstacles in EESCs, and annual reports of the energy service companies.

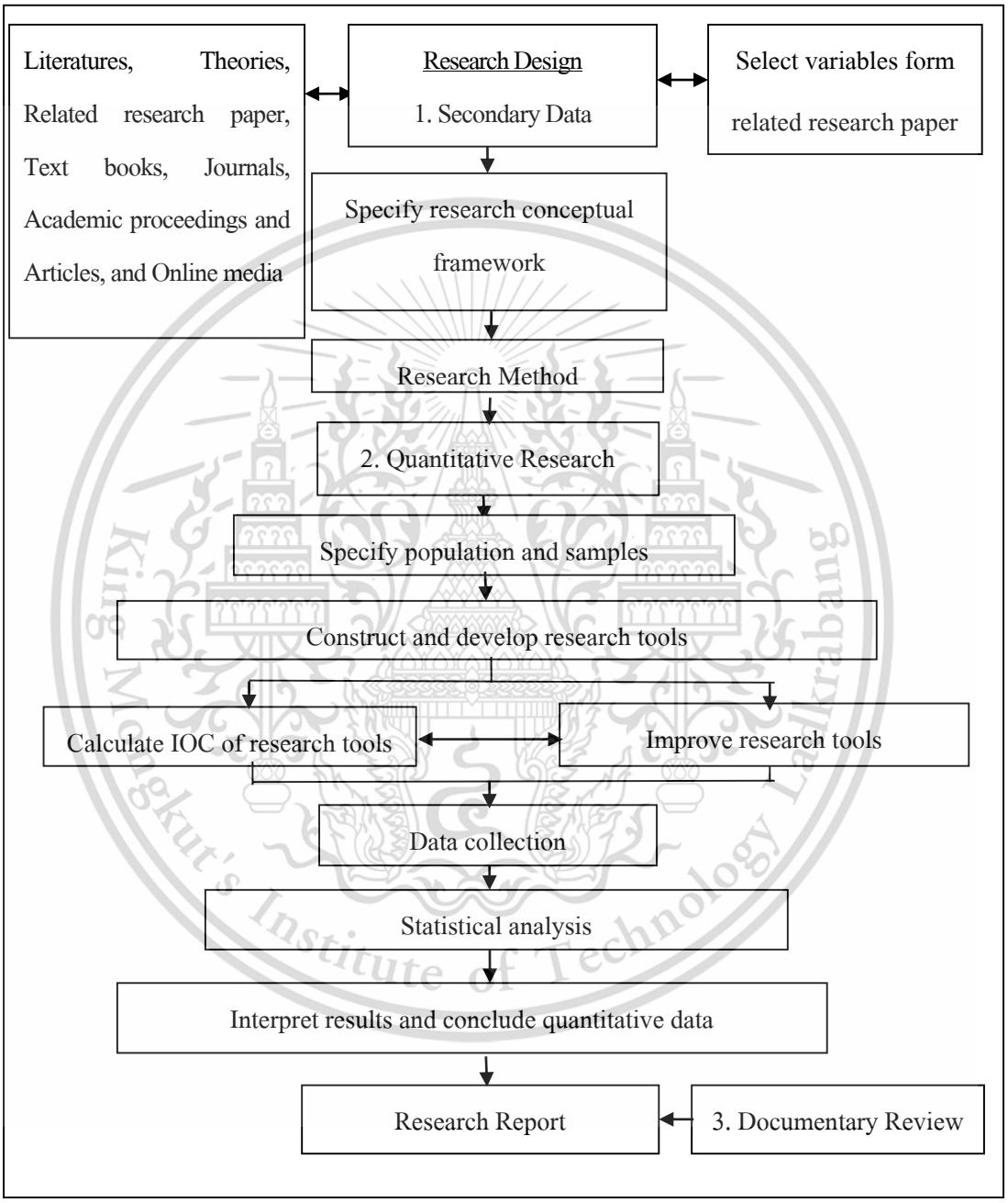

Figure 3.1 Research Design Diagram

3.2 Research Variables

The researcher collected data, reviewed literatures, concepts, theories, academic journals, and related research paper, and then summarized variables for this study as follows.

1. Exogenous latent variables: 2 variables

1.1 Enterprise Risks (ER) consists of 4 observed variables which are

1.1.1 Strategic Risk (SR)

1.1.2 Operational Risk (OR)

1.1.3 Financial Risk (FR)

1.1.4 Reputation Risk (RR)

1.2 Contingent Variables (CoV) consists of 5 observed variables which are

1.2.1 Environmental Uncertainty (EU)

1.2.2 Industry Competition (CI)

1.2.3 Firm Complexity (FC)

1.2.4 Firm Size (FS)

1.2.5 Monitoring by Board of Directors (MBD)

2. Mediator/Intervening construct variable: 1 variable

2.1 Enterprise Risk Management consists of 4 observed variables which are

2.1.1 Strategy (S)

2.1.2 Operation (O)

2.1.3 Reporting (R)

2.1.4 Compliance (C)

3. Endogenous Latent Variable: 1 variable

3.1 Firm Financial Performance (FFP) consists of 3 observed variables which are

3.1.1 Return on Assets (ROA)

3.1.2 Return on Equity (ROE)

3.1.3 Earnings Per Share (EPS)

3.3 Population and Samples

3.3.1 Population and Samples

Population for this research that collect opinions and data relating to the causal factors that affect the ERM and consequently to the firm financial performance in EESC industry are 203 EESCs, with three respondents representing each company, from two groups of EESCs according to their registration, are selected to answer the research questionnaires. The two groups of EESCs generally operated somehow in intertwined business and they cover all population in EESC business in Thailand.

1. The Energy Service Company (ESCO)

The energy service companies, 54 members, were registered with The Institute of Industrial Energy (ESCO Information Center).

2. Energy consultant firms with Rating A, 149 members, were registered with the Ministry of Finance in Thailand (Ministry of Finance, 2018).

Only 4 companies were in both groups. However, they were qualitatively classified in the ESCO group to reflect their true business.

Kindström, Ottosson, & Thollander (2017) conducted a similar research on a broad perspective on the driving forces and barriers perceived by local and regional actors in the Swedish energy company market by collecting data from energy companies, energy service consultancies, and installation firms. The representatives who provided opinions from these companies include senior managers, head of energy services, service technicians, energy experts, and technical consultancies.

Therefore, questionnaires for this research were sent by post to 203 companies, to three key persons in management position, in each company. They were responsible for three key areas of firm risk management and firm performance in senior levels (Kindström, Ottosson, & Thollander, 2017), which were the 1) chief executive officers (CEO)/managing directors (MD), 2)

chief financial officers (CFO) / accounting or financial managers, and 3) chief operating managers/ project/ technical managers as everyone in an organization has responsibility for managing risk (ISO 31000, 2018). The integrated and combined opinions from 3 respondents who deeply manage and cover risks in each key area, for each company, are more appropriate and valuable than opinions obtained by either only one's wide information or a specific one's area.

3.3.2 Sampling technique and sample size in quantitative research

The probability sampling technique is used ensure that every individual company selected actually participates in this study. After questionnaires were sent to EESCs, only completed questionnaires were collected and used based on simple random sampling method. This sampling technique is subject to a number of population and the sample size applicable with quantitative statistic, SEM. The sample size can be determined by the following criteria.

The appropriate sample size for this study should be higher than 80 samples determined by the following criteria:

Rule of thumb: the appropriate ratio between measured variables and constructed variables are 5:1 to 10:1 (Bentler & Chou, 1987; Nunnally, 1967).

Standard sample size (n) = ratio of the selected rule of thumb x manifest variables

Manifest variables of this study are 16 and constructed variables are 4, so the range of standard sample size should be between 5 x 16 = 80 and 10 x 16 = 160.

3.4 Research Instrument

The researcher used the questionnaire as a tool to collect data on the risk drivers related to Strategic Risk, Operational Risk, Financial Risk, and Reputation Risk affecting the Enterprise Risk Management that subsequently impact firm financial performance according to the hypothesis set to be proven by statistical methods to find the significance of the relationship between variables.

3.4.1 Developing Measurement tools

1. Collect data from concepts, theories, documentation, and guidelines, and research related to the questionnaire structure

2. Study relationships of endogenous variables, exogenous variables, and observed variables and then prepare a test questionnaire

3. The test questionnaire was reviewed by five experts in EESCs business and ERM, consisting of academics and top executives of the energy management company, to check for Index of Item-Objective Congruence (IOC) between questions in the test questionnaire and research objectives and research problems. The opinion for each question consists of 3 scores, which are 1) +1; certain that the research objectives are congruent to the question, 2) 0; uncertain, 0, and 3) -1; certain that that the research objectives are incongruent. The average score is the IOC that must be between 0.5 - 1.0. If IOC score is less than 0.5, the test question has to be revised so that each question meets the research objectives.

4. Revise the test questionnaire in relation to the recommendations by the experts.

5. Test the questionnaire that has been revised in relation to the expert's advices with 37 samples before the actual use to check each question whether it is clear, cover the same issue, and ask respondents in the same direction or not.

6. Test the questionnaire results from the 37 samples for Reliability, a measurement of internal consistency, by calculating the coefficient of Cronbach's alpha or the coefficient of reliability. The Cronbach's alpha must be greater than or equal to accepted criterion of 0.70.

7. Improve the test questionnaire in order to obtain the original questionnaire that will be used for data collection in the next step.

3.4.2 Questionnaire structure

There are four parts in the questionnaire.

Part 1 is the background information of the respondents consisting of position, gender, age, education level, and working experience with their companies. Scales used are nominal scale, ordinal scale, or ratio scale.

Part 2 is the business operation data of the respondents' organization consists of questions regarding 1) types of business of the company as it is registered or was used to be registered with the Energy Institute for Industry or the Ministry of Finance as the energy consultant, 2) the average number of board of directors, 3) the average number of employees, 4) shareholder structure, 5) the average number of completion years of energy efficiency projects, 6) contract types of energy efficiency projects that the company undertakes, 7) auditor fee, 8) fine, net reimbursement or net claim by the company's counterparty parties (customers) from undertaking energy efficiency projects, 9) revenue from energy efficiency business (Poole & Geller, 1997), the numbers of business units/ products in the company, and 10) the average number of risk management committees. The questions are either close-end or open-end questions for more details. Scales used are nominal scale, ordinal scale, rating scale, or ratio scale.

Part 3 is the questionnaire relating to opinion survey with the close-end question type in 5-point Likert scale.

Questionnaire

The developed questionnaire is based on guidelines from COSO (2012), Garbuzova-Schlifter and Madlener (2014), and Hu and Zhou (2011). Questions include opinions relating to the causes of risk, synthesized according to the literature review in Chapter 2. Scales used are 5-point rating scale as recommended by COSO.

1) Enterprise Risks (ER): Enterprise risks contain four group of risk categories which are strategic risk, operation risk, financial risk, and reputation risk. Each risk category concludes relevant risk drivers as question items in the questionnaire. Respondents were asked to rate each question in a 5-point Likert scale, as 1) is most often used and illustrated by COSO 2004 and 2) to increase the response rate and quality in providing answers without confusing the respondents (Babakus & Mangold, 1992; Buttle, F., 1996; Devlin, Dong, & Brown, 1993), ranked from the highest impact to the least impact as risk drivers as shown in the following table:

Table 3.1 Impact Score and Description

5	4	3	2	1
Highest impact	Moderate high impact	Moderate impact	Moderate low impact	Lowest impact

The questionnaire was tested for content validity calculated by the index of item-objective congruence (IOC) scored by 5 experts in energy service business sector. Any questions with value under 0.6 were excluded (Rovinelli & Hambleton, 1997). A reliability of the questionnaire was also applied with 37 sample respondents representing similar characteristics as those of target groups. The Cronbach's alpha exhibited coefficient of reliability of 0.898, as shown in the appendix C with details of each item, above the accepted level of 0.7 (Bearden, Netemeyer, & Mobley, 1989).

The Cronbach's alpha of each part of questionnaire is shown in the following table.

Table 3.2 Reliability Measurement of Tryout Questionnaire

Cases	**N**	**%**
Valid	37	100.00
Excluded[a]	0	0.00
Total	37	100.00
Variables	**Cronbach's Alpha**	**N of Items**
SR	0.807	14
OR	0.904	8
FR	0.796	11
RR	0.828	4
ER	0.898	37

Note: a. Listwise deletion based on all variables in the procedure.

2) Enterprise Risk Management (ERM): Data for 4 indicators, Strategy (S), Operation (O), Reporting I, and Compliance I, can be obtained from company information and audited financial statement, available for being downloaded on http://corpus.bol.co.th website, provided by Business Online PCL., answers from questionnaire, companies' web sites, or web sites of institutes that EESCs are registered. Each indicator was averaged over the past observation years, standardized, and scored into 5-point Likert scale as is most often used and illustrated by COSO 2004. The higher the rating means the higher the success in achieving goals of enterprise risk management.

3) Contingent Variables (CoV): Data for 5 indicators, Environmental uncertainty (EU), Industry competition (CI), Firm complexity (FC), Firm size (FS), and Monitoring by Board of Directors (MBD), could be obtained from audited financial statements, available for being downloaded on http://corpus.bol.co.th website, provided by Business Online PCL., answers from questionnaire, companies' web sites, or web sites of institutes that EESCs were registered. Each

indicator was averaged over the past observation years, standardized, and scored into 5-point Likert scale as is most often used and illustrated by COSO 2004. The higher the rating means the higher the need for enterprise risk management and more variability to firm financial performance.

4) Firm Financial Performance (FFP): Firm financial performance contains 3 indicators, Return on Equity (ROE), Return on Asset (ROA), and Earnings Per Share (EPS). The data can be obtained from company information and audited financial statement, available for being downloaded on http://corpus.bol.co.th website, provided by Business Online PCL. Each indicator was averaged over the past observation years, standardized, and scored into 5 point-Likert scale as is most often used and illustrated by COSO 2004. The higher rating means the healthier the firm financial performance.

Business Online PCL. is a private company that collects and provides companies' official documents available to public and audited financial statement submitted by EESCs to Ministry of Commerce, Thailand. Audited financial statements were the latest available for most non-listed private firms during the period that this study was conducted.

Notes: 1) In the questionnaire, "ESCO" is used instead of "EESC" because it is more familiar to respondents in this industry in Thailand.

2) Respective measured variables of CoV, ERM, and FFP exhibited the metric scale (interval, ratio, or absolute scale) values in varying ranges. From a practical stand point, it is possible that the unprocessed raw data at the first instance may lead to poor interpretation because of effects of systematic variations. An appropriate data transformation relying on normalization and standardization can nullify the effect of such variations (Muralidharan, 2010). Moreover, the important attribute of the scale measurement is to uphold precision, objectivity, unambiguousness, and meaningfulness. The utmost concern of this study is to make correct interpretation, meaningful statements, and valid inference on the collected data. The transformation and its interpretation of the metric scale of measured variables, apart from ER and its corresponding variables, into the 5-point Likert scale are performed where they are most suitable (Yusoff & Janor, 2014).

In order to better align interpretation and common comparison of these variables with the same scales as ER and its measured variables, the metric scale values of these variables have to be transformed into the 5-point Likert scale as variables of ER by using quintile division (by assigning values from 1 to 5). The data of each measured variable are sorted from the highest value to the lowest value. The sorted data are transformed by using normalization, which rescales the values into a range of [0,1], and then by using standardization, that rescales the normalized data to have a mean of 0 and a standard deviation of 1 (unit variance). The sorted and transformed data are divided and classified into five ranges, with 20 percent of ratio values in each data range by taking into account of outlier data exclusion. Any transformed values that fall in the top 20 percent of data are assigned by the value of 5. Next lower values below the lower bound of the top 20 percent data are assigned by the value of 4. By following this similar procedure, all transformed values are completely converted into the 5-point Likert scale ranging from 1 to 5 for each measured variable. The interpretation of these converted values, such as mean, standard deviation, skewness, and kurtosis, for this particular research study, is determined by the researcher to be applicable with interpretation tables of ER and its measured variables as shown in section 3.6. In other words, all variables can now share and be compared within the same interpretation tables, as this will maintain the important attribute of the scale measurement as mentioned earlier.

The initial data, which are calculated according to corresponding theories, presented in the following table, demonstrate the minimum, mean, and maximum metric values of measured variables of CoV, ERM, and FFP, before transformation, that are applicable for this research. These initial data are difficult to be interpreted and compared among each other. The summary of converted values, descriptive statistics, and their interpretation are shown in Chapter 4.

Table 3.3 A Summary of Initial Values of Measured Variables of CoV, ERM, and FFP

No.	Contingent Variables (CoV)	Units	Min	Max	Mean	Standard Deviation
1	Environmental Uncertainty (EU)	-	0.50	6.67	2.44	1.25
2	Industry Competition (CI)	-	0.68	0.91	0.82	0.11
3	Firm Complexity (FC)	units	1.00	10.00	2.44	1.68
4	Firm Size (FS)	-	13.64	21.42	17.12	1.66
5	Monitoring by Board of Directors (MBD)	-	0.05	1.06	0.13	0.14
No.	**Enterprise Risk Management (ERM)**		**Min**	**Max**	**Mean**	**Standard Deviation**
1	Strategy (S)	-	-0.93	10.13	-0.01	1.79
2	Operation (O)	-	0.49	36.90	5.10	5.80
3	Reporting (R)	-	-1.00	1.00	0.89	0.37
4	Compliance (C)	-	-0.06	0.02	0.00	0.01
No.	**Firm Financial Performance (FFP)**		**Min**	**Max**	**Mean**	**Standard Deviation**
1	Return on Assets (ROA)	%	-54.41%	66.66%	16.75%	14.88%
2	Return on Equity (ROE)	%	-215.91%	219.20%	5.93%	48.08%
3	Earnings Per Share (EPS)	Baht/Share	-106.54	11,453.08	197.96	1,314.63

Table 3.4 Questionnaire Structure

Variables	# of Q	Q No.	Scale
Part 1 Respondents' information	5		
1.1 Current position	1	1	Nominal
1.2 Gender	1	2	Nominal
1.3 Age	1	3	Ratio
1.4 Highest education level	1	4	Ordinal
1.5 Work experience with current company	1	5	Ratio
Part 2 Respondent's company information	11		
2.1 Years of providing energy services	1	6	Ratio
2.2 Company registration with Ministry of Finance or The Institute of Industrial Energy	1	7	Nominal
2.3 Average numbers of Board of Directors over the past years since 2013	1	8	Ratio
2.4 Average numbers of employees over the past years since 2013	1	9	Ratio
2.5 Shareholder structure	1	10	Ordinal
2.6 Average energy efficiency projects undertaken	1	11	Ratio

Table 3.4 (Continue)

Variables	# of Q	Q No.	Scale
2.7 Energy efficiency contracts types	1	12	Nominal
2.8 Auditors' fee over the past years since 2013 (as % of Total Assets, up, down, or unchanged	1	13	Interval/Rating
2.9 Net fine, reimbursement, or product claim from counterparties (clients)	1	14	Rating
2.10 Revenue from energy efficiency services over the past years since 2013	1	15	Interval
2.11 Average business units/sectors/ products over the past years since 2013	1	16	Interval
Part 3 Problems and hindrances in providing energy efficiency services	37		
3.1 Strategic Risk	14	30	Rating
3.2 Operation Risk	8	38	Rating
3.3 Financial Risk	11	49	Rating
3.4 Reputation Risk	4	53	Rating
Total numbers of questions	**53**	**Items**	

Table 3.4 (Continue)

Variables	# of Q	Scale
Part 4 Contingent variables	**5**	Extract from financial statement/Part 2 data
4.1 Environmental Uncertainty	1	Interval
4.2 Industry Competition	1	Interval
4.3 Firm Complexity	1	Interval
4.4 Firm Size	1	Interval
4.5 Monitoring by Board of Directors	1	Interval
Part 5 Enterprise Risk Management	**8**	Extract from financial statement/Part 2 data
5.1 Sales standard deviation	1	Interval
5.2 Company risk diversification compared to industry	1	Interval
5.3 Total assets turnover ratio	1	Interval
5.4 Employee turnover ratio	1	Interval
5.5 Auditor Opinion	1	Interval
5.6 Accounting manipulation	1	Rating / Interval
5.7 Auditor's fees to net revenue	1	Ratio
5.8 Net Settlement Gain (Loss) / Average Total Assets	1	Rating / Interval

Table 3.4 (Continue)

Variables	# of Q	Scale
Part 6 Firm Financial Performance	**3**	Extract from financial statement
6.1 Return on Average Total Assets	1	Interval
6.2 Return on Equity	1	Interval
6.3 Earnings per Share	1	Interval
Total indicators from calculation	**16**	

3.4.3 Quality of research instruments

Examination of the quality of questionnaires was conducted by bringing a sample questionnaire to five experts in the energy efficiency business in Thailand or enterprise risk management experts is to examine the questions in the questionnaire for complete and covering content, and enough comprehension on the subject being measured including language that respondents are able to read, easy to understand, and to the point. After that, the questionnaires were tested for 1) content validity and 2) reliability. The five experts are as follows. 1) A dean of Faculty Division of Energy Management from a University in Thailand, a lecturer of Faculty of Energy Management Technology from a University in Thailand, Lecturer of Faculty of Business Administration from a University in Thailand, President of Thai ESCO Association and Managing Director of an EESC company, and a fund manager of Management Division of ESCO Revolving Fund of The Energy Conservation Foundation of Thailand (ECFT).

1) Content validity

Five experts rate their opinions on each question in the questionnaire. The score value is then averaged for the Index of Item-Objective Congruence (IOC) for each question. Each question with IOC of 0.6 or above is desirable.

Score+1 = if the expert is sure that this item really measured the attribute

Score 0 = if the expert is not sure that the item does measure or does not measure the expected attribute.

Score -1 = if the expert is sure that this item does not measure the attribute.

Content validity formula

$$IOC = \frac{\sum R}{N}$$

R = Congruent score

N = numbers of experts

1 = Congruent

0 = Questionable

-1 = Incongruent

IOC score is range from -1 to +1, the closer to 1, the better.

How to determine content validity.

The item with IOC score	□ 0.6 – 1.00	the item measured the attribute.
The item with IOC score	between 0.5-0.6	the item must be revised.
The item with IOC score	□ 0.50	the item must be removed.

2) Measurement Reliability

Coefficient of reliability assesses the consistency of the entire items in an instrument. It measures internal consistency, represented by Cronbach's Alpha Coefficient (Cronbach, 1951). The individual items or observe variables of the scale should all measure the same construct and thus be highly intercorrelated. Measure of internal consistency by Cronbach's Alpha can be applied with rating scale and is calculated as follows.

$$\alpha = \frac{K}{K-1}\left[1 - \frac{\sum S_i^2}{S_t^2}\right]$$

α = Coefficient of reliability

k = the numbers of items or indicators in the instrument

S_i^2 = the variance of each item

S_t^2 = the variance of total score

Interpretation: The reliability coefficients or Cronbach's Alpha Coefficient calculated from at least 30 sets of a standard version of the experiment questionnaire of 0.70 or above are considered as high reliability (Hair et al., 2010).

3.5 Data Collection

The collection of quantitative data is explained in the following steps.

3.5.1 Primary data

1) Request a permission and courtesy letter, from the president of the Ph.D. program, for cooperation in collecting research data from top management in 203 EESCs.

2) Send the questionnaires by post or email to 3 senior management positions who are the Chief Executive Officer or Managing Director, Chief of Financial Officer or Accounting Manager, Chief of Operating Officer or Engineering Manager totaling 609 people.

3) The data were prepared and collected from 2013 to 2018. The researcher also resorted on own company to follow up and collected questionnaire to speed up process and to increase response rate. The data in all returned questionnaire were checked for completeness and then were analyzed.

3.5.2 Secondary data

The researcher has studied and summarized concepts, theories, literatures and related researches, both domestic and international, from various sources such as academic journals, textbooks, articles, commercial paper, media on the internet, and statistical data from various institutions, both public and private sectors. The data are analyzed and then synthesized to create new body of knowledge that is used in this research and is applied to analyze the research results.

3.6 Statistical Data Analysis and Interpretation

After the researcher received returned questionnaires and checked the correctness and completeness of the information, the researcher defined and encoded the data, and examined the preliminary information to meet the convention of statistical analysis. This research sets determined the significance level of acceptance of the error (α) or the chance of the error to be equal to 0.05 ($\alpha = 0.05$) or sets the confidential level at 95 percent. The statistical analysis process is as follows.

3.6.1 Basic statistical analysis

1) Descriptive

Descriptive statistics, i.e., frequency and percentage, are used to explain general information of respondents. Mean, Standard Deviation, Coefficient of variation, Skewness, and Kurtosis, by AMOS version 21, of respondents' opinions towards causes of risks that EESCs in Thailand had faced and empirical data of EESCs, are used to explain the distribution and dispersion of manifest variables in this research model.

Mean interpretation

COSO (2004) explain the interpretation of means of risk factors as follows.

Table 3.5 Interpretation of Mean Table

Range of mean value	Interpretation
4.51 – 5.00	mean impacts from the risk factors are extreme, with 90% chance of occurrence, and its impacts are immediately realized.
3.51 – 4.50	mean impacts from the risk factors are major, with 65% chance of occurrence, and its impacts will be realized in many days or many weeks later.
2.51 – 3.50	mean impacts from the risk factors are moderate, with 35-65% chance of occurrence, and its impacts will be realized in a few months later.
1.51 – 2.50	mean impacts from the risk factors are minor, with 10-35% chance of occurrence, and its impacts will be realized in a several months later
1.00- 1.50	means impacts from the risk factors are incidental, with less than 10 chances of occurrence, and its impacts will be realized in a year later or more

Standard deviation interpretation

Interpretation of standard deviation in the case of 5-point rating scale (Panthai, 2002, p. 174-175).

Table 3.6 Interpretation of Standard Deviation Table

Range of standard deviation	Interpretation
Value higher than 1.75	high variance
Value between 1.25-1.75	fairly high variance
Value less than 1.25	low variance

Skewness interpretation

Table 3.7 Interpretation of Skewness Table

Skewness	Distribution shape of data	Interpretation
< 0	Left or negative distribution	The tail of the left side of the distribution is longer or fatter than the tail on the right side. The mean and median will be less than the mode.
0	Normal distribution	Data are symmetrically distributed.
>0	Right or positive distribution	The tail on the right side of the distribution is longer or fatter. The mean and median will be greater than the mode.

Kurtosis interpretation

Table 3.8 Interpretation of Kurtosis Table

Skewness	Distribution shape of data	Interpretation
< 3 (or Kurtosis – 3 < 0)	Platykurtic	Data disperse out of the mean and distribution has thinner tails.
3 (or Kurtosis – 3 = 0)	Mesokurtic	Data exhibit a normal distribution.
> 3 (or Kurtosis-3 >0)	Leptokurtic	Data center around the mean and distribution has fatter tails.

For testing the distribution of data whether each observation variable exhibits a normal distribution or not, the data distribution can be measured by Kolmogorov-Smirnov test from the AMOS software package.

2) The analysis of relationships between variables

The relationships between variables are indicated by the Pearson's product-moment correlation coefficient (PPMCC) which can be obtained from AMOS software package.

Correlation interpretation

PPMCC values of observed variables range from -1 to 1. The positive sign means that 2 observed variables have relationship in the same direction and vice versa.

Criteria for interpretation of correlation coefficient I (Hinkle, 1998, p. 118)

Table 3.9 Interpretation of Correlation Coefficient Table

Correlation Coefficient, r	Interpretation
$r \geq 0.9$	extremely high correlation
$0.7 \leq r < 0.9$	moderate high correlation
$0.5 \leq r < 0.7$	moderate correlation
$0.3 \leq r < 0.3$	moderate low correlation
$r < 0.3$	extremely low correlation

3) Test for appropriateness of data for factor analysis

Kaiser – Meyer – Olkin (KMO) is used to measure sampling adequacy for each variable in the model and for the complete model by measuring proportion of variance among variables that might be common variance, the lower the proportion, the more desirable the data to Factor Analysis. High KMO values (close to 1.0) generally indicate that a factor analysis may be useful with research data. If the value is less than 0.50, the results of the factor analysis probably will not be suitable.

Bartlett's Test of Sphericity is used to tests the null hypothesis that observed variables are unrelated. If the null hypothesis (H0) is accepted, factor analysis should not be used because correlation matrix is an identity matrix, unsuitable for structure detection. Small Bartlett's Test of Sphericity values (less than 0.05) of the level of significance indicate that a factor analysis may be appropriate for research data (Wanichbancha, 2011).

4) Examine the consistency of conceptual framework of ERM, CoV, and firm financial performance that were synthesized from literature reviews, concepts, and related theories and manifest variables with AMOS version 21 program.

3.6.2 Statistics for analyzing Structural Equation Modeling (SEM)

In this research, the researcher uses the Structural Equation Modeling (SEM), which is the model that combines the two principles of linear analysis statistics that are Path Analysis and Factor Analysis. The Structural Equation Model (SEM) is a multivariate analysis technique that combines

Factor Analysis and Multiple Regression. The benefits of this SEM technique are used to examine the relationships between various variables in the conceptual research framework model, with direct and indirect effect, within one time. The statistical programs commonly used in the SEM examination are AMOS and LISERL etc. (Hair et al., 2010).

The researcher used AMOS version 21 program to a) study the relationship between latent variables by testing based on theories, and b) analyze the relationship between latent variables and indicators, or measured variables, by examining on the quality of the measurement. The AMOS program increases the opportunity to analyze variance and covariance. This technique is also applied with Confirmatory Factor Analysis (CFA) to examine the quality of measurement construction. The objective of this technique is to test hypotheses and relationship between latent variables and measured variables and to explore relationship between exogenous latent variables and endogenous latent variables (Wanichbancha, 2011).

3.6.2.1 Factor Analysis

Factor Analysis is a technique used to study the relationship structure of observed variables in research study. For example, in questioning opinions of respondents regarding impacts of the strategic risk, instead of asking a single question that may not be clear or detailed, and in confirming the impacts of the strategic risk, the questionnaire needs to have several items that question about the impacts of the strategic risk, and thus resulting in possibilities that create multiple observed variables. In practice, there are often many observable variables and these variables may be related to each other as well.

Factor analysis techniques analyze the structure of the correlation of observable variables, group the observed variables that are correlated together, called factors, and treat the generated factors as new variables. Therefore, the factor analysis is a classification of several observable variables, or it is also called a technique for reducing the number of variables. Confirmatory Factor Analysis (CFA) is used in case that the researcher has known the structure of the correlation of the observed variables, which may be based on relevant theories or reviews of relevant researches. Therefore, the researcher created a model demonstrating the relationship of the

variables. That is, the researcher expects some of the variables that are highly correlated and should be classified under common factors. The researcher usually knows the number of factors before and then uses techniques to confirm or verify the relationship model whether the results are in accordance with expectations or not. For analyzing the Structural Equation Model, most of the measurement models are Confirmation Factor Analysis. Therefore, the factor analysis for this research is the CFA analyzed by AMOS program before all the data are used to test the research hypotheses (Wanichbancha, 2013). The steps are as follows.

1) Create models of factors based on concepts and theories for the relationships between latent variables and observed variables.

2) Validate data, including the analysis of the correlation matrix by SPSS for Windows, calculate the correlation coefficient between observed variables and latent variables by the Pearson's correlation statistic.

3) analyze results of CFA by AMOS program with Goodness of Fit statistics which have the most common criteria to be considered i.e., 1) Chi-square value that should be insignificant 2) Chi-square/df that must not exceed 2, and 3) Root Mean Square Error of Approximation (RMSEA) that must be less than 0.05 etc.

3.6.2.2 Structural Equation Model Analysis

The steps of SEM analysis are as following.

1) Examine the multicollinearity: to pass this criterion, all observed variables must be independent and correlation between all pairs of observed variables must be less than 0.90 (Hair et al., 2010)

2) Assess measurement model validity: measurement model validity depends on 1) pass acceptable criteria of goodness of fit, 2) pass construct validity, and 3) pass reliability

The measurement of the goodness of model fit for SEM as well as CFA is determined by 1) Absolute Fit Indices that indicate how well the research model fits the empirical data e.g. p-value of Chi-squares ($\chi 2$), Relative Chi-square (CMIN/df), Goodness of Fit Index (GFI), Standardized Root Mean Square Residual (SRMR), and Root Mean Square Error of Approximation

(RMSEA), 2) Incremental Fit Indices that indicate how well the estimated research model fits relative to a baseline model that assumes all observed variables are uncorrelated e.g. Incremental Fit Index (IFI), Comparative Fit Index (CFI) and Normed Fit Index (NFI), and 3) Parsimony Fit Indices that indicate which model among competing models (relative to their complexity because more complex models are expected to fit the data better) exhibits the best fit e.g. Adjusted Goodness of Fit Index (AGFI). The details are explained in Table 3.10.

Construct validity determines the extent to which a set of observed variables represents the latent variables that were constructed in relation to theories. It comprises of convergent validity and discriminant validity. The standardized factor loading (with t-value greater than |1.96| or p-value is greater 0.05) of each observed variable must be higher than 0.35 (Hair et al., 2010, p. 117) and this indicates the degree of strength of that observed variable in the measurement model.

Convergent validity measure how close of a set of observed variables altogether to determined their latent variables. The Average Variance Extracted (AVE) of each latent variable must be equal to or greater than 0.5 (Hair et al., 2010).

Discriminant validity tests whether two dissimilar constructs measure the same thing or not and the relationship between measures from different constructs should be very low. Pearson's correlation coefficients between pairs of latent variables must be less than the square root of the extracted average variance (AVE) (Hair et al., 2010).

$$\text{AVE} = \frac{\sum \text{Standardized factor loading}^2}{[\sum \text{Standardized factor loading}^2 + \sum \text{Variance(error)}]}$$

$$\text{Communality or Common Variance} = \sum \text{Standardized factor loading}^2$$

Reliability is measure by Composite Reliability (C.R. > 0.7, Hair et al., 2010) that indicates the shared variance among the set of observed variables of a latent variable (internal consistency reliability).

$$C.R. = \frac{(\sum \text{Standardized factor loading})^2}{[(\sum \text{Standardized loading})^2 + \sum \text{Variance(error)}]}$$

Variance(error) = variance of the error term for the ith indicator

3.6.2.3 Structural Equation Model Assessment

SEM presents relationship between all pairs of latent variables in the form of a linear regression. Therefore, there are three issues to be assesses.

1) the direction of each regression coefficient must conform to theories

2) each regression coefficient must be statistically significant

3) Coefficient of Determination (R^2) must be higher than 0.50 (Hair et al., 2010).

3.6.2.4 Model Modification

Model modification is used when common variance of the research model does not fit the total variance of empirical data or measurement errors between the research model and empirical data differ largely. The aim of model adjustment is to estimate new parameters by expecting that the difference of the measurement errors will decrease. AMOS program generates Modification Index (MI) as a guide for model adjustment. MI roughly indicates that if a new parameter is added in the research model, the χ^2 of the model will decrease to MI. The model MI with the largest value is the first model to be modified (one at a time, and re-assess), however the model modification has to be explained in terms of theories as well as empirical data. Model adjustment relying on MI only is not sufficient because MI may not help find the right model. Therefore, any parameter with Standardized Residual value higher than 2.58 can be added and analyze the research model again. If any parameter with Standardized Residual value less than -2.58, the parameter should be deleted and analyze the research model again. There are two steps as following (Hair et al., 2010; Wanichbancha, 2013).

1) investigate the overall model in a holistic view

2) investigate parameters especially the influence of independent variables that affect dependent variables i.e., regression coefficient, standardized regression weight, Standardized

Residual, Item Reliability (Communality, Variance extracted, or squared multiple correlation: R^2), and MI.

Table 3.10 SEM Statistical Criteria for Research Model

Statistics	Symbol	Objectives	Accepted level
Chi-square	χ^2	Test null hypothesis that the conceptual research framework model is overall fit empirical data	Ns.($p > 0.05$) [4]
Relative Chi-square	χ^2/df or CMIN/df	Test the consistency between the conceptual research framework model and empirical data	< 2.00 [3,7]
Goodness of Fit Index	GFI	To measure the goodness of fit of SEM as a whole	> 0.90 [4]
Standardized Root Mean Square Residual	Standardized RMR (SRMS)	To evaluate the covariance that are not explained by the model (residuals) by calculating the square root of the discrepancy between the elements of sample covariance matrix and the covariance matrix predicted by the model. SRMR values range between 0-1.	< 0.05 [6]
Root Mean Square Error of Approximation	RMSEA	To evaluate how well the model would fit the population covariance matrix if it were available. RMSEA values range between 0-1.	< 0.05 [4, 6]

Table 3.10 (Continue)

Statistics	Symbol	Objectives	Accepted level
Incremental Fit Index	IFI	Test how well the estimated model fits the baseline (null model) that assumes all observed variables uncorrelated regardless of sample size.	> 0.90 [6]
Comparative Fit Index	CFI	To analyze the model fit by examining the discrepancy between the empirical data and the hypothesized model. Values range between 0-1.00.	> 0.90 [4, 6]
Normed Fit Index	NFI	To analyze the discrepancy between the chi-squared value of hypothesized model and the chi-squared value of the null mode.	≥ 0.90 [1, 2, 6]
Adjusted Goodness of Fit Index	AGFI	To evaluate the overall goodness of fit of SEM by taking into account differing degrees of model complexity by penalizing more complex models and favoring those with a minimum number of free paths. AGFI values range between 0-1.	≥ 0.90 [5, 6]

Source: Barbara and Linda (2013), Bentler & Bonet (1980) [1], Bollen (1989) [2], Carmines & McIver (1981) [3], Hair et al. (2010) [4], Schumacker & Lomax (2004) [5], Wanichbancha (2013) [6], Ullman (2001) [7]

3.7 Summary

The researcher used quantitative approach by employing the questionnaire to collect data from a sample of energy efficiency service companies in Thailand. The structural equation model is used to analyze the results. In addition, a documentary review approach by documentary review is conducted to confirm problems and obstacles, and risks that EESCs has been facing and to provide guidelines to respond to the risks according to the ERM concepts. Moreover, the results are consistent with the empirical data.

CHAPTER 4

ANALYSIS AND FINDINGS

At this stage of the research study of the development of model of causal factors that impact enterprise risk management and firm financial performance for energy efficiency services in Thailand. The objective of this research is to developed the Structural Equation Model (SEM) for enterprise risk management system that impact firm financial performance. There are 4 latent variables such as Enterprise Risks (ER), Enterprise Risk Management (ERM), Contingent Variables (CoV), and Firm Financial Performance (FFP) for this SEM model to test the casual relationship of collected empirical data with the theoretical research framework. ER and CoV together relate to ERM and ERM then relates to FFP. There is no direct relationship from ER to FFP and CoV to FFP in this model as they were not fully supported by theories and by actual operation. Thirty seven risk drivers were classified into four groups under ER i.e., 1) Strategic Risk (SR), 2) Operation Risk (OR), 3) Financial Risk (FR), and 4) Reputation Risk (RR). There are 14, 8, 11, and 4 risk drivers for SR, OR, FR, and RR respectively. CoV comprises of five components i.e. 1) Environment Uncertainty (EU), 2) Industry Competition (CI), 3) Firm Complexity (FC), 4) Firm Size (FS), and 5) Monitoring by Board of Directors (MBD). The level of ERM implemenation is measured by Strategy (S), Operation (O), Reporting (R), and Compliance (C). The Firm Financial Performance is measured in terms of accounting approach, by Return on Assets (ROA), Return on Equity (ROE), and Earnings Per Share (EPS).

The analysis and findings are orderly presented in the following topics.

4.1 General Information

4.2 Opinion Level, Normality Test, and Correlation Coefficient Results

4.3 The Measurement Model

4.4 The Structural Equation Model Analysis

4.5 Hypothesis Testing Results

4.1 General Information

The researcher analyzed the general data of the respondents and display the frequency and percentage according to the analyzed data in the Appendix E.

The respondents consisted of 88 chief executive officers/managing directors (39.11%), 86 chief operating/ engineering/ technical/ project officers/ managers (38. 22%), and 51 chief financial/accounting officers/managers (22.67%). The majority of the 225 respondents were 175 males (77.78%) and 50 females (22.22%). Their ages ranged from 25 to over 55 years old. The majority of ages ranged between 36-45 years old, or 119 people (52.89%), the second largest group of people ranged between 46-55 years old, or 67 people (29.78%), and respondents with ages over 55 old were 32 people (14.22%). Most respondents held a master's degree, or 124 people (55.11%), followed by a bachelor's degree, or 100 people (44. 44%). Seventy- three people had work experience with the current companies for a range of 5-10 (32.44%), 72 people were in a range of 11-15 (32.00%), and 50 people were in a range of 16-20 (22.22%).

4.2 Opinion Level, Normality Test, and Correlation Coefficient Results

The results of the analysis of opinions of samples of respondents who worked in the EESCs industry in Thailand on causes of risks were classified as a result of the normal distribution of the data by considering the skewness (SKEW) and kurtosis (KUR) and the result of basic statistical analysis by relying on mean ($\overline{X}$) and standard deviation (S.D.).

In summary, all mean values of latent variables found in the EESCs industry are major. The normal distribution assumption is still valid for SEM because all skewness and kurtosis parameters are in acceptable ranges of ±2 (Field, 2000, 2009; Gravetter & Wallnau, 2014; Trochim & Donnelly, 2006).

4.2.1 Normality Test

These statistical data of each latent variable of ER are provided in Table 4.1. Descriptive Statistical Data for ER and Its Manifest Variables.

Enterprise Risk (ER): Overall, the average of the risk impacts is major ($\overline{X}$ = 4.07, S.D.= 0.50), skewed -0.51, which is a slightly left-skewed curve, with the kurtosis of -0.38 indicating that its distribution curve is slightly more flat with lighter tail than normal. The overall skewness and kurtosis are within acceptable criteria, because the values were between -2 and + 2. It can be concluded that ER data is normally distributed. When considered individually, it is found that skewness is between -1.23 and -0.39 and kurtosis is between -0.57 and 1.07, which both skewness and kurtosis values are still acceptable. Financial Risk exhibits the highest mean (impacts) while Strategic Risk, Operation Risk, and Reputation Risk are slightly similar and lower than Financial Risk.

Strategic Risk (SR): Overall, the average of the risk impacts is major ($\overline{X}$ = 4.02, S.D.= 0.65), skewed -0.39, which is a slightly left-skewed curve, with the kurtosis of -0.57 indicating that its distribution curve is slightly more flat with lighter tail than normal. The overall skewness and kurtosis are within acceptable criteria, because the values were between -2 and + 2. The overall manifest variable is considered as normal distribution. The skewness of each sub-item is in a range of -0.77 to -0.29, and -0.78 to 0.20 for kurtosis, which both skewness and kurtosis are in acceptable limits. The mean of each sub-item is all major. "Public fiscal tax and financial support were ambiguous, but unanswerable to EESCs' needs." Exhibits the highest mean ($\overline{X}$ = 4.11, S.D. = 0.85) and "New technologies with better efficiency and return emerged continuously. Hence, reaping the maximum benefits of projects was unlikely." Is the second largest mean ($\overline{X}$ = 4.07, S.D. = 0.77).

Operation Risk (OR): Overall, the average of the risk impacts is major ($\overline{X}$ = 3.98, S.D.= 0.77), skewed -0.55, which is a slightly left-skewed curve, with the kurtosis of -0.44 indicating that its distribution curve is slightly more flat with lighter tail than normal. The overall skewness and kurtosis are within acceptable criteria, because the values were between -2 and + 2. The overall manifest variable is considered as normal distribution. The skewness of each sub-item is in a range

of -0.78 to -0.39, and -0.85 to 0.18 for kurtosis, which both skewness and kurtosis are in acceptable limits. The mean of each sub-item is all major. “Discrepancies on guarantee issues between EESCs and technology suppliers.” Exhibits the highest mean ($\overline{X}$ = 4.07, S.D. = 0.88) and “EESCs absence of unified and simplified measurement and verification standards rendered sophisticated and costly expeditions.” Is the second largest mean ($\overline{X}$ = 4.03, S.D. = 0.93).

Financial Risk (FR): Overall, the average of the risk impacts is major ($\overline{X}$ = 4.23, S.D.= 0.86), skewed -1.23, which is a slightly left-skewed curve, with the kurtosis of 1.07 indicating that its distribution curve is slightly more top with heavier tail than normal. The overall skewness and kurtosis are within acceptable criteria, because the values were between -2 and + 2. The overall manifest variable is considered as normal distribution. The skewness of each sub-item is in a range of -1.30 to -1.05, and 0.24 to 1.39 for kurtosis, which both skewness and kurtosis are in acceptable limits. The mean of each sub-item is all major. “EESCs’ operating cash flow was inadequate, and access to funding sources was limited.” Exhibits the highest mean ($\overline{X}$ = 4.27, S.D. = 0.90) and “EESCs needed long terms and large funding amounts, hence exposure to high and fluctuating cost changes, i.e., interest rates or bank guarantee fees.” Is the second largest mean ($\overline{X}$ = 4.25, S.D. = 0.96).

Reputation Risk (RR): Overall, the average of the risk impacts is major ($\overline{X}$ = 4.05, S.D.= 0.85), skewed -1.00, which is a slightly left-skewed curve, with the kurtosis of 0.44 indicating that its distribution curve is slightly more top with heavier tail than normal. The overall skewness and kurtosis are within acceptable criteria, because the values were between -2 and + 2. The overall manifest variable is considered as normal distribution. The skewness of each sub-item is in a range of -1.39 to -0.47, and -0.96 to 1.66 for kurtosis, which both skewness and kurtosis are in acceptable limits. The mean of each sub-item is all major. “Customers were unfamiliar with roles and the importance of EESCs in materializing significant energy saving.” Exhibits the highest mean ($\overline{X}$ = 4.23, S.D. = 0.77) and “EESCs’ past performance record and reputation in view of customers were under par.” Is the second largest mean ($\overline{X}$ = 4.16, S.D. = 0.84).

Table 4.1 Descriptive Statistical Data for ER and Its Manifest Variables

No	Variables	Mean	S.D.	SKEW	KUR	Remarks
Enterprise Risks (ER)		4.07	0.50	-0.51	-0.38	Major
Strategic Risk (SR)		4.02	0.65	-0.39	-0.57	Major
1	Customers had limited insight into the energy efficiency technology and credit ability of ESCOs' prior undertaking such as data originality, limitation, conditions, etc., which lead to concerns regarding EESCs' exploitation.	4.06	0.87	-0.77	0.20	Major
2	Customer top executives required a high return on investment projects for energy efficiency, or there is no policy on the latter.	4.02	0.81	-0.39	-0.52	Major
3	Negative attitudes of customers' operation staff toward EESCs' employment due to fear of work interference or job uncertainty.	3.95	0.87	-0.39	-0.26	Major
4	Small customers lacked interest in EESCs' employment due to limited financial resources, non-sizeable savings, and less financial attractiveness for energy efficiency projects.	4.00	0.77	-0.29	-0.54	Major

Table 4.1 (Continue)

No	Variables	Mean	S.D.	SKEW	KUR	Remarks
5	Small customers did not have enough staff and knowledge to oversee and verify EESCs' performance.	4.04	0.83	-0.45	-0.54	Major
6	EESCs' proposals were derived from a different basis. It is difficult for customers to compare, evaluate, and decide.	3.97	0.84	-0.49	-0.37	Major
7	Customers collaborated under a moral obligation, while EESCs expected full collaboration under contract obligation.	4.00	0.79	-0.43	-0.25	Major
8	High net worth customers had technical and financial competency and thus were likely to implement plans by themselves.	4.03	0.82	-0.50	-0.11	Major
9	Customers required highly experienced third-party inspectors or consultants to ensure fairness in savings and costs.	4.04	0.81	-0.47	-0.41	Major
10	Public policies on supporting EESCs lacked clarity and continuity.	4.03	0.86	-0.48	-0.60	Major

Table 4.1 (Continue)

No	Variables	Mean	S.D.	SKEW	KUR	Remarks
11	Public fiscal tax and financial support were ambiguous, but unanswerable to EESCs' needs.	4.11	0.85	-0.51	-0.69	Major
12	Public procurement regulations awarded bidding on the lowest price basis, not on lifecycle cost.	4.02	0.82	-0.53	-0.23	Major
13	New technologies with better efficiency and return emerged continuously. Hence, reaping the maximum benefits of projects was unlikely.	4.07	0.77	-0.41	-0.39	Major
14	Trustworthy proven evidence based on continuous and long-time operation rarely existed, thus posing risks on saving evaluations and guarantees.	4.00	0.88	-0.41	-0.78	Major
Operation Risk (OR)		3.98	0.77	-0.55	-0.44	Major
1	EESCs absence of unified and simplified measurement and verification standards rendered sophisticated and costly expeditions.	4.03	0.93	-0.63	-0.35	Major
2	Inadequate qualified staff to execute deals and monitor projects en masse, particularly in SMEs, which are numerous and costly.	4.00	0.87	-0.64	0.18	Major

Table 4.1 (Continue)

No	Variables	Mean	S.D.	SKEW	KUR	Remarks
3	EESCs' absence of unified and simplified measurement and verification standard rendered sophisticated and costly expeditions.	3.98	0.89	-0.49	-0.43	Major
4	EESCs' disability on measurement and verification accuracy led to unacceptable results by customers.	4.02	0.87	-0.45	-0.71	Major
5	Improper use and maintenance or equipment failure rendering lower than expected savings.	3.99	0.86	-0.59	-0.02	Major
6	Discrepancies on guarantee issues between EESCs and technology suppliers.	4.07	0.88	-0.78	0.18	Major
7	EESCs' high reliance on external technologies resulted in high costs and complicated management structures.	4.00	0.89	-0.39	-0.85	Major
8	EESCs difficulty in accessing customers' real energy usage information led to inaccurate and uncertain saving estimations.	3.74	1.31	-0.71	-0.70	Major

Table 4.1 (Continue)

No	Variables	Mean	S.D.	SKEW	KUR	Remarks
Financial Risk (FR)		4.23	0.86	-1.23	1.07	Major
1	Customers intentionally withheld payment to EESCs.	4.22	0.91	-1.14	0.90	Major
2	Long-term payment nature of energy projects was unattractive to customers and financial institutes.	4.20	0.96	-1.24	1.18	Major
3	EESCs needed long terms and large funding amounts, hence exposure to high and fluctuating cost changes, i.e., interest rates or bank guarantee fees.	4.25	0.96	-1.15	0.53	Major
4	Regulated or subsidized energy prices distorted saving and payback periods.	4.23	0.95	-1.30	1.39	Major
5	Accounting rules rendered compliance difficulties in book entry and tax management for obtaining tax privileges, i.e., capital expenditures (Board of Investment) or expenses (Department of Revenue).	4.20	0.94	-1.20	1.25	Major

Table 4.1 (Continue)

No	Variables	Mean	S.D.	SKEW	KUR	Remarks
6	Financial institutes lending criteria are based on securities rather than project financing. Thus, EESCs with limited collaterals faced difficulties in gaining credit lines.	4.21	0.94	-1.16	0.91	Major
7	EESCs with small registered capital hardly were qualified to bid on large-scale projects.	4.23	0.94	-1.05	0.24	Major
8	EESCs' operating cash flow was inadequate, and access to funding sources was limited.	4.27	0.90	-1.27	1.30	Major
9	EESCs' excessive lead time in project and contract preparation caused extra unforeseen expenses.	4.24	0.92	-1.19	0.96	Major
10	EESCs' saving estimation error, or customers' energy consumptions, deviated from the baseline, and relocation or stopping operations was detrimental to financial performance.	4.20	0.94	-1.15	0.87	Major
11	EESCs' delayed project operation brought extra burden on expenses, project costs, and overhead costs later.	4.25	0.94	-1.23	1.06	Major

Table 4.1 (Continue)

No	Variables	Mean	S.D.	SKEW	KUR	Remarks
Reputation Risk (RR)		4.05	0.85	-1.00	0.44	Major
1	Customers were unfamiliar with roles and the importance of EESCs in materializing significant energy saving.	4.23	0.77	-0.47	-0.96	Major
2	Financial institutes possessed limited information and staff who understood EESCs' business and presumed EESCs to be a high-risk business.	3.92	1.10	-1.39	1.66	Major
3	EESCs' past performance record and reputation in view of customers were under par.	4.16	0.84	-0.68	0.08	Major
4	Failures of some EESCs in the past tarnished the ESCO industry reputation.	3.88	1.15	-1.22	0.97	Major

These statistical data, such as $\overline{X}$, S.D., skewness, and kurtosis of each latent variable of CoV are provided in Table 4.2 Descriptive Statistical Data for CoV and Its Manifest Variables.

Contingent Variables (CoV): Overall, the average of the CoV impacts is moderate ($\overline{X}$ = 3.47, S.D.= 0.54), skewed -0.26, which is a slightly left-skewed curve, with the kurtosis of -0.05 indicating that its distribution is very close to and slightly more flat with lighter tail than normal. The overall skewness and kurtosis are within acceptable criteria, because the values were between -2 and + 2. It can be concluded that CoV data is normally distributed. When considered individually, it is found that skewness is between -0.57 and 0.28 and kurtosis is between -1.74 and 0.15, which both skewness and kurtosis values are still acceptable. Firm Size exhibits the highest mean (influence), the second largest mean value is Industry Competition.

Table 4.2 Descriptive Statistical Data for CoV and Its Manifest Variables

No	Variables	Mean	S.D.	SKEW	KUR	Remarks
	Contingent Variables (CoV)	3.47	0.54	-0.26	-0.05	Moderate
1	Environment Uncertainty (EU)	2.68	1.58	0.28	-1.48	Moderate
2	Industry Competition (CI)	3.88	1.45	-0.53	-1.74	Major
3	Firm Complexity (FC)	3.20	0.62	0.06	-0.11	Moderate
4	Firm Size (FS)	3.96	0.86	-0.57	0.15	Major
5	Monitoring by Board of Directors (MBD)	3.60	0.61	-0.27	-0.15	Major

These statistical data, such as $\overline{X}$, S.D., skewness, and kurtosis of each latent variable of ERM are provided in Table 4.3 Descriptive Statistical Data for ERM and Its Manifest Variables.

Enterprise Risk Management (ERM): Overall, the average of the ERM levels is major ($\overline{X}$ = 3.63, S.D.= 0.65), skewed -0.42, which is a slightly left-skewed curve, with the kurtosis of -0.27 indicating that its distribution is slightly more flat with lighter tail than normal. The overall skewness and kurtosis are within acceptable criteria, because the values were between -2 and + 2. It can be concluded that ERM data is normally distributed. When considered individually, it is found that skewness is between -0.58 and -0.29 and kurtosis is between -0.50 and 1.22, which both

skewness and kurtosis values are still acceptable. Reporting exhibits the highest mean (successful level), the second largest mean value is Compliance.

Strategy (S): Overall, the average of the strategy risk management level is moderate ($\overline{X}$ = 3.36, S.D.= 0.98), skewed -0.29, which is a slightly left-skewed curve, with the kurtosis of -0.17 indicating that its distribution curve is slightly more flat with lighter tail than normal. The overall skewness and kurtosis are within acceptable criteria, because the values were between -2 and + 2. The overall manifest variable is considered as normal distribution. The skewness of each sub-item is in a range of -0.34 to -0.21, and -0.38 to -0.06 for kurtosis, which both skewness and kurtosis are in acceptable limits. The mean of each sub-item is between moderate for all items. Strategic effectiveness2 (the diversification of firm risks compared with the competitors in the industries) exhibits the highest mean ($\overline{X}$ = 3.37, S.D. = 1.02) and Strategic effectiveness1 (the firm market share acquisition and systematic risk diversification compared with competitors in the same industry) is the second largest mean ($\overline{X}$ = 3.34, S.D. = 0.99).

Operation (O): Overall, the average of the operation risk management level is moderate ($\overline{X}$ = 3.42, S.D.= 1.07), skewed -0.39, which is a slightly left-skewed curve, with the kurtosis of -0.40 indicating that its distribution curve is slightly more flat with lighter tail than normal. The overall skewness and kurtosis are within acceptable criteria, because the values were between -2 and + 2. The overall manifest variable is considered as normal distribution. The skewness of each sub-item is -0.37 for all items, and -0.47 to -0.39 for kurtosis, which both skewness and kurtosis are in acceptable limits. The mean of each sub-item is moderate for all items. Operation efficiency1 (utilizing assets to generate revenue) exhibits the mean ($\overline{X}$ = 3.42, S.D. = 1.09) equal to Operation efficiency2 (utilizing employees to generate revenue) ($\overline{X}$ = 3.42, S.D. = 1.11).

Reporting I: Overall, the average of the reporting reliability risk management level is major ($\overline{X}$ = 4.14, S.D.= 0.82), skewed -0.58, which is a slightly left-skewed curve, with the kurtosis of -0.50 indicating that its distribution curve is slightly more flat with lighter tail than normal. The overall skewness and kurtosis are within acceptable criteria, because the values were between -2 and + 2. The overall manifest variable is considered as normal distribution. The skewness of each

sub-item is in a range of -0.59 to -0.57, and -0.64 to -0.49 for kurtosis, which both skewness and kurtosis are in acceptable limits. The mean of each sub-item is major for all items. Reporting reliability2 (accounting manipulation) exhibits the highest mean ($\overline{X}$ = 4.15, S.D. = 0.84) and Reporting reliability1 (unqualified financial statement) is the second largest mean ($\overline{X}$ = 4.12, S.D. = 0.84).

Table 4.3 Descriptive Statistical Data for ERM and Its Manifest Variables

No	Variables	Mean	S.D.	SKEW	KUR	Remarks
Enterprise Risk Management (ERM)		3.63	0.65	-0.42	-0.27	Major
Strategy (S)		3.36	0.98	-0.29	-0.17	Moderate
1	Strategic effectiveness1	3.34	0.99	-0.34	-0.06	Moderate
2	Strategic effectiveness2	3.37	1.02	-0.21	-0.38	Moderate
Operation (O)		3.42	1.07	-0.39	-0.40	Moderate
1	Operation efficiency1	3.42	1.09	-0.37	-0.39	Moderate
2	Operation efficiency2	3.42	1.11	-0.37	-0.47	Moderate
Reporting (R)		4.14	0.82	-0.58	-0.50	Major
1	Reporting reliability1	4.12	0.84	-0.59	-0.49	Major
2	Reporting reliability2	4.15	0.84	-0.57	-0.64	Major
Compliance (C)		3.61	0.61	-0.49	1.22	Major
1	Compliance1	3.61	0.66	-0.50	0.71	Major
2	Compliance2	3.60	0.64	-0.45	0.73	Major

These statistical data, such as $\overline{X}$, S.D., skewness, and kurtosis of each latent variable of FFP are provided in Table 4.4 Descriptive Statistical Data for FFP and Its Manifest Variables.

Firm Financial Performance (FFP): Overall, the average of the FFP levels is moderate ($\overline{X}$ = 3.18, S.D.= 0.54), skewed 0.20, which is a slightly right-skewed curve, with the kurtosis of 0.07 indicating that its distribution is very close to and slightly more top with heavier tail than

normal. The overall skewness and kurtosis are within acceptable criteria, because the values were between -2 and + 2. It can be concluded that FFP data is normally distributed. When considered individually, it is found that skewness is between 0.08 and 0.34 and kurtosis is between -0.35 and 0.54, which both skewness and kurtosis values are still acceptable. Return on Assets exhibits the highest mean (the best performance), the second largest mean value is Earnings Per Share (EPS).

Table 4.4 Descriptive Statistical Data for FFP and Its Manifest Variables

No	Variables	Mean	S.D.	SKEW	KUR	Remarks
Firm Financial Performance (FFP)		3.18	0.54	0.20	0.07	Moderate
2	Return on Assets (ROA)	3.25	0.74	0.11	-0.32	Moderate
3	Return on Equity (ROE)	3.13	0.77	0.08	-0.35	Moderate
4	Earnings Per Share (EPS)	3.16	0.49	0.34	0.54	Moderate

4.2.2 Correlation Coefficient

Table 4.6 presents the correlation of between each pair of 16 observed variables in the research model. It was found that the correlations between the 27 pairs of variables were statistically and significantly different from zero at 0.01 and 8 pairs of variables at 0.05, totaling 35 pairs of correlations, and they were in a range of -0.195 and 0.599 which fell in all acceptable criteria and passed the preliminary assumption of multicollinearity. This is because they were found to be less than 0.90 (Hair, Anderson, Tatham, & Black 1998; Hinkle, 1998, p. 118). The lowest correlation is the correlation between the S and FR (-0.195) while the highest correlation is the correlation between ROE and ROA (0.599).

Table 4.5 Pearson Product Moment Correlation Coefficient (PPMC) Between Pairs of Observed Variables

Variables	SR	OR	FR	RR	EU	CI	FC	FS	MBD	S	O	R	C	ROA	ROE	EPS
SR	1															
OR	0.482**	1														
FR	0.453**	0.407**	1													
RR	0.114	0.060	0.070	1												
EU	-0.024	0.044	0.107	0.062	1											
CI	-0.013	-0.067	0.014	0.364**	0.086	1										
FC	-0.055	-0.045	0.004	0.019	-0.151*	-0.071	1									
FS	-0.102	-0.060	-0.040	0.007	-0.111	-0.053	0.373**	1								
MBD	-0.063	-0.108	-0.009	-0.072	-0.084	-0.085	0.301**	0.444**	1							
S	-0.173**	-0.169*	-0.195**	-0.065	-0.143*	-0.044	0.203**	0.243**	0.158*	1						
O	-0.058	-0.079	-0.180**	0.033	-0.097	0.001	0.199**	0.195**	0.190**	0.568**	1					
R	-0.097	-0.068	-0.115	0.036	-0.092	-0.046	0.218**	0.163*	0.128	0.446**	0.464**	1				
C	-0.117	-0.125	-0.119	0.064	-0.044	-0.008	0.185**	0.080	0.080	0.315**	0.252**	0.196**	1			
ROA	-0.042	-0.040	-0.024	-0.052	-0.008	-0.026	0.093	0.176**	0.114	0.044	0.158*	0.077	-0.060	1		
ROE	-0.113	-0.103	-0.064	0.050	-0.040	0.022	-0.018	0.109	0.121	0.096	0.149*	0.158*	-0.039	0.599**	1	
EPS	0.009	-0.044	-0.095	-0.006	-0.044	-0.010	-0.064	0.087	0.006	0.057	0.105	0.068	-0.013	0.406**	0.348**	1

Note to Table 4

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

4.3 The Measurement Model

The measurement model Structural Equation Model (SEM) comprises of the goodness of fit (GoF) analysis that determines whether the model corresponds to empirical data or not (Confirmatory Factor Analysis: CFA) for the four latent variables in the research model such as 1) Enterprise Risk (ER), 2) Contingent Variables (CoV), 3) Enterprise Risk Management (ERM), and 4) Firm Financial Performance (FFP) with their respective observed variables, analysis of regression weight of each questionnaire item, factor loading analysis, validity test, and reliability test. The objective is to determine the significant factor loading values for all variables. Any observed variable that is the confirmed factor will have Critical Ratio (C.R.) value with $Z > 1.96$, p-value < 0.05. This mean that the factor loading value of that observed variable is significantly different from zero at 0.05 ($p < 0.05$) (Hair et al., 2010, Wanichbancha, 2013). The measurement of the goodness of model fit for CFA and SEM is determined by 1) Absolute Fit Indices e.g. p-value of Chi-squares (χ^2), Relative Chi-square (CMIN/df), Goodness of Fit Index (GFI), Standardized Root Mean Square Residual (SRMR), and Root Mean Square Error of Approximation (RMSEA), 2) Incremental Fit Indices e.g., Incremental Fit Index (IFI), Comparative Fit Index (CFI) and Normed Fit Index (NFI), and 3) Parsimony Fit Indices e.g., Adjusted Goodness of Fit Index (AGFI). The use of p-value of Chi-squares (χ^2) is limited because it rapidly increases with larger sample size and higher latent variables, thus resulting in higher chance to reject null hypothesis (H_0). When the model rejects H_0, Relative Chi-square (χ^2/df or CMIN/df) with value less than 2.00 (Carmines & McIver 1981; Ullman, 2001) (or < 3.00: Kline, 2011) should be is used instead.

If any of GoF parameters of each latent variable did not pass model measurement criteria, observed variables (with factor loading smaller than 0.35, Hair et al., 2010, p. 117 or p-value < 0.05) were deleted from their corresponding latent variables. The research model adjustment is based on theoretical reasoning and empirical evidences.

4.3.1 Overall CFA model

CFA analysis for the overall model comprises of 4 latent variables such as Enterprise Risks (ER), Contingent Variables (CoV), Enterprise Risk Management (ERM), and Firm Financial Performance (FFP) and 16 observed variables. ER has 4 observed variables i.e., Strategic Risk (SR) with 14 items, Operation Risk (OR) with 8 items, Financial Risk (FR) with 11 items, and Reputation Risk (RR) with 4 items. CoV comprises of 5 observed variables such as Environmental Uncertainty (EU) with 1 item, Industry Competition (CI) with 1 item, Firm Complexity (FC), with 1 item, Firm Size (FS) with 1 item, and Monitoring by Board of Directors (MBD) with 1 item. ERM comprises 4 observed variables such as Strategy (S) with 2 items, Operation (O) with 2 items, Reporting with 2 items, and Compliance with 2 items. FFP comprises 3 observed variables such as Return on Assets (ROA) with 1 item, Return on Equity (ROE) with 1 item, and Earnings Per Share (EPS) with 1 item. The CFA analysis results of the overall research model are shown in the following table.

Table 4.6 GoF Statistics of Overall Model Before and After Modification

Goodness of Fit Indices	Criteria	Before Modification	After Modification
p-value of χ^2	> 0.05	0.24	0.79
CMIN/df	< 2.00	1.10	0.85
GFI	> 0.90	0.95	0.97
SRMR	< 0.05	0.05*	0.04
RMSEA	< 0.05	0.02	0.00
IFI	> 0.90	0.98	1.02
CFI	> 0.90	0.98	1.00
NFI	≥ 0.90	0.85*	0.92
AGFI	≥ 0.90	0.92	0.95

Note: * Not pass criteria

Some statistics of goodness of fit of overall CFA model did not pass certain criteria e.g., SRMR and NFI. Therefore, the research model needed modification so that it fits the empirical data relying on theoretical reasons and modification indices. After the model was adjusted, statistical values conform to CFA criteria. Three observed variables that are erased from the research model are Reputation Risk (RR), Environmental Uncertainty (EU), and Industry Competition (CI). The modification is indicated by standardized factor loading values before modification of RR, EU, and CI which are less than 0.35.

The details of model measurement and model modification for each latent variable are shown in the following topics.

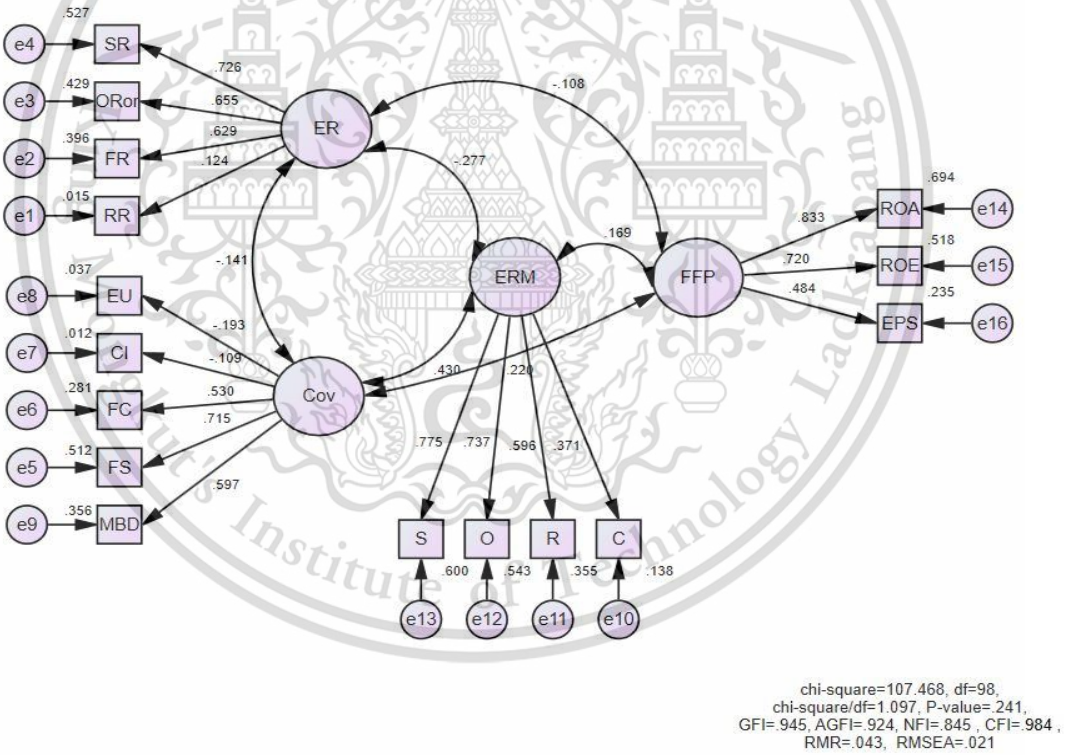

Figure 4.1 CFA model of the Overall Research Model Before Modification

The modification of the model of indicators, RR, EU, and CI, is based on their C.R. and p-value given in the Regression Weights table generated by AMOS as shown in the following table. Each indicator RR and CI were deleted first because their C.R. and p-value did not pass the

respective criteria (C.R. value with Z > 1.96, p-value < 0.05). However, the after deletion of RR and CI some of the GoF Statistics of the CFA overall model did not meet their respective criteria. The next indicator to be deleted was EU, which has C.R. value with Z of -2.29 and the next highest p-value of 0.022. After these three indicators were deleted, all GoF Statistics met all criteria and the model fits the empirical data.

Table 4.7 Regression Weights of Overall CFA Model Before Modification

Indicator	(1)	Latent Variable	Estimate	S.E.	C.R.	p-value
RR	<---	ER	0.16	0.10	1.55	0.121
FR	<---	ER	1.00			
OR	<---	ER	0.93	0.14	6.48	***
SR	<---	ER	0.87	0.14	6.41	***
FS	<---	CoV	1.00			
FC	<---	CoV	0.54	0.10	5.31	***
CI	<---	CoV	-0.26	0.19	-1.33	0.184
EU	<---	CoV	-0.41	0.18	-2.29	0.022
MBD	<---	CoV	0.59	0.10	5.91	***
C	<---	ERM	1.00			
R	<---	ERM	2.16	0.48	4.51	***
O	<---	ERM	3.51	0.74	4.72	***
S	<---	ERM	3.37	0.69	4.92	***
ROA	<---	FFP	1.00			
ROE	<---	FFP	0.90	0.14	6.28	***
EPS	<---	FFP	0.39	0.07	5.68	***

Note (1): Each latent variable is confirmed by its corresponding indicator.

Note: *** statistically significant level at 0.001

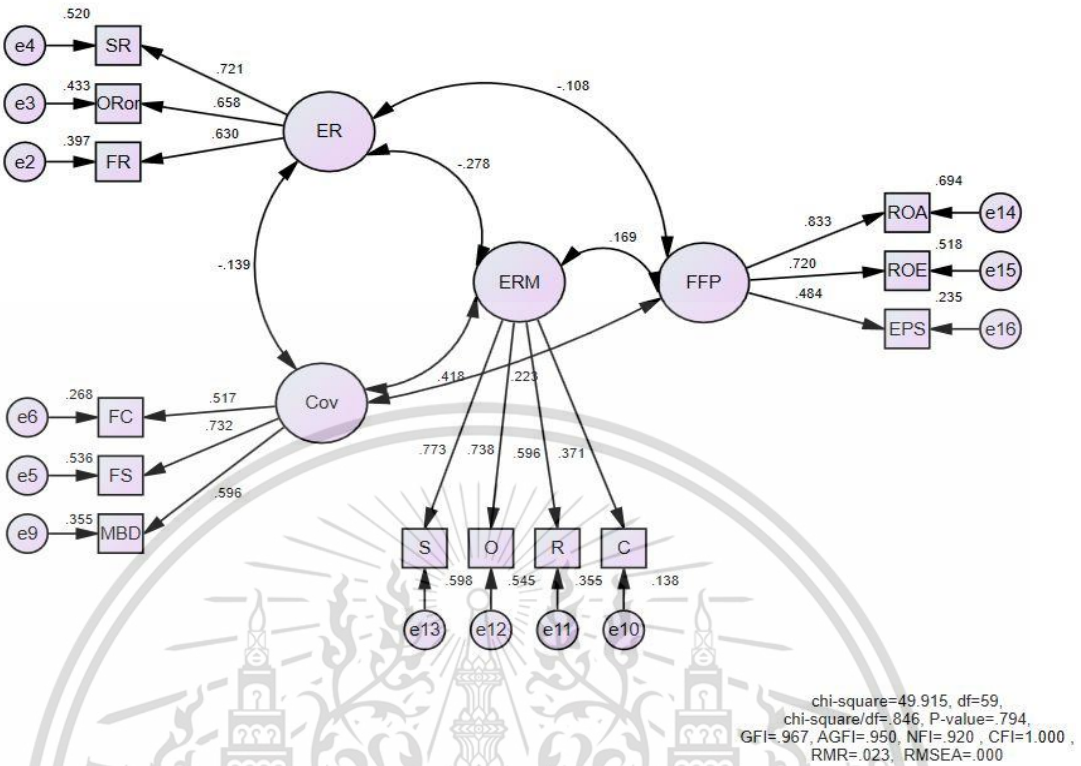

Figure 4.2 CFA model of the Overall Research Model After Modification

ER Measurement model: The regression weight of each observed variable ranges between 0.63-0.72. All Critical Ratio values (C.R.) > 1.96. Regression weights of all observed variables are significantly different from zero at statistically significant level of 0.05 (p-value < 0.05). The R^2 value of each observed variables ranges from 0.40-0.52. Manifest variables i.e., SR, OR, and FR are significant indicators, except RR. The Composite Reliability (CR) is 0.81 greater than 0.70 criterion. The Average Extracted Variance (AVE) is 0.58 greater than 0.50 criterion. The new definition of ER has to be changed to reflect the exclusion of RR from ER. The explanation is under Implication and Recommendations section on Chapter 5.

CoV Measurement model: The regression weight of each observed variable ranges between 0.52-0.73. All Critical Ratio values (C.R.) > 1.96. Regression weights of all observed variables are significantly different from zero at statistically significant level of 0.05 (p-value < 0.05). The R^2 value of each observed variables ranges from 0.27-0.36. Manifest variables i.e., FC, FS, and MBD are significant indicators, except EU and CI. The Composite Reliability (CR) is 0.80 greater than 0.70 criterion. The Average Extracted Variance (AVE) is 0.57 greater than 0.50

criterion. The new definition of CoV has to be changed to reflect the exclusion of EU from CI. The explanation is under Implication and Recommendations section on Chapter 5.

ERM Measurement model: The regression weight of each observed variable ranges between 0.37-0.77. All Critical Ratio values (C.R.) > 1.96. Regression weights of all observed variables are significantly different from zero at statistically significant level of 0.05 (p-value < 0.05). The R^2 value of each observed variables ranges from 0.14-0.60. Manifest variables i.e., S, O, R, and C are significant indicators, with no deletion. The Composite Reliability (CR) is 0.79 greater than 0.70 criterion. The Average Extracted Variance (AVE) is 0.50 close to 0.50 criterion.

FFP Measurement model: The regression weight of each observed variable ranges between 0.48-0.83. All Critical Ratio values (C.R.) > 1.96. Regression weights of all observed variables are significantly different from zero at statistically significant level of 0.05 (p-value < 0.05). The R^2 value of each observed variables ranges from 0.24-0.69. Manifest variables i.e., ROA, ROE, and EPS are significant indicators, with no deletion. The Composite Reliability (CR) is 0.87 greater than 0.70 criterion. The Average Extracted Variance (AVE) is 0.70 close to 0.50 criterion. Goodness of fit statistics with no modification is not shown because the initial FFP measurement model comprises of only 3 indicators such as ROA, ROE, and EPS.

All details are shown in the following table.

Table 4.8 CFA Statistics of the Overall Research Model

Item	(1)	Latent Variables	Standardized Factor Loading	S.E.	Critical Ratio	p-value	R^2	CR	AVE
SR	←	ER	0.72	0.13	6.42	***	0.52	0.81	0.58
OR	←	ER	0.66	0.15	6.43	***	0.43		
FR	←	ER	0.63				0.40		
FC	←	CoV	0.52	0.10	5.15	***	0.27	0.80	0.57
FS	←	CoV	0.73				0.54		
MBD	←	CoV	0.60	0.10	5.63	***	0.36		
S	←	ERM	0.77	0.69	4.91	***	0.60	0.79	0.50
O	←	ERM	0.74	0.75	4.72	***	0.55		
R	←	ERM	0.60	0.48	4.51	***	0.36		
C	←	ERM	0.37				0.14		
ROA	←	FFP	0.83				0.69	0.87	0.70
ROE	←	FFP	0.72	0.14	6.28		0.52		
EPS	←	FFP	0.48	0.07	5.68	***	0.24		

Note: *** statistically significant level at 0.001

** statistically significant level at 0.01

* statistically significant level at 0.05

Note (1): Each latent variable is confirmed by its corresponding indicator.

Shapiro-Wilk value of each latent variable is insignificant meaning that each latent variable passes the normality test. All pairs of Pearson's correlation coefficients between latent variables are less than the square root of the extracted average variance (shown in the main diagonal of the following table) and the discriminant validity test is satisfied.

Table 4.9 Discriminant Validity

LV	Mean	SD	Shapiro-Wilk	Pearson's Correlations vs Sqrt (AVE) (in main diagonal)			
				ER	CoV	ERM	FFP
ER	4.081	0.902	0.000	0.762			
CoV	3.590	0.770	0.000	-0.086	0.758		
ERM	3.629	0.937	0.001	-.215**	.308**	0.706	
FFP	3.179	0.677	0.000	-0.092	.132*	.133*	0.834

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

4.3.2 Measurement Model of Enterprise Risks (ER) Components

All statistics of goodness of fit passed all criteria before model modification. However, the regression weights of RR to its latent variable, ER, was 0.124 which are lower than 0.35 criterion. Therefore, RR were dropped from the research model to alleviate the fit problem and SR, OR, and FR are significant indicators only. The CFA analysis results of are shown in the following figure and table.

Table 4.10 GoF Statistics of Enterprise Risk Before and After Modification

Goodness of Fit Indices	Criteria	Before Modification	After Modification
p-value of χ^2	> 0.05	0.80	Just-Identified
CMIN/df	< 2.00	0.22	Just-Identified
GFI	> 0.90	1.00	Just-Identified
SRMR	< 0.05	0.01	Just-Identified
RMSEA	< 0.05	0.00	Just-Identified
IFI	> 0.90	1.01	Just-Identified
CFI	> 0.90	1.00	Just-Identified
NFI	≥ 0.90	1.00	Just-Identified
AGFI	≥ 0.90	1.00	Just-Identified

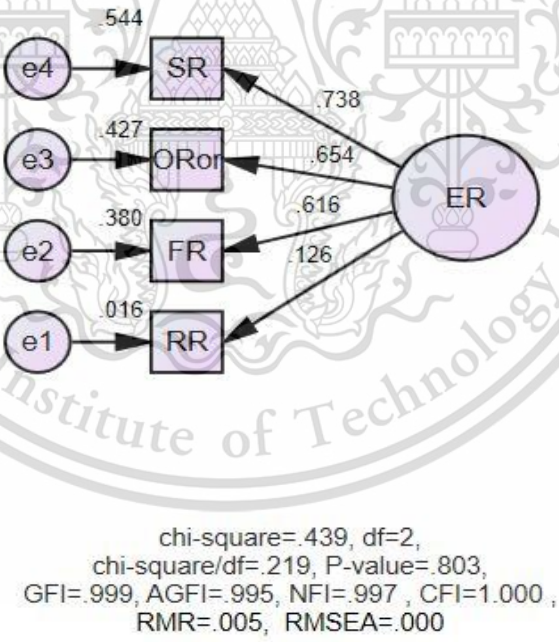

Figure 4.3 CFA model of Enterprise Risk Before Modification

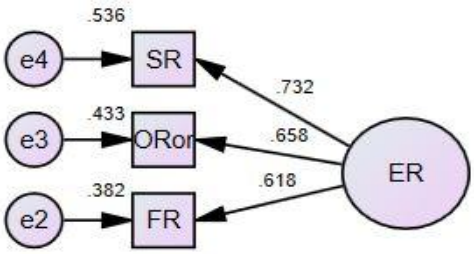

Figure 4.4 CFA model of Enterprise Risk After Modification

Strategic Risk (SR)

Some statistics of goodness of fit did not pass certain criteria such as p-value of χ^2 (0.01). Therefore, the research model needed modification so that it fits the empirical data relying on theoretical reasons and modification indices. The model was adjusted by estimating 2 more parameters i.e., e5- e14 and e12-e14. The CFA analysis results of are shown in the following table.

Table 4.11 GoF Statistics of Strategic Risk Before and After Modification

Goodness of Fit Indices	Criteria	Before Modification	After Modification
p-value of χ^2	> 0.05	0.01*	0.15
CMIN/df	< 2.00	1.39	1.17
GFI	> 0.90	0.94	0.95
SRMR	< 0.05	0.03	0.03
RMSEA	< 0.05	0.04	0.03
IFI	> 0.90	0.99	0.99
CFI	> 0.90	0.99	0.99
NFI	≥ 0.90	0.95	0.96
AGFI	≥ 0.90	0.91	0.93

Note: * Not pass criteria

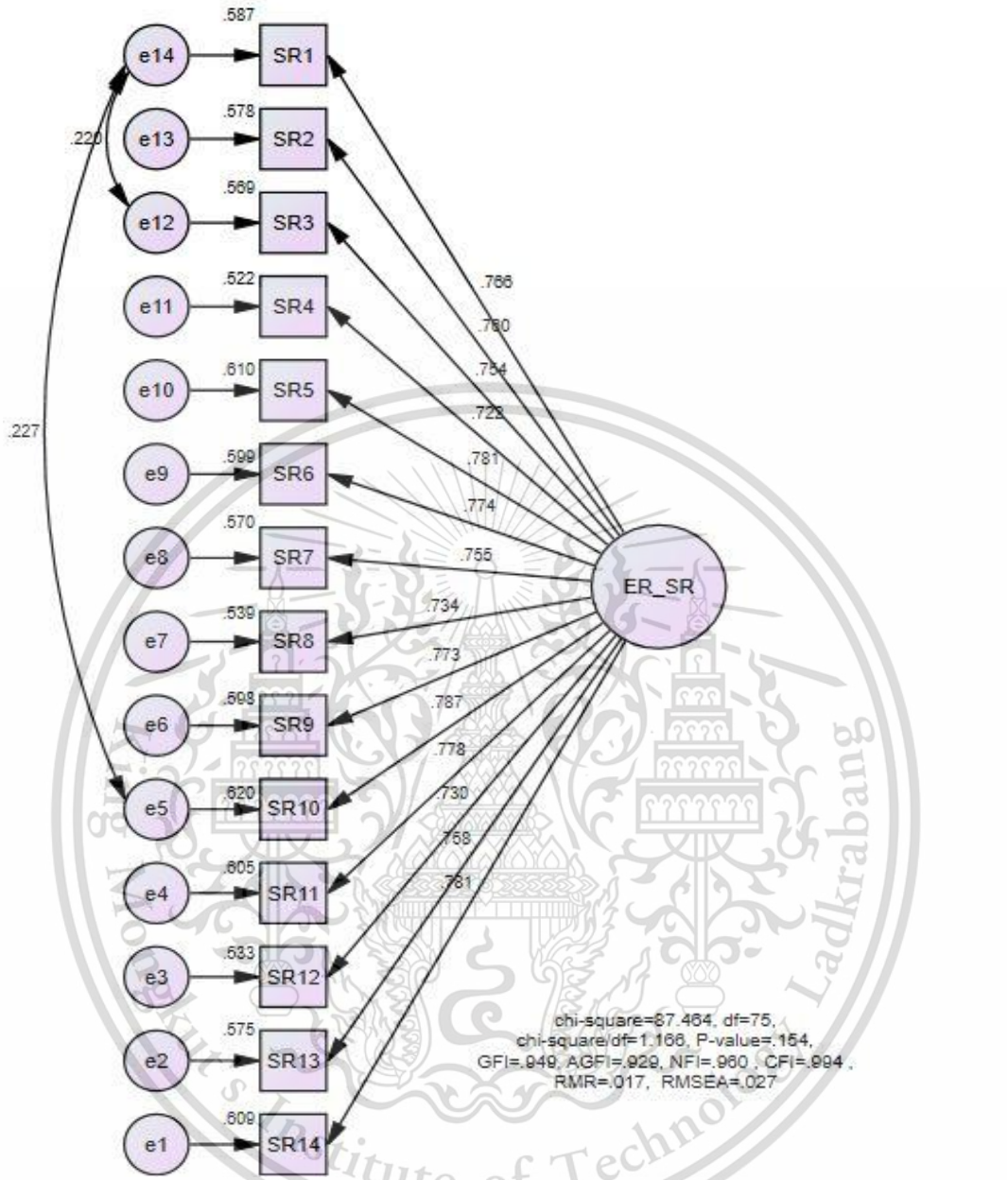

Figure 4.5 CFA model of Strategic Risk After Modification

Standardized factor loadings of each item of SR are range between 0.72-0.79. Critical Ratio (C.R.) > 1.96. Therefore, standardized factor loadings of all observed variables are significantly different from zero at statistically significant level of 0.05 (p-value < 0.05). SR10: "Public policies on supporting EESCs lacked clarity and continuity" is the most important factor.

Composite Reliability (CR) is 0.97 (> 0.7 pass). Average Extracted Variance (AVE) is 0.67 (> 0.5 pass).

Table 4.12 CFA Statistics of Strategic Risk

Item	Confirmed by	Observed Variable	Standardized Factor Loading	S.E.	Critical Ratio	p-value
SR1	←	SR	0.77	0.078	12.45	***
SR2	←	SR	0.76	0.072	12.41	***
SR3	←	SR	0.75	0.078	12.21	***
SR4	←	SR	0.72	0.070	11.62	***
SR5	←	SR	0.78	0.074	12.81	***
SR6	←	SR	0.77	0.075	12.66	***
SR7	←	SR	0.76	0.071	12.27	***
SR8	←	SR	0.73	0.074	11.89	***
SR9	←	SR	0.77	0.072	12.69	***
SR10	←	SR	0.79	0.077	12.92	***
SR11	←	SR	0.78	0.076	12.74	***
SR12	←	SR	0.73	0.074	11.78	***
SR13	←	SR	0.76	0.069	12.35	***
SR14	←	SR	0.78	0.000	0.00	***

Note: *** statistically significant level at 0.001

Operation Risk (OR)

All statistics of goodness of fit passed their respective criteria. Therefore, the research model needed no modification and it fits the empirical data. The CFA analysis results of are shown in the following table.

Table 4.13 GoF Statistics of Operation Risk with No Modification

Goodness of Fit Indices	Criteria	No Modification
p-value of χ^2	> 0.05	0.82
CMIN/df	< 2.00	0.71
GFI	> 0.90	0.99
SRMR	< 0.05	0.02
RMSEA	< 0.05	0.00
IFI	> 0.90	1.01
CFI	> 0.90	1.00
NFI	≥ 0.90	0.99
AGFI	≥ 0.90	0.97

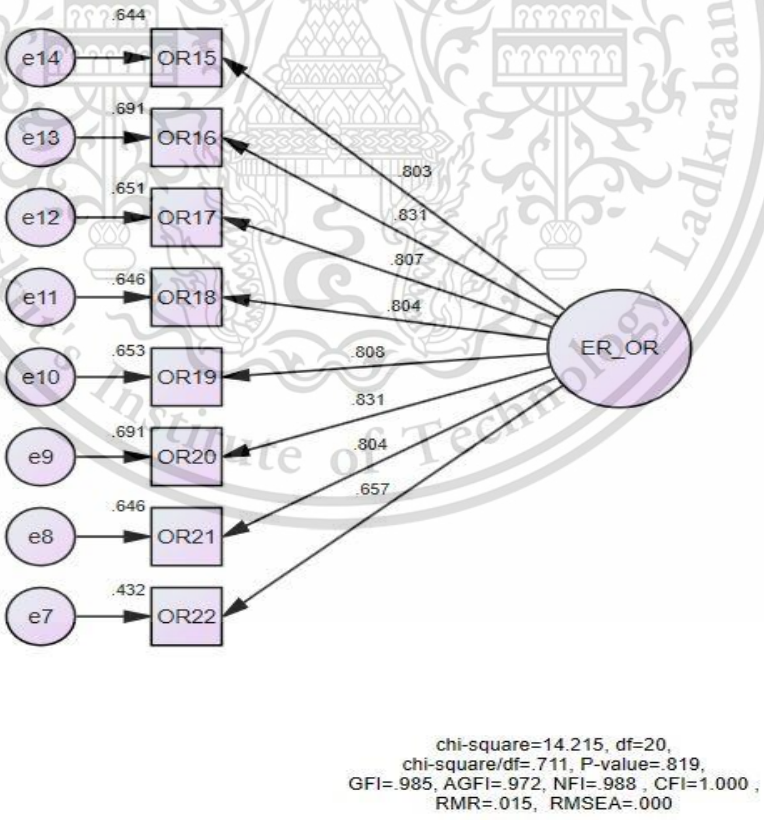

Figure 4.6 CFA model of Operation Risk with No Modification

Standardized factor loadings of each item of OR are range between 0.66-0.83. Critical Ratio (C.R.) > 1.96. Therefore, standardized factor loadings of all observed variables are significantly different from zero at statistically significant level of 0.05 (p-value < 0.05). OR16 (item OR2): "Inadequate qualified staff to execute deals and monitor projects en masse, particularly in SMEs, which are numerous and costly." And OR20 (item OR6): "Discrepancies on guarantee issues between EESCs and technology suppliers." Are the most important factors.

Composite Reliability (CR) is 0.93 (> 0.7 pass). Average Extracted Variance (AVE) is 0.64 (> 0.5 pass).

Table 4.14 CFA Statistics of Operation Risk

Item	Confirmed by	Observed Variable	Standardized Factor Loading	S.E.	Critical Ratio	p-value
OR15	←	OR	0.80			
OR16	←	OR	0.83	0.069	14.27	***
OR17	←	OR	0.81	0.070	13.78	***
OR18	←	OR	0.80	0.069	13.63	***
OR19	←	OR	0.81	0.068	13.71	***
OR20	←	OR	0.83	0.069	14.32	***
OR21	←	OR	0.80	0.071	13.58	***
OR22	←	OR	0.66	0.110	10.55	***

Note: *** statistically significant level at 0.001

Financial Risk (FR)

Some statistics of goodness of fit did not pass certain criteria such as p-value of χ^2 (0.01). Therefore, the research model needed modification so that it fits the empirical data relying on theoretical reasons and modification indices. The model was adjusted by estimating 2 more parameters i.e., e7- e17 and e9-e10. The CFA analysis results of are shown in the following table.

Table 4.15 GoF Statistics of Financial Risk Before and After Modification

Goodness of Fit Indices	Criteria	Before Modification	After Modification
p-value of χ^2	> 0.05	0.01*	0.09
CMIN/df	< 2.00	1.53	1.30
GFI	> 0.90	0.95	0.96
SRMR	< 0.05	0.01	0.01
RMSEA	< 0.05	0.05	0.04
IFI	> 0.90	0.99	1.00
CFI	> 0.90	0.99	1.00
NFI	≥ 0.90	0.98	0.98
AGFI	≥ 0.90	0.92	0.93

Note: * Not pass criteria

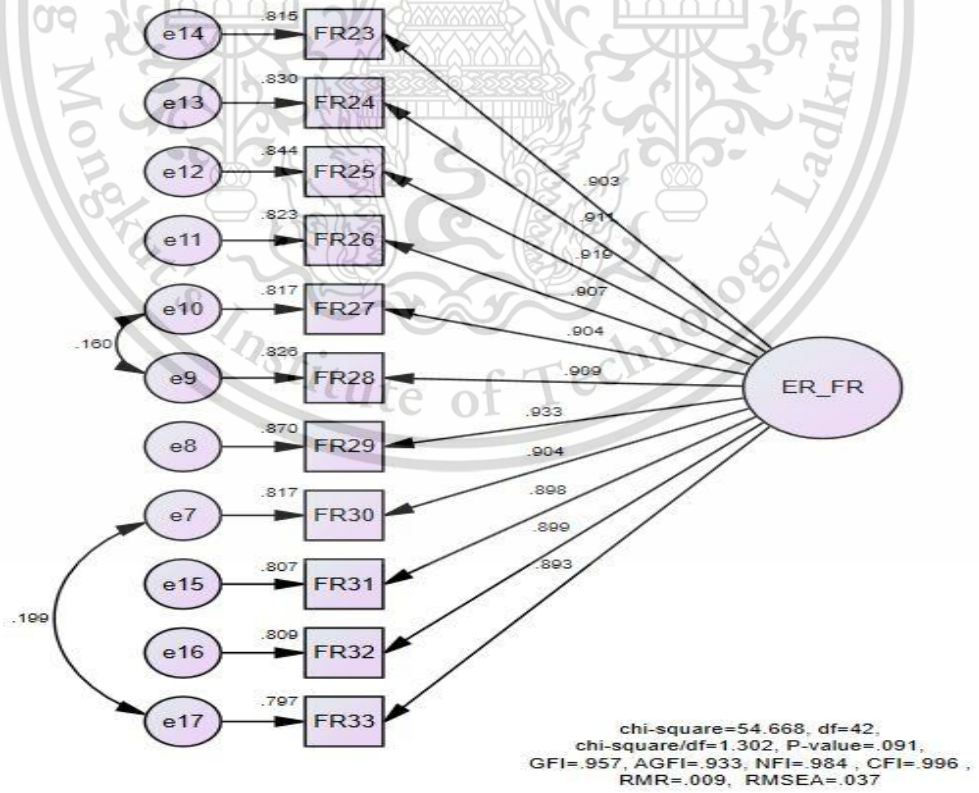

Figure 4.7 CFA model of Financial Risk After Modification

Standardized factor loadings of each item of FR are range between 0.89-0.93. Critical Ratio (C.R.) > 1.96. Therefore, standardized factor loadings of all observed variables are significantly different from zero at statistically significant level of 0.05 (p-value < 0.05). FR29 (Item FR7): "EESCs with small registered capital hardly were qualified to bid on large-scale projects." Is the most important factor.

Composite Reliability (CR) is 0.98 (> 0.7 pass). Average Extracted Variance (AVE) is 0.84 (> 0.5 pass).

Table 4.16 CFA Statistics of Financial Risk

Item	Confirmed by	Observed Variable	Standardized Factor Loading	S.E.	Critical Ratio	p-value
FR23	←	FR	0.90			
FR24	←	FR	0.91	0.05	22.47	***
FR25	←	FR	0.92	0.05	23.05	***
FR26	←	FR	0.91	0.05	22.26	***
FR27	←	FR	0.90	0.05	22.00	***
FR28	←	FR	0.91	0.05	22.35	***
FR29	←	FR	0.93	0.05	24.04	***
FR30	←	FR	0.90	0.05	21.97	***
FR31	←	FR	0.90	0.05	21.67	***
FR32	←	FR	0.90	0.05	21.64	***
FR33	←	FR	0.89	0.05	21.27	***

Note: *** statistically significant level at 0.001

Reputation Risk (RR)

All statistics of goodness of fit did not pass certain criteria before model modification. However, after modification, the RR measurement model still did not fit the empirical data (p-value of χ^2 = 0.03, CMIN/df = 4.53, and RMSEA = 0.13) Moreover, the regression weight of RR to its

latent variable, ER, was 0.124 lower than 0.35 criterion. Therefore, RR was dropped from the research model. The CFA analysis results of are shown in the following table.

Table 4.17 GoF Statistics of Reputation Risk Before and After Modification

Goodness of Fit Indices	Criteria	Before Modification	After Modification
p-value of χ^2	> 0.05	0.00*	0.03*
CMIN/df	< 2.00	34.42*	4.53*
GFI	> 0.90	0.86*	0.99
SRMR	< 0.05	0.07*	0.01
RMSEA	< 0.05	0.39*	0.13*
IFI	> 0.90	0.86*	0.99
CFI	> 0.90	0.86*	0.99
NFI	≥ 0.90	0.86*	0.99
AGFI	≥ 0.90	0.30*	0.90

Note: * Not pass criteria

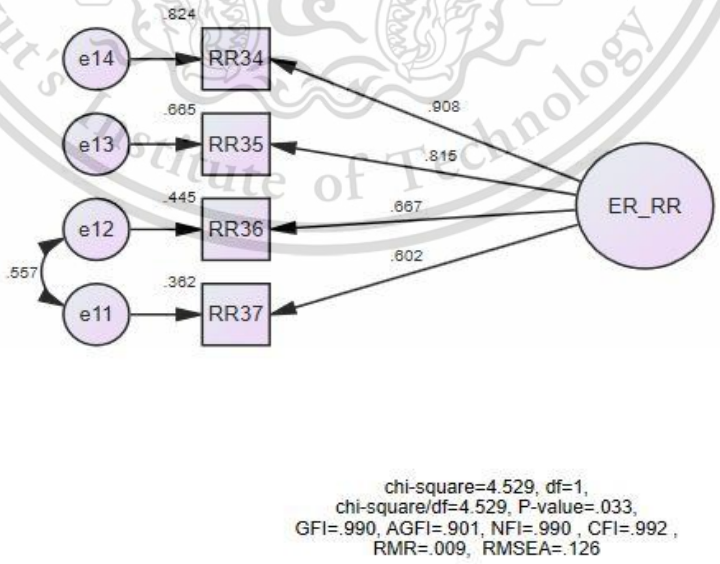

Figure 4.8 CFA model of Reputation Risk After Modification

4.3.3 Contingent Variables (CoV)

All statistics of goodness of fit passed all criteria before model modification. However, the regression weights of EU and CI to its latent variable, CoV, was -0.178 and -0.111 respectively which are lower than 0.35 criterion. Therefore, EU and CI were dropped from the research model to alleviate the fit problem and FC, FS, and MBD are significant indicators only. The CFA analysis results of are shown in the following table.

Table 4.18 GoF Statistics of Contingent Variables Before and After Modification

Goodness of Fit Indices	Criteria	Before Modification	After Modification
p-value of χ^2	> 0.05	0.69	Just-Identified
CMIN/df	< 2.00	0.61	Just-Identified
GFI	> 0.90	0.99	Just-Identified
SRMR	< 0.05	0.03	Just-Identified
RMSEA	< 0.05	0.00	Just-Identified
IFI	> 0.90	1.02	Just-Identified
CFI	> 0.90	1.00	Just-Identified
NFI	≥ 0.90	0.97	Just-Identified
AGFI	≥ 0.90	0.98	Just-Identified

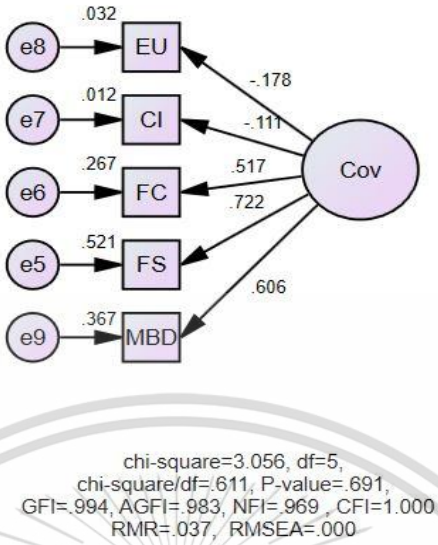

Figure 4.9 CFA model of Contingent Variables Before Modification

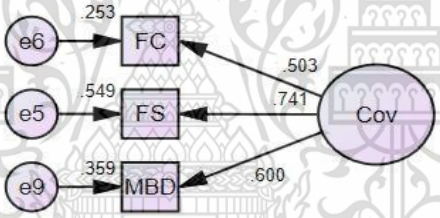

Figure 4.10 CFA model of Contingent Variables After Modification

Standardized factor loadings of each item of CoV are range between 0.50-0.74. Critical Ratio (C.R.) > 1.96. Therefore, standardized factor loadings of all observed variables are significantly different from zero at statistically significant level of 0.05 (p-value < 0.05). Firm Size (FS) is the most important factor.

Composite Reliability (CR) is 0.80 (> 0.7 pass). Average Extracted Variance (AVE) is 0.58 (> 0.5 pass).

Table 4.19 CFA Statistics of Contingent Variables

Item	Confirmed by	Observed Variable	Standardized Factor Loading	S.E.	Critical Ratio	p-value
FC	←	CoV	0.50	0.11	4.62	***
FS	←	CoV	0.74			
MBD	←	CoV	0.60	0.12	4.66	***

Note: *** statistically significant level at 0.001

4.3.4 Enterprise Risk Management (ERM)

All statistics of goodness of fit passed their respective criteria. Therefore, the research model needed no modification and it fits the empirical data. The CFA analysis results of are shown in the following table.

Table 4.20 GoF Statistics of Enterprise Risk Management with No Modification

Goodness of Fit Indices	Criteria	Before Modification
p-value of χ^2	> 0.05	0.46
CMIN/df	< 2.00	0.78
GFI	> 0.90	1.00
SRMR	< 0.05	0.02
RMSEA	< 0.05	0.00
IFI	> 0.90	1.00
CFI	> 0.90	1.00
NFI	≥ 0.90	0.99
AGFI	≥ 0.90	0.98

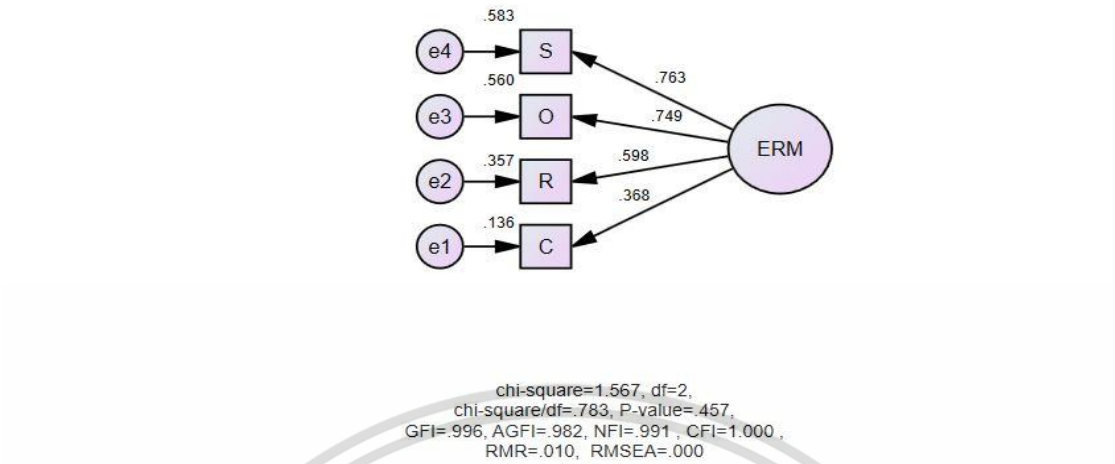

Figure 4.11 CFA model of Enterprise Risk Management with No Modification

Standardized factor loadings of each item of ERM are range between 0.37-0.76. Critical Ratio (C.R.) > 1.96. Therefore, standardized factor loadings of all observed variables are significantly different from zero at statistically significant level of 0.05 (p-value < 0.05). Strategy risk management is the most important factors.

Composite Reliability (CR) is 0.79 (> 0.7 pass). Average Extracted Variance (AVE) is 0.50 (> 0.5 pass).

Table 4.21 CFA Statistics of Enterprise Risk Management

Item	Confirmed by	Observed Variables	Standardized Factor Loading	S.E.	Critical Ratio	p-value
S	←	ERM	0.76	0.694	4.83	***
O	←	ERM	0.75	0.779	4.61	***
R	←	ERM	0.60	0.491	4.44	***
C	←	ERM	0.37			

Note: *** statistically significant level at 0.001

4.3.5 Firm Financial Performance (FFP)

Firm Financial Performance is a just-identified model because it has only 3 observed variables. Therefore, the research model needed no modification and there is no CFA analysis result table.

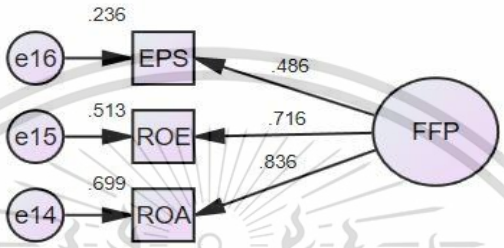

Figure 4.12 CFA model of Firm Financial Performance with No Modification

Standardized factor loadings of each item of FFP are range between 0.49-0.84. Critical Ratio (C.R.) > 1.96. Therefore, standardized factor loadings of all observed variables are significantly different from zero at statistically significant level of 0.05 (p-value < 0.05). Return on Assets ratio is the most important factors.

Composite Reliability (CR) is 0.87 (> 0.7 pass). Average Extracted Variance (AVE) is 0.70 (> 0.5 pass).

Table 4.22 CFA Statistics of Firm Financial Performance

Item	Confirmed by	Observed Variable	Standardized Factor Loading	S.E.	Critical Ratio	p-value
ROA	←	FFP	0.84			
ROE	←	FFP	0.72	0.144	6.19	***
EPS	←	FFP	0.49	0.069	5.60	***

Note: *** statistically significant level at 0.001

4.4 The Structural Equation Model Analysis

The researcher analyzed the structural equation model synthesized from ERM theories and concepts in order to examine the goodness of fit between the research model and the empirical evidences and to test the research hypotheses after CFA models was audited.

The initial research model did not fit to empirical data as shown in following figure.

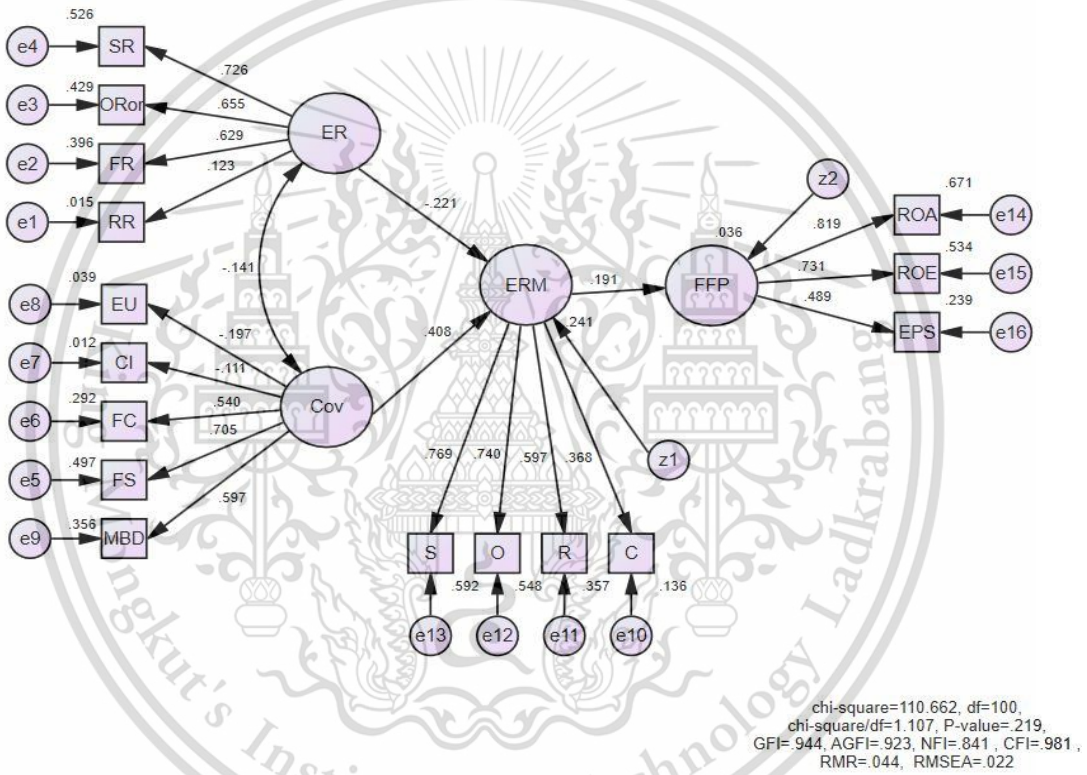

Figure 4.13 The Initial Research Model

Table 4.23 GoF Statistics of the Initial SEM Model

Goodness of Fit Indices	Criteria	Before Modification	Results
p-value of χ^2	> 0.05	0.22	Pass
CMIN/df	< 2.00	1.11	Pass
GFI	> 0.90	0.94	Pass
SRMR	< 0.05	0.05	Not Pass*
RMSEA	< 0.05	0.02	Pass
IFI	> 0.90	0.98	Pass
CFI	> 0.90	0.98	Pass
NFI	≥ 0.90	0.84	Not Pass*
AGFI	≥ 0.90	0.92	Pass

Note: * Not pass criteria

Some statistics of goodness of fit did not pass certain criteria such as SRMR (0.05) and NFI (0.84). Therefore, the research model needed modification so that it fits the empirical data relying on theoretical reasons and modification indices. The model was adjusted by dropping some observed variables with weak standardized regression weights such as Reputation Risk (RR), Environment Uncertainty (EU), and Industry Competition (CI) and then the modified research model fits the empirical data this approach followed the modification of CFA overall model in similar manner. The modified research model is depicted in the following figure and table.

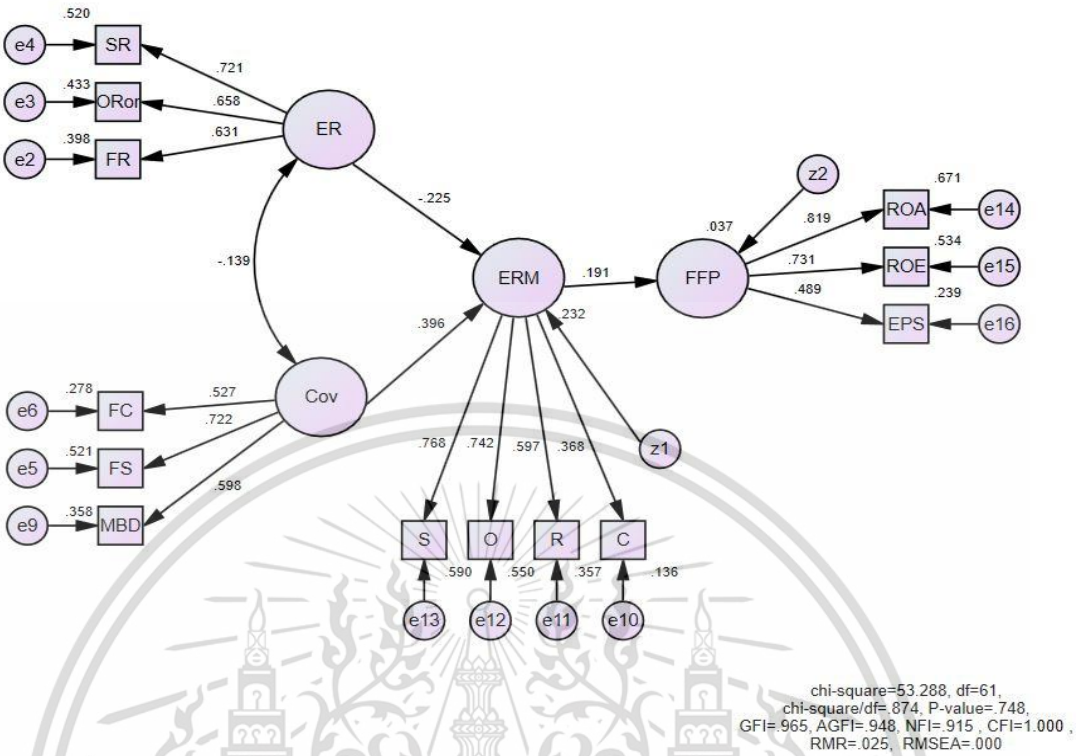

Figure 4.14 The Modified Research Model

Table 4.24 GoF Statistics of the Modified SEM Model

Goodness of Fit Indices	Criteria	After Modification	Results
p-value of χ^2	> 0.05	0.75	Pass
CMIN/df	< 2.00	0.87	Pass
GFI	> 0.90	0.97	Pass
SRMR	< 0.05	0.04	Pass
RMSEA	< 0.05	0.00	Pass
IFI	> 0.90	1.01	Pass
CFI	> 0.90	1.00	Pass
NFI	≥ 0.90	0.92	Pass
AGFI	≥ 0.90	0.95	Pass

Table 4.25 Statistics of the Observed Variables of Modified SEM Model

Latent Variables	Observed Variables	Standardized Factor Loading	S.E.	t	p-value	R^2
Enterprise Risks	SR	0.72	0.14	6.41	***	0.52
	OR	0.66	0.15	6.43	***	0.43
	FR	0.63				0.40
Contingent Variables	FC	0.53	0.10	5.17	***	0.28
	FS	0.72				0.52
	MBD	0.60	0.10	5.67	***	0.36
Enterprise Risk Management	S	0.77	0.69	4.88	***	0.59
	O	0.74	0.76	4.69	***	0.55
	R	0.60	0.49	4.49	***	0.36
	C	0.37				0.14
Firm Financial Performance	ROA	0.82				0.67
	ROE	0.73	0.14	6.48	***	0.53
	EPS	0.49	0.07	5.88	***	0.24

Note: *** means statistical significance at 0.001 (p-value < 0.001)

Enterprise Risks: The standardized factor loading of each observed variable is statistically significant at 0.001. Strategic Risk has the highest R^2 (0.52) and standardized regression weight (0.72) among observed variables.

Contingent Variables: The standardized factor loading weight of each observed variables is statistically significant at 0.001. Firm Size has the highest R^2 (0.52) and standardized regression weight (0.72) among observed variables.

Enterprise Risk Management: The standardized factor loading of each observed variable is statistically significant at 0.001. Strategy has the highest R^2 (0.59) and standardized regression weight (0.77) among observed variables.

Firm Financial Performance: The standardized regression weight of each observed variables is statistically significant at 0.001. Strategy has the highest R^2 (0.67) and standardized regression weight (0.83) among observed variables.

4.5 Hypothesis Testing Results

4.5.1 Direct Effect

The results of the research hypothesis test and the consistency of each hypothesis are shown in the following table.

The conclusion on the three hypotheses is that:

1) the hypothesis testing result supports a negative significant relationship between Enterprise Risk (ER) and Enterprise Risk Management (ERM) at 0.05;

2) The hypothesis testing result supports a positive significant relationship between Contingent Variables (CoV) and Enterprise Risk Management (ERM) at 0.01;

3) The hypothesis testing result supports a positive relationship between Enterprise Risk Management (ERM) and Firm Financial Performance (FFP) with p-value of 0.044 slightly less than the criterion p-value of 0.05 and the estimated coefficient is 0.191.

Table 4.26 Hypothesis Testing Results and Consistency

Hypothesis	Path	Estimated coefficient	S.E.	C.R.	p-value	Results
H1: Enterprise Risks (ER) has a significant relationship with Enterprise Risk Management (ERM).	ER → ERM	-0.225	0.041	-2.259	0.024*	Supported
H2: Contingent Variables (CoV) has a significant relationship with Enterprise Risk Management (ERM).	CoV → ERM	0.396	0.046	3.108	0.002**	Supported
H3: The Enterprise Risk Management (ERM) has a significant relationship with Firm Financial Performance (FFP).	ERM → FFP	0.191	0.257	2.016	0.044*	Supported

Note: *** statistically significant level at 0.001 (p-value < 0.001)

** statistically significant level at 0.01 (p-value < 0.01)

* statistically significant level at 0.05 (p-value < 0.05)

4.5.1 Indirect Effect

The analysis of indirect effect was conducted through Path Analysis by analyzing the relationship and testing hypotheses that 1) Enterprise Risks (ER) has an indirect relationship with Firm Financial Performance (FFP) and 2) Contingent Variables (CoV) has an indirect relationship with Firm Financial Performance (FFP).

In order to determine the indirect effect, there are 3 casual steps (Baron & Kenny, 1986) for consideration.

1) The independent variable and its mediator affect dependent variables

2) The independent variable affects its mediator.

3) The relationship between the independent variable and its dependent variable must be reduced and not statistically significant when there exists the mediator.

The indirect effect value is determined by Sobel (1982) formula as follows:

$$S_{ßaßb} = \sqrt{ß^2_a S^2_b + ß^2_b S^2_a - S^2_a S^2_b}$$

where $S_{ßaßb}$ = indirect effect,

$ß_a$ = path coefficient of the independent variable (path a),

$ß_b$ = path coefficient of the mediator (path b),

S_a = standard error of estimate of the independent variable,

S_b = standard error of estimate of mediator.

The indirect effect must be tested for statistical significance at 0.01 by using Sobel test statistic (t) at 0.01 (for C.R. or $t > 2.58$). If t is less than 2.58, then the null hypothesis is rejected or in other word the indirect effect is statistically insignificant.

$$\text{Sobel test statistic: } t = \frac{ß_a\, ß_b}{S_{ßaßb}}$$

4.5.3 Null hypothesis ER to FFP

H4: Enterprise Risks (ER) has an indirect relationship with Firm Financial Performance (FFP) by passing through Enterprise Risk Management (ERM).

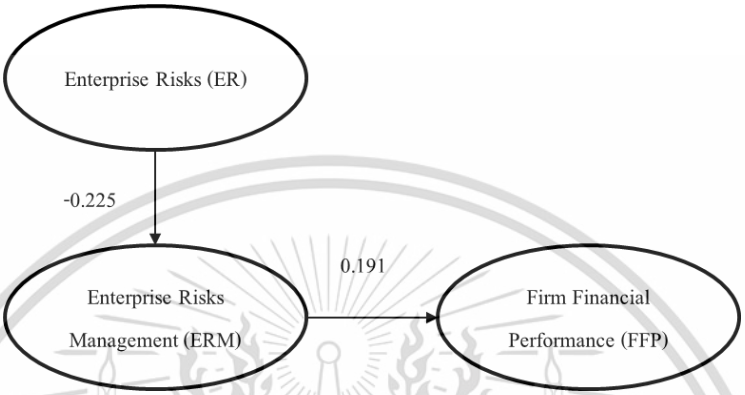

Figure 4.15 Indirect Relationship Between Enterprise Risks and Firm Financial Performance

Source: The researcher

From the influential path of relationship between Enterprise Risks and Firm Financial Performance by passing through Enterprise Risk Management, the path coefficient between the independent variable (Enterprise Risks: ER) and its mediator (Enterprise Risk Management: ERM) is -0.225 and the path coefficient between the mediator (Enterprise Risk Management: ERM) and its dependent variable (Firm Financial Performance: FFP) is 0.191.

1) The independent variable (Enterprise Risks: ER) does not directly affect dependent variable (Firm Financial Performance: FFP) and its mediator (Enterprise Risk Management: ERM) directly affect dependent variables (Firm Financial Performance: FFP).

2) The independent variable (Enterprise Risks: ER) directly affects its mediator (Enterprise Risk Management: ERM).

3) The indirect effect of ER to FFP is $S_{\beta a \beta b}$ is 0.057 and Sobel test statistic (t) is -0.75. The indirect effect between ER to FFP through ERM is statistically insignificant and the 1) null hypothesis ER to FFP is not supported.

The detail of calculation is in the following table.

Table 4.27 Regression Coefficient and Standard Error of Estimate of Path Analysis of ER to FFP

Path a		Path b	
ER → ERM		ERM → FFP	
$ß_a$	-0.225	$ß_b$	0.191
S_a	0.041	S_b	0.257
t	-2.259*	t	2.016*
$S_{ßaßb}$ =	0.057	t =	-0.75

Note: ** statistically significant level at 0.01

* statistically significant level at 0.05

2) Null hypothesis CoV to FFP

H5: Contingent Variables (CoV) has an indirect relationship with Firm Financial Performance (FFP) by passing through Enterprise Risk Management (ERM).

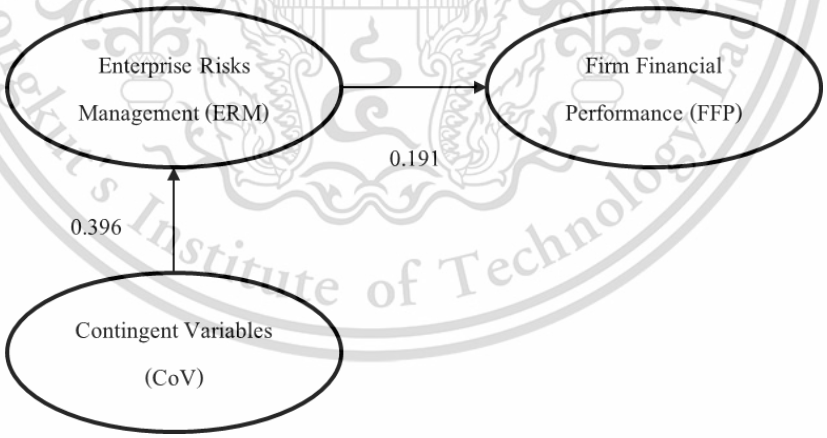

Figure 4.16 Indirect Relationship Between Contingent Variables and Firm Financial Performance

Source: The researcher

From the influential path of relationship between Contingent Variables and Firm Financial Performance by passing through Enterprise Risk Management, the path coefficient between the independent variable (Contingent Variables: CoV) and its mediator (Enterprise Risk Management: ERM) is 0.396 and the path coefficient between the mediator (Enterprise Risk Management: ERM) and its dependent variable (Firm Financial Performance: FFP) is 0.191.

1) The independent variable (Contingent Variables: CoV) does not directly affect dependent variable (Firm Financial Performance: FFP) and its mediator (Enterprise Risk Management: ERM) directly affect dependent variables (Firm Financial Performance: FFP).

2) The independent variable (Contingent Variables: CoV) directly affects its mediator (Enterprise Risk Management: ERM).

3) The indirect effect of CoV to FFP is $S_{ßaßb}$ is 0.101 and Sobel test statistic (t) is 0.75. The indirect effect between ER to FFP through ERM is statistically insignificant and the 2) null hypothesis CoV to FFP is not supported.

The detail of calculation is in the following table.

Table 4.28 Regression Coefficient and Standard Error of Estimate of Path Analysis of CoV to FFP

Path a		Path b	
CoV → ERM		ERM → FFP	
$ß_a$	0.396	$ß_b$	0.191
S_a	0.046	S_b	0.257
t**	3.108	t*	2.016
$S_{ßaßb}$ =	0.101	t =	0.75

Note: ** statistically significant level at 0.01

* statistically significant level at 0.05

From the study of Structural Equation Model and measurement model of manifest variables that measure the 4 latent variables such as Enterprise Risks (ER), Enterprise Risk Management (ERM), Contingent Variables Firm (CoV), and Financial Performance (FFP) to investigate the causal relationship, the summary of direct, indirect, and total effect of Path Analysis is shown in the following table.

Table 4.29 A Summary Table of Direct and Indirect Effects of All Latent Variables

Independent variables	Dependent Variables	Direct Effect	Indirect Effect	Total Effect	t	Results
ER	ERM	-0.23	-	-0.23	-2.26*	Supported
ER	FFP	-	-0.06 ER→ERM→FFP	-0.06	-0.75	Not Supported
CoV	ERM	0.40	-	0.40	3.11**	Supported
CoV	FFP	-	0.10 CoV→ERM→FFP	0.10	0.75	Not Supported
ERM	FFP	0.19	-	0.19	2.02*	Supported

Note: ** statistically significant level at 0.01

* statistically significant level at 0.05

The indirect effect of Enterprise Risks (ER) to Financial Performance (FFP) (H4) is not statistically significant as well as the indirect effect of Contingent Variables Firm (CoV) (H5) to Financial Performance (FFP). The total effect of all pairs of latent variables are from direct effect.

CHAPTER 5

DISCUSSION AND CONCLUSION

The study of a development of enterprise risk management model that affects firm financial performance for energy efficiency services in Thailand in this chapter are presented in the following topics.

5.1 Conclusion

5.2 Discussion

5.3 Implication and Recommendations

5.4 Limitation of the Study and Direction for Future Research

5.1 Conclusion

EESCs in Thailand are the key operators that help increase the efficiency of energy consumption in Thailand and reduce global warming effect that is the international agenda today. However, EESCs have been facing a lot of problems and obstacles, which are the causes of risks, found in global countries as specific or common issues, in proceeding their business. The objective of this research study is to develop and investigate an enterprise risk management model that affects firm financial performance for EESCs in Thailand including their causal relationship for each pair of 4 latent variables such as Enterprise Risks (ER), Contingent Variables (CoV), Enterprise Risk Management, and Firm Financial Performance (FFP), covering both direct and indirect effect. There is no direct effect from ER to FFP and CoV to FFP as the relationships are barely supported by both theories and actual operation. There are 14, 8, 11, and 4 risk drivers for SR, OR, FR, and RR respectively, totaling up to 37 risk drivers. The 37 risk drivers were classified into four groups under ER i.e., 1) Strategic Risk (SR), 2) Operation Risk (OR), 3) Financial Risk (FR), and 4) Reputation Risk (RR). CoV comprises of five components i.e., 1) Environment Uncertainty (EU), 2) Industry Competition (CI), 3) Firm Complexity (FC), 4) Firm Size (FS), and 5) Monitoring by

Board of Directors (MBD). The level of ERM implementation is measured by Strategy (S), Operation (O), Reporting (R), and Compliance (C). The Firm Financial Performance is measured in terms of accounting approach, by Return on Assets (ROA), Return on Equity (ROE), and Earnings Per Share (EPS). This study used a quantitative approach by distributing questionnaires to respondents responsible for three key areas such as CEO and managing director, accounting and finance, and operation and engineering in top management levels from all 203 EESCs in Thailand. The Cronbach's Alpha Coefficient of the questionnaire test set is 0.898, which is above the criterion of 0.70. The distributed questionnaires with completed data were collected and used based on the simple random sampling method. All data were interpreted and used until the final statistical analysis. Reputation Risk (RR) is dropped from ER and Environment Uncertainty (EU) and Industry Competition (CI) are dropped from CoV from the analysis in Chapter 4. ER significantly relates to ERM in negative direction. CoV significantly relates to ERM in positive direction. ERM significantly relates to FFP in positive direction. There is no direct relationship from ER and CoV to FFP. ER and CoV has insignificantly indirect relationship to FFP. The documentary review is employed in this Chapter to verify the validity of research results.

5.2 Analysis of Results

5.2.1 Research Questions

From the research study, the most applicable ERM concept in Thailand is the concept of COSO ERM. Not only the COSO ERM concept provides the definition of ERM, but it also caters vivid frameworks and guidelines for implementation i.e., risk identification, risk assessment, impact interpretation, rating scale for conducting questionnaire, and how to measure ERM objectively. In addition, it clearly states the connection between ERM and firm performance. Moreover, COSO ERM is widely employed by Thai listed companies as well as Thailand ESCO fund for systemic risk management. Following the ERM framework, this study discovered that there are 37 problems and obstacles that EESCs in Thailand have been facing as risk drivers. These

causes of risks can be classified into 3 main categories, complying with empirical data, such as Strategic Risk (SR), Operation Risk (OR), and Financial Risk (FR). The research analysis revealed that SR, OR, and FR are confirmed indicators of Enterprise Risks (ER). Firm Complexity (FC), Firm Size (FS), and Monitoring by Board of Directors (MBD) are important factors of Contingent Variables (CoV). Strategy (S), Operation (O), Reporting (R), and Compliance (C) are significant measured variables of Enterprise Risk Management (ERM). Finally, Firm Financial Performance (FFP) can be measured by Return on Assets (ROA), Return on Equity (ROE), and Earnings Per Share (EPS). The research results shows that Enterprise Risks (ER) together with Contingent Variables (CoV) directly affect Enterprise Risk Management (ERM) and then indirectly affect Firm Financial Performance (FFP) through ERM mediator. The direct impacts of ER and CoV to FFP were barley supported by theories as the relationships have indefinite economic meanings.

5.2.2 Analysis and Hypothesis Testing Results

5.2.2.1 Confirmatory Factor Analysis Summary

This research analyzed CFA goodness of fit statistics as well as regression weights for each of 4 latent variables in the conceptual model and concluded as follows.

The CFA goodness of fit statistics for the modified research model such as p-value of χ^2 = 0.79, CMIN/df = 0.85, GFI = 0.97, SRMR = 0.04 RMSEA = 0.00, IFI = 1.02, CFI = 1.00, NFI = 0.92, and AGFI = 0.95 all conform to their respective acceptable levels.

Enterprise Risks (ER)

Goodness of fit statistics after modification is not presented because ER measurement model after modification is just-identified and comprises of only 3 indicators such as SR, OR, and FR. Standardized factor loading of confirmed manifest variables such as Strategic Risk (SR), Operation Risk (OR), and Financial Risk (FR) that indicate their latent variable, Enterprise Risks (ER), ranges between 0.63-0.72 which are over acceptable levels of 0.35.

Contingent Variables (CoV)

Goodness of fit statistics after modification is not presented because CoV measurement model after modification is just-identified and comprises of only 3 indicators such as

FC, FS, and MBD. Standardized factor loadings of confirmed manifest variables such as Firm Complexity (FC), Firm Size (FS), and Monitoring by Board of Directors (MBD) that indicate their latent variable, Contingent Variables (CoV), ranges between 0.52-0.73 which are over acceptable levels of 0.35.

Enterprise Risk Management (ERM)

The goodness of fit statistics such as p-value of $\chi^2 = 0.46$, CMIN/df = 0.78, GFI = 1.00, SRMR = 0.02 RMSEA = 0.00, IFI = 1.00, CFI = 1.00, NFI = 0.99, and AGFI = 0.98 all conform to their respective acceptable levels and the ERM measurement model required no modification. Standardized factor loadings of confirmed manifest variables such as Strategy (S), Operation (O), Reporting I and Compliance I that indicate their latent variable, Enterprise Risk Management (ERM), ranges between 0.37-0.77 which are over acceptable levels of 0.35.

Firm Financial Performance (FFP)

Goodness of fit statistics after modification is not presented because FFP measurement model required no modification and it is just-identified and comprises of only 3 indicators such as ROA, ROE, and EPS. Standardized factor loadings of confirmed manifest variables such as Return on Assets (ROA), Return on Equity (ROE), and Earnings Per Share (EPS) that indicate their latent variable, Firm Financial Performance (FFP), ranges between 0.48-0.83 which are over acceptable levels of 0.35.

5.2.2.2 Structural Equation Model Analysis Summary

The analysis results of the structural equation model of a development of enterprise risk management model that affects firm financial performance for energy efficiency services in Thailand, after modification that fits the empirical data, fall in all acceptable criteria as determined by p-value of $\chi^2 = 0.75$, CMIN/df = 0.87, GFI = 0.97, SRMR = 0.04 RMSEA = 0.00, IFI = 1.01, CFI = 1.00, NFI = 0.92, and AGFI = 0.95.

For the Enterprise Risks (ER) measurement model, the Strategic Risk (SR) indicator has the most standardized factor loading equal to 0.721.

For the Contingent Variables (CoV) measurement model, the Firm Size (FS) indicator has the most standardized factor loading equal to 0.722.

For the Enterprise Risk Management (ERM) measurement model, the Strategy (S) indicator has the most standardized factor loading equal to 0.768.

For the Firm Financial Performance (FFP) measurement model, the Return on Assets (ROA) indicator has the most standardized factor loading equal to 0.819.

5.2.2.3 Research Objective Results

According to the three hypotheses in this research, the results of research objectives are as following.

1) Enterprise Risks (ER) has a significant negative relationship with Enterprise Risk Management (ERM) at statistical significance level of 0.05.

2) Contingent Variables (CoV) has a significant positive relationship with Enterprise Risk Management (ERM) at statistical significance level of 0.01.

3) The Enterprise Risk Management (ERM) has a positive relationship with Firm Financial Performance (FFP) at statistical significance level of 0.05.

4) There is insignificantly indirect effect between Enterprise Risks (ER) to Financial Performance (FFP).

5) There is insignificantly indirect effect between Contingent Variables (CoV) to Financial Performance (FFP).

From the research hypotheses, CFA, and SEM analysis results, this study proposes discussion following**.**

5.2.2.4 Enterprise Risks (ER) and Enterprise Risk Management (ERM)

Enterprise Risks (ER) has a significant negative relationship with Enterprise Risk Management (ERM). The estimated coefficient (beta weight) is equal to -0.225 (statistically significant at 0.05) which is a small effect size ($0.1 \leq r < 0.3$ Cohen, 1988, p. 412-414). The higher the impacts from risk drivers can lessen the level of achievement of enterprise risk management. The mean of ER is considered major with 65% chance of occurrence, and its impacts

will be realized in many days or many weeks later. These empirical evidences can be viewed that the ERM theories is still valid, the risks were successfully managed and achieved in certain limited areas, and there are more room to implement enterprise risk management for EESCs Thailand.

5.2.2.5 Contingent Variables (CoV) and Enterprise Risk Management (ERM)

Contingent Variables (CoV) has a significant positive relationship with Enterprise Risk Management (ERM). The estimated coefficient (beta weight) is equal to +0.396 (statistically significant at 0.01) which is a medium effect size ($0.3 \leq r < 0.5$ Cohen, 1988, p. 412-414). The higher the Contingent Variables the higher the need for the level of achievement of enterprise risk management. These empirical evidences can be viewed that the influences of contingent variables ware consistent with ERM theories for EESCs Thailand.

5.2.2.6 Enterprise Risk Management (ERM) and Firm Financial Performance (FFP)

The Enterprise Risk Management (ERM) has a positive relationship with Firm Financial Performance (FFP). The estimated coefficient (beta weight) is equal to +0.191 (statistically significant at 0.05) which is a small effect size ($0.1 \leq r < 0.3$ Cohen, 1988, p. 412-414) with p-value equal to 0.044, which is slightly less than the critical value of 0.05. This finding was still consistent with ERM theories in which ERM can lead to the organization's performance.

5.2.2.7 Discussion on an integrated view

From empirical data, most of the observed variables found in EESC in Thailand corresponded to theoretical factors as they indicated the ERM system, namely Strategic Risk, Operation Risk, Financial Risk, Firm Complexity, Firm Size, Monitoring by Board of Directors, Strategy, Operation, Reporting and Compliance. Firm financial performance is identified by ROA, ROE and EPS.

For Strategic Risk, "Public policies on supporting EESCs lacked clarity and continuity" (item SR10) is the most distinct factor.

For Operation Risk, "Inadequate qualified staff to execute deals and monitor projects en masse, particularly in SMEs, which are numerous and costly." (item OR16)

and “Discrepancies on guarantee issues between EESCs and technology suppliers.” (item OR20) are the most distinct factors.

For Financial Risk, “ EESCs with small registered capital hardly were qualified to bid on large-scale projects.” (item FR29) is the most distinct factor.

Based on a documentary review to support the results of this study, the latest ESCO Annual Report 2018 addressed strategic risks on EESCs which are requirements for third-party inspectors or consultants to assure fairness in savings and costs (SR9), operation risks i.e. unified and simplified measurement and verification (M&V) standards (OR15), and financial risks i.e., large registered capital (FR29), banks’ credit lines and bank guarantees (FR28). The findings from the research model suggested risks that the EESCs should focused on management in addition to their requirements.

The proper matching between ER and CoV to ERM for EESCs to achieve enterprise risk management can be done mainly due to mitigating strategic risk, enlarging firm size, and having effective strategies to manage the company. Possible explanations of the exclusion indicators such as Reputation Risk from ER, and Environmental Uncertainty and Industry Competition from CoV, that did not relate the ERM system to firm financial performance in the structural equation model are as following.

Reputation Risk of Enterprise Risks: Some of the previous causes of risks in Thailand (mentioned by Vechakij, 2015) and in other countries did not mentioned that it connected the ERM system to firm performance. It is possible that several governments’ supports, activities and finance, would divert these reputation risks away from respondents’ perception (ESCO Annual Report, 2013-2018). This differs from the what literatures described by International Energy Agency (2010); Ellis (2010); Garbuzova-Schlifter & Madlener (2012, 2013, 2014, 2016); Hansen et al. (2009); Hu & Zhou (2011); SEAI (2013); WEC (2008); Vechakij (2015).

Environment Uncertainty (EU) and Industry Competition (CI) of Contingent Variables: The common factor that the EU and CI use in calculating common equity is corporate sales and Compliance1 (a certain portion of the auditor fee is usually related variably

with sales in practice). As a result, Compliance1 also exhibits a loading factor of 0.368 which is the lowest among the indicators of the ERM (S, O, R, and C). The explication is that competition in EESCs industry is not so intense because the market potential was large, vindicated by the average of companies' revenues, in sample data, with less than USD 7 million per year, or 1.4% of the total potential investment and EESCs required to work together in unity in order to gain market trust and government support (ESCO Annual Report 2013-2018). In fact, pure ESCOs and energy consultants were synergic partners, not competitors, because consultants engaged in ground works e.g., energy audits and feasibility studies, which are considered as high risk to pure ESCOS if pure ESCOs would operate those tasks independently, in addition to customers' discretion to proceed further (Hansen et al., 2009). Moreover, Thailand had just been recovered from the flood crisis in the late 2011, and then experienced political turmoil from the second half of the year 2013 to 2014 "Bangkok Shutdown", and following by coup d'état in 2014, EESCs were under difficult economic circumstances or systematic risk to sales, thus presenting a weak linkage between ERM and Firm Financial Performance (similar to findings of Quon et al., 2012) and disintegrating indicators EU and CI (and lessen C) from relevant ERM systems. The significance of these contingent variables differs from the literatures described by Chenhall (2003), Gordon et al (2009), Liebenberg and Hoyt (2003), Luft and Shields (2003), Panicker and Hiremath (2016), Sithipolvanichgul (2016), Tymon et al. (1998). Therefore, sales of most EESCs had been fallen under similar influences of environmental context and conditions and could not be diversified away easily.

The influence of Enterprise Risk Management on Firm financial Performance is supported and positive. This result is similar to findings of Florio and Leoni (2017), Gordon et al. (2009), Mirza and Javed (2013), Sithipolvanichgul (2016), Yang, Ishtiaq, and Anwar (2018), Zou and Hassan (2015), but opposite to studies of Laisasikorn and Rompho (2014) who studied relationship between ERM and firm financial performance in listed companies in Thailand. One reason that may strengthen the relationship between ERM and FFP is from Florio and Leoni (2017) who studied this relationship on non-financial companies listed on the Milan Stock

Exchange during 2011-2013. Firms with advanced levels of ERM implementation presents higher performance, both as financial performance and market evaluation and effective ERM systems lead to higher performance by reducing risk exposure**.** This means that EESCs in Thailand could manage their financial performance and did survive amidst a number of overwhelmed risks.

The indirect influences of ER and CoV to FFP depend on the strength of successful level of ERM implementation. The indirect relationships between ER to FFP and CoV to FFP, by passing through ERM, are both insignificant. These insignificant relationships can be inferred from Agustina and Baroroh **(**2016**)** who explained that the adoption of ERM by Indonesian banks was compliant and was not pursued seriously. Another reason is that Thailand had been subject to influences of natural disaster and then political crises during that surveyed period and these events could undermine the accomplishment of the ERM to improve firm financial performance. These similar events occurred during the financial and economic crisis in Canada as studied by Quon et al. (2012) who conducted research on companies listed in the Toronto Stock Exchange (TSX) during 2006-2009, when the corporates' earnings varied differently. Therefore, it is possible that enterprise risk management by EESCs was at the beginning stage and is superficial.

5.3 Implication and Recommendations

5.3.1 The Change of ER and CoV Definitions

Because observed variable RR is dropped from constructed variable ER and observed variable EU and CI are dropped from constructed variable CoV by the goodness of fit results of CFA and SEM models. The initial definitions of ER and CoV have to be changed to reflect this exclusion as follows:

Enterprise Risks (ER) is redefined as the overall effects of all events that are likely to harm business achievement in providing energy efficiency services. It consists of 3 main risk categories

according to the concept of Enterprise Risk Management (ERM), which are 1) Strategic Risk (SR), 2) Operation Risk (OR), and 3) Financial Risk (FR).

Contingent Variables (CoV) is redefined as factors that may affect Enterprise Risk Management and then affecting to the firm financial performance. CoV consists of 3 observed variables which are 1) Firm Complexity (FC), 2) Firm Size (FS), and 3) Monitoring by Board of Directors (MBD).

5.3.2 Suggestion to Related Parties

This study clearly shows that the major risks of EESCs relating to internal and external problems are Strategic Risk (SR), Operational Risk (OR) and Financial Risk (FR), which needed to be mitigated in tandem**.** Under aforementioned contexts, this study suggests the following solutions for EESCs.

1) internal activities: EESCs should focus on reviewing and improving business strategies, i.e., binding contracts for equipment maintenance and performance guarantee through lifetime of projects with manufacturers, use accredited equipment/technology and/or purchase equipment from certified manufacturers/suppliers/service providers (Industrial Energy Accelerator, 2020), partnering with academic institutions for customized innovative technology (e.g., IoT) with traditional equipment (e.g., Heating, ventilation, and air conditioning: HVAC) to collect energy saving data and performance measurement instead of purchasing technology only, developing common practices such as the M&V protocol, and empowering people to handle disruption and to adapt to new normal.

2) external activities**:** The EESC industry should have an independent entrusting entity to facilitate, mediate, and ensure fair arrangement and payment between EESCs and their stakeholders. The third-part entity may cater funds and guarantees, bring knowhow and new technologies, set up standards, practices, and common agreement, verify suppliers' equipment performance as well as EESCs performance, and certify qualified EESCs as this will help EESCs

especially with small size and limited access to resources in terms of technology, knowledges, and funds as well as will unify and clarify the government supports.

For government agencies, they should establish an independent intermediary to reconcile any issues with EESCs to help set up governmental policies and to resolve the tax benefit and financial support that do not answer to EESCs' needs.

For financial institutions, this study clarifies relevant risk drivers and risk categories that EESCs have been facing for better understanding. Financial institutions may investigate whether EESCs have already covered or responded to various risks that each EESC cannot manage effectively with specific issues together with each EESC's business context or not and price the financial rates based on each EESC's risk levels.

These suggestions can be referred to Article 18, Energy services, of Official Journal of the European Union (2012) which states that "Member States must promote the energy services market and access for SMEs to it by disseminating information on available energy service contracts and financial instruments and incentives. It must support the public sector in taking up energy service offers, in particular for building refurbishment by providing model contracts for energy performance contracting. Member States must also, if necessary, take measures to remove the regulatory and non-regulatory barriers That impede the uptake of energy performance contracting.".

5.4 Limitation of the Study and Direction for Future Research

Limitations of this study are as following.

1) the data during surveyed periods were affected by crisis such as political turmoil which did not favor the systematic risk management and leading to unfavorable EESCs financial performance. The results may not be generalized to other extending periods. 2) The stage of EESCs development and operations was not at full capacity so the results may differ from other literatures' results that based on different maturities, environments and cultures. 3) Some observed variables may be defined and used differently from other researches i.e., causes of risks, classification of

risks, contingent variables, and performance because of interpretation, service activities, accounting standards, and available data e.g., market- based performance. 4) The findings should be determined as initiative, rather than confirmation for business as usual. Nonetheless, these results may provide useful information for EESCs as a guidance to manage risks in a similar context. 5) Calculated data of measured variables of CoV, ERM, and FFP related to EESCs are limited to the numbers of firms that their representative respondents returned questionnaires because respondents who rated the impacts of risk drivers from their different angles on the questionnaire items might work in the same companies. And 6) The interpretation of raw data, i.e., ROA, ROE, and EPS, except ER and its measured variables, beyond the scope of this study (as given in tables under section 3) may be limited or cannot be generalized. In other words, further data collection is needed for periods and regions beyond the scope of this study. However, procedures under this research can be followed and applied.

Directions for future researches are as following.

In order to complement findings of this research, a comprehensive longitudinal study should be conducted in other periods e.g., during more normal, stable, or growth environment (less subject to influences of crisis situations) when new government regulations are enforced more vigorously and EESCs' industry and numbers increase largely. Further studies by using different models may also help for cross checking this research findings i.e., PLS SEM, and second order Confirmatory Factor Analysis, however other cross-checking statistics are beyond the scope of this study and the second order CFA is studied in another short paper by the researcher. An in-dept interview research helps support the deep insight for reasons to answer why the risk drivers still exist and how to resolve these issues and this research required deeper study in a separate full qualitative approach. A measurement invariance analysis of data between pure ESCOs and energy consultants can investigate the differences between their inputs for each factor and this should also be conducted in another separate research. A further study on other new mediators in addition to ERM may discover more relationship between ER and CoV to FFP. An extension to this research is on a study of risk responses.

REFERENCES

Abotsi, A. K., Dake, G. Y., & Agyepong, R. A. (2014). Factors influencing risk management decision of small and medium scale enterprises in Ghana. *Contemporary Economics, 8*(4), 397-414.

Accenture. (2013). *Accenture 2013 global risk - Management study focus on findings for the energy and utilities sector*. Retrieved April 14, 2016, from https://www.oxfordeconomics.com/publication/open/243223

Achawangkool, A. (2012, September). *Energy efficiency promotion through esco mechanism*. Paper presented at the meeting of Department of Alternative Energy Development and Efficiency, Bangkok, Thailand.

Agustina, L., & Baroroh, N. (2016). The relationship between enterprise risk management (erm) and firm value mediated through the financial performance. *Review of Integrative Business and Economics Research, 5*(1), 128-138.

Ai, J., Bajtelsmit, V., & Wang, T. (2014). Enterprise risk management and diversification effects for property and casualty insurance companies. *SSRN Electronic Journal.* Retrieved August 12, 2016, from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2422452

Ai, J., Brockett, P. L., Cooper, W. W., & Golden, L. L. (2012). Enterprise risk management through strategic allocation of capital. *Journal of Risk and Insurance, 79*(1), 29-56.

Al-Manaseer, M. F., Al-Hindawi, R. M., Al-Dahiyat, M. A., & Sartawi, I. I. (2012). The impact of corporate governance on the performance of Jordanian banks. *European Journal of Scientific Research*, *67*(3), 349-359.

Al-Matari, E. M., Al-Swidi. A. K., & Fadzil, F. H. B. (2014). The measurements of firm performance's dimensions. *Asian Journal of Finance & Accounting*, *6*(1), 24–49.

Aon Risk Solutions. (2013). Global risk management survey 2013. Retrieved May 6, 2018, from

Arena, M., Arnaboldi, M., & Azzone, G. (2010). The organizational dynamics of enterprise risk management. *Accounting Organizations and Society*, *35*(7), 659-675.

Arnold, V., Benford, T., Canada, J., & Sutton, S. G. (2015). Leveraging integrated information systems to enhance strategic flexibility and performance: The enabling role of enterprise risk management. *International Journal of Accounting Information Systems*, *19*, 1-16.

Aron, R., Clemons, E. K., Reddi, S. P. (2005). Just right outsourcing: Understanding and managing risk. *Journal of Management Information Systems*, *22*(2), 37–55.

ASEAN Centre for Energy. (2010). *ASEAN Plan of Action for Energy Cooperation 2010-2015 (APAEC).* Retrieved December 10, 2015, from https://aseanenergy.org/2010-2015-asean-plan-of-action-for-energy-cooperation-apaec/

ASEAN Centre for Energy. (2015). *ASEAN plan of action for energy cooperation (APAEC) 2016-2025*. Jakarta: Author.

ASEAN Centre for Energy. (2017). *ASEAN ESCO Report*. Jakarta: Author.

Asia-Pacific Economic Cooperation. (2017). *Sector study on environmental services: Energy efficiency businesses*. Retrieved from the Asia-Pacific Economic Cooperation website: https://www.apec.org/Publications/2017/10/Sector-Study-on-Environmental-Services-Energy-Efficiency-Businesses

Association of Insurance and Risk Managers, The Public Risk Management Association, & Institute of Risk Management. (2010). *A structured approach to enterprise risk management (ERM) and the requirements of ISO 31000*. Retrieved October 23, 2014, from https://www.ferma.eu/app/uploads/2011/10/a-structured-approach-to-erm.pdf

Association of Southeast Asian Nations. (2004). *Vientiane Action Programme (VAP) 2004-2010 in the tenth ASEAN summit*. Retrieved from the Association of Southeast Asian Nations website: https://www.asean.org/storage/images/archive/VAP-10th%20ASEAN%20Summit.pdf

Babakus, E., & Mangold, G. (1992). Adapting the SERVQUAL scale to hospital services: An empirical investigation. *Health Service Research*, *26*, 767-780.

Banker, R. D., Datar, S., & Kaplan, R. S. (1989). Productivity measurement and management accounting. *Journal of Accounting, Auditing and Finance*, *4* (4), 528–554.

Barnett, M., Jermier, J., & Lafferty, B. (2006). Corporate reputation: The definitional landscape. *Corporate Reputation Review*, *9*(1), 26-38.

Baron, R. M. & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistics considerations. *Journal of Personality and Social Psychology*, *51*, 1173-1182.

Barton, T. L., Shenkir W. G., & Walker P. L. (2002). *Making enterprise risk management pay off: How leading companies implement risk managemen*t. Upper Saddle River, NJ: Financial Times/Prentice Hall.

Basel Committee on Banking Supervision (2009). *Enhancements to the Basel II framework*. Basel, Switzerland: Bank for International Settlements Press & Communications.

Basel Committee on Banking Supervision (2017). *Guidelines: Identification and management of step-in risk*. Retrieved September 12, 2018, from https://www.bis.org/bcbs/publ/d423.htm.

Bateman, T. S. & Snell, S. A. (2012). *Management: Leading and collaborating in competitive world* (10th ed.), Burr Ridge, IL: McGraw-Hill Higher Education.

Baxter, R., Bedard, J. C., Hoitash, R., & Yezegel, A. (2013). Enterprise risk management program quality: Determinants, value relevance, and the financial crisis. *Contemporary Accounting Research*, *30*(4), 1264-1295.

Bearden, W.O., Netemeyer G. R., & Mobley, M. (1989). *Handbook of marketing scales: Multi-item measures for marketing and consumer behavior*. Newbury Park, USA: Sage.

Beasley, M. S., & Frigo M. L. (2007, May). Strategic Risk Management: Creating and protecting value. *Strategic Finance*, 25-53.

Beasley, M., Pagach, D., & Warr, R. (2008). Information conveyed in hiring announcements of senior executives overseeing enterprise-wide risk management process. *Journal of Accounting, Auditing & Finance*, *23*(3), 311-332.

Bell, T. B., Marrs, F. O., Solomon, I., & Thomas, H. (1997). *Auditing organizations through a strategic-systems lens: The KPMG business measurement process.* Montvale, NJ: KPMG Peat Marwick LLP.

Ben-Amar, W., Boujenoui, A., Zéghal, D. (2014). The Relationship between corporate strategy and enterprise risk management: Evidence from Canada. *Journal of Management and Strategy*, *5*(1), 1-7.

Bentler, P. M., & Bonett, D. G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin*, *88*, 588–606.

Bentler, P. M., & Chou, C. (1987). Practical issues in structural modeling. *Sociological Methods and Research*, *16*, 78–117.

Bertoldi, P. & Boza-Kiss, B. (2017). Analysis of barriers and drivers for the development of the ESCO markets in Europe. *Energy Policy*, *107*, 345-355.

Blach, J. (2010). Financial risk identification based on the balance sheet information. *Conference: V international conference managing and modelling of financial risks, 2010, VŠB-TU Ostrava.* Ekonomická Fakulta, Katedra Financí.

Bodnar, G. M., Tang, C., & Weintrop, J. (1999). *Both sides of corporate diversification: The value impacts of geographic and industrial diversification (December 1999).* Retrieved April 13, 2015, from https://ssrn.com/abstract=217869. DOI:10.2139/ssrn.217869.

Bollen, K. A. (1989). *Structural equations with latent variables*. NY: John Wiley & Sons, Inc.

Bowen, J. K., Cassel, R., Collins, C., Dickson, K., Fleet, M., Ingram, D., Meyers, S., Mueller, H., Samaniego, Z., Siberón, J., Wille, S., & Yu, M. (2006). *Enterprise risk management specialty guide*. Society of Actuaries. Retrieved December 10, 2017, from the Enterprise Risk Management (ERM) website: https://www.soa.org/globalassets/assets/library/

Boza-Kiss, B., Bertoldi, P., & Panev, S. (2015). The European ESCO market: Recent trends, market sizes, barriers and drivers and the remaining market potential. In T. L. Lindström (Ed.), *ECEEE summer study proceedings on energy efficiency* (p. 445-454), Stockholm, Sweden: ABA Intercopy.

Bromiley, P. (1991). Testing a causal model of corporate risk taking and performance. *The Academy of Management Journal*, *34*(1), 37-59.

Bromiley, P., McShane, M., Nair, A., & Rustambekov, E. (2015). Enterprise risk management: review, critique, and research directions. *Long Range Planning, 48*(4), 265-276.

Buttle, F. (1996). SERVQUAL: Review, critique, research agenda. *European Journal of Marketing*, *30*, 8-32.

Callon, M., Lascoumes, P., & Barthe, Y. (2009). *Acting in an uncertain world*. Cambridge, MA: The MIT Press.

Canadian Institute Chartered Accountants. (2012). *A Framework for board oversight of enterprise risk*. Retrieved April 15, 2015, from https://www.cpacanada.ca/-/media/site/operational/rg-research-guidance-and-support/docs/02481-rg-framework-board-oversight-enterprise-risk-may-2020.pdf?la=en&hash=338596A51F647493F3DC3377E6490DEB21FC3695

Carmines, E. G., & McIver, J. P. (1981). Analyzing models with unobserved variables: Analysis of covariance structures. In G. W. Bohrnstedt, & E. F. Borgatta (Eds.), *Social measurement*: *Current issues* (p. 65-115). Beverly Hills: Sage.

Casualty Actuarial Society, Enterprise Risk Management Committee. (2003). *Overview of enterprise risk management*. Retrieved January 1, 2015 from https://www.academia.edu/39164266/Overview_of_Enterprise_Risk_Management_Casualty_Actuarial_Society_Enterprise_Risk_Management_Committee

Casualty Actuarial Society. (2019). *Enterprise risk management.* Retrieved October 23, 2019, from https://www.casstudentcentral.org/about-our-profession/what-is-a-property-and-casualty-actuary/enterprise-risk-management

category/410-eep

Cater, C. I. (2006). Playing with risk? Participant perceptions of risks and management implications in adventure tourism. *Tourism Management*, *27*(2), 317-325.

Chapman, C., & Ward, S. (2003). Constructively simple estimating: A project management example. *Journal of the Operational Research Society*, *54*(10), 1050–1058.

Chapman, R. J. (2006). *Simple tools and techniques for enterprise risk management.* London: Wiley.

Charles, S. T. (2004). *Risk and financial management: Mathematical and computational methods*. Surrey: John Wiley & Son.

Charoenkijjarukorn, P. (2013). Sarbanes-Oxley Act and oversea corporate governance towards good governance in Thailand. *Chulalongkorn Business Review*, *35*(4), 138.

Chatterjee, S., Wiseman, R. M., Fiegenbaum, A., & Devers, C. E. (2003). Integrating behavioural and economic concepts of risk into strategic management: The twain shall meet. *Long Range Planning*, *36*, 61-79.

Chenhall, R. H. (2003). Management control systems design within its organizational context: Findings from contingency-based research and directions for the future. *Accounting, Organizations and Society*, *28*(2–3), 127–168.

Chenhall, R. H., & Langfield-Smith, K. (1998). The relationship between strategic priorities, management techniques and management accounting: An empirical investigation using a systems approach. *Accounting, Organizations and Society*, *23*(3), 243–264.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). NJ: Lawrence Erlbaum Associates.

Collier, P. M. (2009). *Fundamentals of risk management for accountants and managers: Tools & techniques*. Amsterdam: Elsevier.

Colquitt, L. L., Hoyt, R. E., & Lee, R. B. (1999). Integrated risk management and the role of the risk manager. *Risk Management and Insurance Review*, *2*(3), 43-61.

Comité Européen des Assurances & Groupe Consultatif Actuariel Européen. (2007). *Solvency II glossary*. Retrieved November, 20, 2012 from http://ec.europa.eu/internal_market/insurance/docs/solvency/impactassess/annex-c08d_en.pdf

Connell, J., & Voola, R. (2007). Strategic alliances and knowledge sharing: Synergies or silos? *Journal of Knowledge Management*, *11*(3), 52 – 66.

Cooper, D. R., & Schindler, P. S. (2001). *Business research methods* (7th ed.). Boston, MA: McGraw-Hill Irwin.

Cooper, T. (2010). *Strategic risk management in the municipal and public sector*: *An exploration of Critical Success Factors and Barriers to Strategic Risk Management within the province of Newfoundland and Labrador.* Newfoundland and Labrador, Canada: The Leslie Harris Centre of Regional Policy and Development, Memorial University.

Cormican, K., (2014). Integrated enterprise risk management: From process to best practice. *Modern Economy*, *5*(4), 401-413.

COSO. (2012). *Thought leadership in erm: Risk assessment in practice*. Retrieve December, 10, 2015 from the COSO website: https://www2.deloitte.com/content/dam/Deloitte/global/ Documents/Governance-Risk-Compliance/dttl-grc-riskassessmentinpractice.pdf

Crockford, N. (1986). *An introduction to risk management* (2nd ed.). Cambridge: Woodhead-Faulkner.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, *16*, 297-334.

Crouhy, M., Galai, D., & Mark, R. (2014). *The* essentials of risk management (2nd ed.). McGraw-Hill.

Damodaran, A. (2008). *Strategic risk taking: A framework for risk management*. NJ: Prentice Hall.

Damodaran, A. (2012). *Investment valuation: Tools and techniques for determining the value of any asset* (3rd ed.). NJ: John Wiley & Sons.

Daniell, M. H. (2000). *World of risk: Next generation strategy for a volatile era*. Singapore: John Wiley & Sons (Asia).

De Vos, A. A. (2003). Scientific theory and professional research (2nd ed.). In A. S., De Vos, H., Strydom, C. B., Fouche, & C. S. L., Delport (Eds), *Research at grass roots: For the social sciences and human service professions*. Pretoria: Van Schaik.

Dechow, P., Sloan, R., & Sweeney, A. (1995). Detecting earnings management. *The Accounting Review*, *70*, 193-225.

Deephouse, D. (2000). Media reputation as a strategic resource: An integration of mass communication and resource-based theories. *Journal of Management*, *26*(6) 1091-1112.

Defond, M. L., & Jiambalvo, J. (1994). Debt covenant violation and manipulation of accruals. *Journal of Accounting and Economics, 17*(1-2), 146-176.

Defond, M. L., & Subramanyam, K. R. (1998). Auditor changes and discretionary accruals. *Journal of Accounting and Economics, 25*(1), 35-67.

Deragon, J. (2000). Old knowledge with a new name. Retrieved August, 19, 2014, from http://riskmania.com

Devlin, S. J., Dong, H., & Brown, M. 2003. Selecting a scale for measuring quality. *Marketing Research*, *15*(3), 13.

Dickinson G., (2001). Enterprise risk management: Its origins and conceptual foundation. *The Geneva Papers on Risk and Insurance*, *26*(3), 360-366.

Dollinger, M. J., Golden, P. A., & Saxton, T. (1997). The effect of reputation on the decision to joint venture. *Strategic Management Journal, 18*(2), 127-140.

Doyle, J., Ge, W., & McVay, S. (2007). Determinants of weaknesses in internal control over financial reporting. *Journal of Accounting and Economics*, *44*(1), 193-223.

Eberl, M. & Schwaiger, M. (2005). Corporate reputation: Disentangling the effects on financial performance. *European Journal of Marketing*, *39*(7), 838–854.

Economic and Social Commission for Asia and the Pacific. (2010). *Statistical perspectives: Energy and development in the ASEAN region*. Retrieved from https://www.unescap.org/resources/energy-and-development-asean-region

Edwards, P. J., & Bowen, P. A. (2005). *Risk management in project organisations*, Oxford: Butterworth Heinemann.

Elliott, M. W. (2013). *Enterprise risk management*. Malvern, PA: The Institutes.

Ellis, J. (2010). *Energy service companies (ESCOs) in developing countries*. Retrieved from the IISD website: https://www.iisd.org/publications/energy-service-companies-escos-developing-countries

Ellul, A., & Yerramilli, V. (2013). Stronger risk controls, lower risk: Evidence from U.S. bank holding companies. *The Journal of Finance*, *68*(5), 1757-1803.

Energy Efficiency Plan. (2015). *Energy policy and planning office*. Retrieved from the Ministry of Energy Thailand website: http://www.eppo.go.th/index.php/th/component/k2/itemlist/

ESCO Information Center (2013-2018). *ESCO Annual Report 2013-2018*. Thai ESCO Association. Federation of Thai Industries. Retrieved December 10, 2019, from http://www.thaiesco.org/

ESCO Information Center. (2021). *ESCO Registration List*. Retrieved October 23, 2017, from https://www.thaiesco.org/thai/info_member.aspx

Espejo, R, & Schwaninger, M. (1993). *Organizational fitness: Corporate effectiveness through management cybernetics*. Frankfurt, Germany: Campus Verlag.

Espejo, R., Schuhmann, W., Schwaninger, M., & Bilello, U. (1996). *Organizational transformation and learning: A cybernetic approach to management*. Chichester, England: Wiley.

Fan, B., & Yuan, Y. (2016). Constructing an assessment index system for strategic risk management in coal science and technology enterprises. *International Journal of Mining Science and Technology*, *26*(4), 653-660.

Farrell, M., & Gallagher, R. (2014). The valuation implications of enterprise risk management maturity. *The Journal of Risk and Insurance*, *82*(3), 625-657.

Federal Energy Management Program. (2015). *Recognizing and assigning ESPC risks and responsibilities using the risk, responsibility, and performance matrix (RRPM)*. Retrieved

December 8, 2015, from the US Department of Energy website: https://www.energy.gov/eere/femp/energy-service-companies-0

Field, A. (2000). *Discovering statistics using spss for windows*. New Delhi: Sage.

Field, A. (2009). *Discovering statistics using SPSS*. London: SAGE.

Fisher, I. N., & Hall, G. R. (1969). Risk and corporate rate of return. *The Quarterly Journal of Economics*, *83*(1), 79–92.

Floricel, S., & Miller, R. (2001). Strategizing for anticipated risks and turbulence in large-scale engineering projects. *International Journal of Project Management*, *19*, 445–455.

Florio, C. & Leoni, G. (2017). Enterprise risk management and firm performance: The Italian case. *The British Accounting Review*, *49*(1), 56-74.

Gahin, F. S. (1967). A theory of pure risk management in the business firm. *The Journal of Risk and Insurance*, *34*(1), 121-129.

Gallagher, R. B. (1956). Risk management: New phase of cost control. *Harvard Business Review, 34*(5), 75-86.

Garatwa, W., & Bollin, C. (2002). *Disaster risk management: Working concept*. Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ). Eschborn: Hofheim-Wallau.

Garbuzova-Schlifter M., & Madlener, R. (2012). *Russia's emerging ESCO market: Prospects and barriers for energy efficiency investmen*ts. Retrieved from the IDEAS website: https://ideas.repec.org/p/ris/fcnwpa/2012_006.html

Garbuzova-Schlifter, M., & Madlener, R. (2013). Prospects and barriers for Russia's emerging ESCO market. *International Journal of Energy Sector Management*, *7*(1), 113-150.

Garbuzova-Schlifter, M., & Madlener, R. (2014). *Risk analysis of energy performance contracting projects in Russia: An analytic hierarchy process approach*. Retrieved from the IDEAS website: https://ideas.repec.org/p/ris/fcnwpa/2014_010.html

Garbuzova-Schlifter, M., & Madlener, R. (2016). AHP-based risk analysis of energy performance contracting projects in Russia, *Energy Policy*, *97*, 559–581.

Gates, S., (2006), Incorporating strategic risk into enterprise risk management: A survey of current corporate practice. *Journal of Applied Corporate Finance*, *18*(4), 81-90.

Gatzert, N., & Schmit, J. (2016). Supporting strategic success through enterprise-wide reputation risk management. *Journal of Risk Finance*, *17*(1), 26-45.

Gaudenzi, B., Confente, I., & Christopher, M. (2015). Managing reputational risk: Insights from an European survey. *Corporate Reputation Review, 18(4), 248-260.*

Gaultier-Gaillard, S., Louisot, J. P., & Rayner, J. (2009). Managing reputational risk – from theory to practice. In J., Klewes & R., Wreschniok (Eds.). *Reputation capital* (p. 161-178). Heidelberg, Berlin: Springer.

Ge, W., & McVay, S. (2005). The disclosure of material weaknesses in internal control after the Sarbanes-Oxley Act. *Accounting Horizons*, *19*(3), 137-158.

Geringer, J. M., Tallman, S., & Olsen, D. M. (2000). Product and international diversification among Japanese multinational firms. *Strategic Management Journal*, *21*(1), 51-80.

Giddens, A. (2003). *Runaway world: How globalization is reshaping our lives*. London: Routledge.

Global Association of Risk Professionals. (2008). *Enterprise risk management (ERM) integrating strategy, capital and risk*. Retrieved April 15, 2015, from https://www.slideserve.com/bruno-bishop/enterprise-risk-management-erm-integrating-strategy-capital-and-risk

Golshan, N. M., & Rasid, S. Z. A., (2012). Determinants of enterprise risk management adoption: An empirical analysis of Malaysian public listed firms. *World Academy of Science, Engineering and Technology*, *6*, 242-249.

Gordon, L. A., Loeb, M. P., & Tseng, C. Y. (2009). Enterprise risk management and firm performance: A contingency perspective. *Journal of Accounting and Public Policy, 28*(4), 301-327.

Grace, M. F., Leverty, J. T., Phillips, R. D., & Shimpi, P. (2015). The value of investing in enterprise risk management. *Journal of Risk and Insurance*, *82*(2), 289-316.

Graham, M. E., & Bansal, P. (2007). Consumers' willingness to pay for corporate reputation: The context of airline companies. *Corporate Reputation Review*, *10*(3), 189-200.

Gravetter, F., & Wallnau, L. (2014). *Essentials of statistics for the behavioral sciences* (8th ed.). Belmont, CA: Wadsworth.

Gupta, P. K. (2011). Risk management in Indian companies: EWRM concerns and issues. *Journal of Risk Finance*, *12*(2), 121-139.

Hair, J. F., Jr., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis* (7th ed.). Noi da, India: Pearson Education in South Asia.

Haka. S., Gordon, L. A., & Pinches, G. E. (1985). Sophisticated capital budgeting selection techniques and firm performance. *The Accounting Review*, *602*(4), 651-669.

Hansen, S. J., (2006). *Performance contracting, expanding horizons* (2nd ed.). Lilburn, GA: The Fairmont Press.

Hansen, S. J., Langlois, P. & Bertoldi, P., (2009). *ESCOs around the world: Lessons learned in 49 countries*. Lilburn, GA: Fairmont Press.

Harrington, S. E., Niehaus, G., & Risko, K. J. (2002). Enterprise risk management: The case of united grain growers. *Journal of Applied Corporate Finance*, *14*(4). 71-81.

Herbert, W. M., Hau, K., Balla, J. R., & Grayson, D. (2010). Is more ever too much: The number of indicators per factor in confirmatory factor analysis. *Multivariate Behavioral Research, 33*(2), 181-220.

Hinkle, D. E., William, W., & Stephan. G. J. (1998). *Applied statistics for the behavior sciences* (4th ed.), NY: Houghton Mifflin.

Hitt, M. A., Duane, I. R., & Hoskisson, R. E. (2014). *Strategic management: Competitiveness & globalization* (5th Asia-Pacific ed.). South Melbourne, Victoria: Cengage Learning.

Hofer, K., Limaye, D., & Singh, J. (2016). Fostering the development of ESCO markets for energy efficiency. The World Bank Group. Retrieved December 10, 2017, from the World Bank Group website: https://openknowledge.worldbank.org/handle/10986/23949

Holton, G. A. (1996). *Enterprise risk management: Contingency analysis*. Retrieved May 1, 2016, from www.exinfm.com/pdffiles/erm.pdf

Holton, G. A. (2004). Defining risk. *Financial Analysts Journal*, *6*, 19–25.

Howard, D. L. (2003, December). Republic of Korea reduction of financing barriers for energy savings performance contracts. *The 9th Conference of the Parties (COP9)*. Organized by UNFCCC secretariat, Milan, Italy.

Hoyt, R. E., & Liebenberg, A. P. (2010). The value of enterprise risk management. *Journal of Risk and Insurance*, *78*(4), 795-822. http://www.aon.com/unitedkingdom/products-and-services/industry- expertise/ attachments/global-professions/grms-report-2013.pdf

Hu, J. R., & Zhou, E. Y. (2011). Engineering risk management planning in energy performance contracting in China. *Engineering and risk management*, *1*, 195–205.

Industrial Energy Accelerator. (2020). *Energy efficiency risk management a report for financial intermediaries in Brazil*. Retrieved October 23, 2021, from https://www.industrialenergyaccelerator.org/brazil/a-report-for-financial-intermediaries-in-brazil/

Institute of Internal Auditors. (2001, October 18). *The standards for the professional practice of internal auditing*. Altamonte Springs, FL: Author.

Institute of Internal Auditors. (2009). *Position paper: The role of internal auditing in enterprise-wide risk management*. Retrieved from the IIA website: https://na.theiia.org/standards-guidance/Public%20Documents/PP%20The%20Role%20of%20Internal%20Auditing%20in%20Enterprise%20Risk%20Management.pdf

International Energy Agency. (2010). *Money matters: Mitigating risk to spark private investments in energy efficiency.* Retrieved December 10, 2014, from https://www.oecd-ilibrary.org/energy/money-matters_5km5zrrvzr42-en

International Energy Agency. (2011). *Joint public-private approaches for energy efficiency finance: Policies to scale-up private sector investment*. Retrieved December 31, 2015, from https://www.managenergy.net/file/773/download?token=AzJfX2qi

International Energy Agency. (2014). *Capturing the multiple benefits of energy efficiency: A guide to quantifying the value added*. Retrieved from the IEA website: https://doi.org/10.1787/9789264220720-en

International Energy Agency. (2015). *Task 45 large systems ESCO models – general*. Retrieved October 23, 2017, from https://task45.iea-shc.org/data/sites/1/publications/IEA-SHC-T45.C.2.1-TECH-ESCo-Models-General.pdf

International Energy Agency. (2018 a). *Energy efficiency 2018: Analysis and outlooks to 2040,* Retrieved from https://doi.org/10.1787/9789264024304-en.

International Energy Agency. (2018 b). *Energy service companies (ESCOs): At the heart of innovative financing models for efficiency*. Retrieved January 12, 2019, from https://www.iea.org/reports/energy-service-companies-escos-2

International Finance Corporation. (2011). *IFC energy service company market analysis*. Canada: Econoler.

International Organization for Standardization (2018). *ISO 31000:2018 risk management — guidelines*. Retrieved December 5, 2018, from https://www.iso.org/obp/ui/#iso:std:iso:31000:ed-2:v1:en

Jalal, A., AlBayati, F. S., & AlBuainain, N. R. (2011). Evaluating enterprise risk management (ERM); Bahrain financial sectors as a case study, *International Business Research*, *4*(3), 83.

Jalal-Karim, A. (2013). Leveraging enterprise risk management (ERM) for boosting competitive business advantages in Bahrain. *World Journal of Entrepreneurship, Management and Sustainable Development*, *9*(1), 65-75.

Johnson, G., Scholes, K., & Whittington, R. (2006). *Exploring corporate strategy*. London: FT-Prentice Hall.

Jones, J. J. (1991). Earnings management during import relief investigation. *Journal of Accounting Research*, *29*(2), 193–228.

Jones, R., Santori, L., & Ingram, D. (2006). Credit FAQ: enterprise risk management one year on. *Reactions*, *26*, 66-68.

Jorion, P. (2007). *Financial risk manager handbook* (4th ed.). NJ: John Wiley & Sons.

Junarsin, E. (2011). Executive compensation and firm performance: An empirical examination. *European Journal of Economics, Finance and Administrative Sciences*, *28*, 163–179.

Jüttner, U. (2005). Supply chain risk management: Understanding the business requirements from a practitioner perspective. *The International Journal of Logistics Management*, *16*(1), 120-141.

Keh, H. T. & Xie, Y. (2007). Corporate reputation and customer behavior intentions: The roles of trust, identification and commitment. *Industrial Marketing Management*, *38*(7), 732-742.

Khanthavit, A. (2008). *COSO enterprise risk management (ERM) to enhance corporate value*. *Proceeding of 16th Professor Sangvien Indaravijaya Conference on Thailand's Financial Market*. Bangkok.

Kim, W. C., & Mauborgne, R. (2005). *The blue ocean strategy*. Boston: Harvard Business School Press.

Kimbrough, R. L. (2006). *The relationship between perceptions of organizational culture and implementation of enterprise risk management* (Doctoral dissertation). Huntsville, AL: University of Alabama in Huntsville.

Kindström, D., Ottosson, M., & Thollander, P. (2017). Driving forces for and barriers to providing energy services - a study of local and regional energy companies in Sweden. *Energy Efficiency, 10*, 21–39.

Kiymaz, H., (2006). The impact of announced motives, financial distress, and industry affiliation on shareholders' wealth: Evidence from large sell-offs. *Quarterly Journal of Business and Economics*, *45*, 69-89.

Kleffner, A., Lee, R., & McGannon, B. (2003). The effect of corporate governance on the use of enterprise risk management: evidence from Canada. *Risk Management and Insurance Review*, *6*(1), 53-73.

Kleindorfer, P. R. (2011). Risk management for energy efficiency projects in developing countries. *SSRN Electronic Journal*. Social Innovation Centre. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1579938

Kline, R. B. (2011). *Principles and practices of structural equation modelling* (3rd ed.). NY: Guilford Press.

Kloman, F. (2010). A brief history of risk management. In J. Fraser & B. Simkins (Eds.). *Enterprise risk management: Today's leading research and best practices for tomorrow's executives*. Hoboken, NJ: John Wiley & Sons.

Kmec, P. (2011). Temporal hierarchy in enterprise risk identification. *Management Decision*, 49, 1489–1509.

Knight, F. H. (1921). *Risk, uncertainty and profit*. Boston, MA: Houghton Mifflin.

Kren, L. (1992). Budgetary participation and managerial performance: The impact of information and environment volatility. *The Accounting Review*, *67*(3), 511-526.

Kuratko, D. F., & Welsch, H. P. (2001). *Strategic entrepreneurial growth.* Fort Worth, TX: Harcourt College.

Laisasikorn, K., & Rompho, N. (2014). A study of the relationship between a successful enterprise risk management system, a performance measurement system and the financial performance of Thai listed companies. *Journal of Applied Business and Economics*, *16*(2), 81–92.

Lajili, K., & Zéghal, D. (2005). A content analysis of risk management disclosures in Canadian annual reports. *Canadian Journal of Administrative Sciences*, *22*(2), 125-142.

Lam, J. (2000). Enterprise-wide risk management and the role of the chief risk officer.

Lam, J. (2001), *Risk management – The CRO is here to stay*. NY: Prentice-Hall.

Lam, J. (2003). *Enterprise risk management: From incentives to controls*. Hoboken, NJ: John Wiley & Sons.

Lange, D., Lee, P. M., & Dai, Y. (2011). Organizational reputation: A review. *Journal of Management*, *37*(1), 153-184.

Langlois, P., & Hansen, S. J., (2012). *World ESCO outlook*. Lilburn, GA: Fairmont Book Press.

Lawrence, P. R., Lorsch, J. W., & Garrison, J. S. (1967). *Organization and environment: Managing differentiation and integration*. Boston, MA: Division of Research Graduation, School of Business Administration, Harvard University.

Lenckus, D. (2006). Risk managers name top threats. *Business Insurance*, *40*(17), 3-5.

Liebenberg, A. P. & Hoyt, R. E. 2003. The determinants of enterprise risk management: Evidence from the appointment of chief risk officers. *Risk Management and Insurance Review*, *6*(1), 37-52.

Limaye, D. (2009, July). *DSM Financing Annex: Financing DSM and Energy Efficiency Programs in China.* Washington, DC: USID ECO-Asia Clean Development and Climate Program.

Lin, Y., Liao, Y., & Chang, K. (2011). Firm performance, corporate governance and executive compensation in high-tech businesses. *Total Quality Management & Business Excellence*, *22*(2), 159–172.

Lin, Y., Wen, M., & Yu, J. (2012). Enterprise risk management: Strategic antecedents, risk integration and performance. *North American Actuarial Journal*, *16*(1), 1-28.

Liu, X. (2011). *A holistic perspective of enterprise risk management* (Unpublished doctoral thesis). Washington State University, WA: United States.

Liu, Y. & Noor, R. (2020). *Energy Efficiency in ASEAN: Trends and financing schemes*. Retrieved from the ASEAN Development Bank Institute website: https://www.adb.org/

Luft, J., & Shields, M. D. (2003). Mapping management accounting: graphics and guidelines for theory-consistent empirical research. *Accounting, Organizations and Society*, *28*(2), 169-249.

Lundqvist, S. A. (2015). Why firms implement risk governance – stepping beyond traditional risk management to enterprise risk management. *Journal of Accounting and Public Policy*, *34*(5), 441-466.

Lynch, R. (2003*). Corporate strategy* (3rd ed.). London: Pearson Education.

Mackay, P., & Moeller, S. B. (2007). The value of corporate risk management. *The Journal of Finance*, *62*(3), 1379-1419.

Marino, A., Bertoldi, P., Rezessy, S., & Boza-Kiss, B. (2010). *Energy service company market in Europe: Status report 2010*. Retrieved from the European Commission website: https://publications.jrc.ec.europa.eu/repository/handle/JRC59863

Markowitz, H. (1952). Portfolio Selection. *The Journal of Finance*, *7*(1), 77-91.

Martin, D., & Power, M. (2007). *The end of enterprise risk management*. Retrieved January 1, 2014, from https://web.actuaries.ie/sites/default/files/erm-resources/122_end_ of_ERM.pdf.pdf

McGuire, J. B., Schneeweis, T., & Branch, B. (1990). Perceptions of firm quality: A cause or result of firm performance. *Journal of Management*, *16*(1), 167-180.

McNamara, R., & Duncan, K. (1995). *Firm performance and macro-economic variables*. Retrieved August 12, 2014, from https://www.semanticscholar.org/paper/Firm-performance-and-macro-economic-variables-McNamara-Duncan/41b3efe9d2a633abccd7f3942c2d1108040f1d2e#extracted

McShane, M. K., Nair, A., & Rustambekov, E. (2011). Does enterprise risk management increase firm value? *Journal of Accounting, Auditing and Finance*, *26*(4).

Merna, T., & Al-Thani, F. F. (2008). *Corporate risk management*. Hoboken, NJ: John Wiley & Sons.

Meulbroek, L. K. (2002). Integrated risk management for the firm: A senior manager's guide. *Journal of Applied Corporate Finance*, *14*(4), 56-70.

Miccolis, J. A. (2003). *ERM lessons across industries*. Retrieved December, 30, 2016, from https://www.irmi.com/articles/expert-commentary/erm-lessons-across-industries

Miccolis, J. A., Hively, K., Merkley, B. W. (2001). *Enterprise risk management: Trends and emerging practices.* Altamonte Springs, Fl: Institute of Internal Auditors Research Foundation.

Mikes, A. (2009). Risk management and calculative cultures. *Management Accounting Research*, *20*(1), 18–40.

Miller, K. D. (1998). Economic exposure and integrated risk management. *Strategic Management Journal*, *19*(5), 497–514.

Miller, K., & Bromiley, P. (1990). Strategic risk and corporate performance: An analysis of alternative risk measure. *Academy of Management Journal*, *33*, 759-779.

Miller, P., Kurunmäki, L., & O'Leary, T. (2008). Accounting, hybrids and the management of risk. *Accounting, Organizations and Society, 33*, 942-967.

Mills, E., Kromer, S., Weiss, G., & Mathew, P. A. (2006). From volatility to value: Analysing and managing financial and performance risk in energy savings projects. *Energy Policy*, *34*(2), 188–199.

Ministry of Finance. (2018). *Name list of consultants*. Retrieved October, 23, 2018 from https://www.consultant.pdmo.go.th/index.php?mod=search& route=consult/

Mintzberg, H., Bruce, A., & Lampel, J. (2005). *Strategy safari: A guided tour through the wilds of strategic management*. NY: Simon & Schuster.

Mirza, S., & Javed, A. (2013). Determinants of financial performance of a firm: Case of Pakistani stock market. *Journal of Economics and International Finance, 5*(2), 43-52.

Moeller, R. R. (2007). *COSO enterprise risk management: Understanding the new integrated ERM framework*. Hoboken, NJ: Wiley.

Moeller, R. R. (2011). *COSO ERM Framework. COSO enterprise risk management: Establishing effective governance, risk, and compliance processes* (2nd ed.). Hoboken, NJ: John Wiley & Sons.

Morgan, G. (2007). *Images of organization*. Thousand Oaks, CA: Sage.

Murakoshi, C., & Nakagami, H. (2009, June). Current state of ESCO activities in Asia: ESCO industry development programs and future tasks in Asian countries. *ECEEE Summer Study Proceedings* (p. 311-322). Retrieved from https://www.eceee.org/ library/ conference_proceedings/eceee_Summer_Studies/2009/Panel_2/2.057/

Muralidharan, K. (2010). A note on transformation, standardization and normalization. *The IUP Journal of Operations Management, 9*(1-2), 116-122. Retrieved from the SSRN website: https://ssrn.com/abstract=1550655

Myers, M. D., Gordon, L. A., & Hamer, M. (1991). Post auditing capital assets and firm performance: An empirical investigation. *Managerial and Decision Economics*, *12*(4), 317-327.

Nan, L. (2015). Study on assess of enterprise risk management in China based on entropy weight/TOPSIS method. *International Journal of u- and e- Service*, *Science and Technology*, *8*(9), 21-30.

Naumoff, C. and A.M. Shipley (2007). Industrial energy efficiency as a risk management strategy. 2007 ACEEE summer study on energy efficiency in industry. *American Council for an Energy-Efficient Economy*.

Nocco, B. W., & Stulz, R. M. (2006). Enterprise risk management: Theory and practice. *Journal of Applied Corporate Finance*, *18*(4), 8-20.

Norman, A., & Lindroth, R. (2002). Supply chain risk management: Purchasers' vs planners' investment risks in views on sharing capacity the telecom industry. *Proceedings of the 11th International Annual IPSERA Conference* (p. 577-595). Twente, Netherlands: Enschede.

Nunnally, J. C. (1967). *Psychometric theory*. NY: McGraw-Hill.

O'Donnell, E. (2005). Enterprise risk management: A systems-thinking framework for the event identification phase. *International Journal of Accounting Information Systems*, *6*, 177-195.

Office of the Council of State. (2017). *Thai constitution* 2017. Retrieved from the Constitutional Court of the Kingdom of Thailand website: https://www.constitutionalcourt.or.th/occ_en/download/article_20170410173022.pdf

Official Journal of the European Union. (2012). *Directive 2012/27/EU of The European parliament and of the council on energy efficiency on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC*. Retrieved from https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX:32012L0027

Olson, D. L., & Wu, D. D. (2010). A review of enterprise risk management in supply chain. *Kybernetes*, *39*(5), 694-706.

Olson, D. L., & Wu, D. D. (2015). *Enterprise risk management (financial engineering and risk management* (2nd ed.). Singapore: World Scientific Publishing.

Pagach, D., & Warr, R. (2010, April). The effects of enterprise risk management on firm performance. Retrieved from the SSRN website: http://ssrn.com/abstract=1155218

Pagach, D., & Warr, R. (2011). The characteristics of firms that hire chief risk officers. *Journal of Risk and Insurance*, *78*(1), 185-211.

Page, C., & Meyer, D. (2000). Applied research design for business and management. Sydney: McGraw-Hill.

Panev, S., Labanca, N., Bertoldi, P., Ribeiro Serrenho, T., Cahill, C., & Kiss, B. (2014). *JRC science and policy reports: ESCO market report for non-european countries 2013*. Luxembourg: Publications Office of the European Union.

Panicker, S., & Hiremath, V. (2016). An empirical analysis of ERMI (Enterprise Risk Management Index) on organisational turnarounds and its impact on information technology sector. *Pacific Business Review International*, *9*(5).

Panjer, H. (2006). *Operational risk: Modeling analytics*. NJ: John Wiley & Son.

Panthai, B (2002). *Introduction to educational research methodology* (2nd ed.). Bangkok: Ramkhamhaeng University.

Peccia, T. (2001a). Designing an operational risk framework from a bottom-up perspective. In C. Alexander (Ed.). *Mastering risk Volume 2: Applications*. London: Pearson Education.

Peccia, T. (2001b, November). *Operational risk management: A practical approach and its regulatory implications*. Retrieved from the Federal Reserve Bank of Boston website: https://www.bostonfed.org/-/media/documents/bankinfo/conevent/oprisk/peccia.pdf

Platt, G. (2004). Beyond compliance: when risk management becomes a competitive advantage. *Global Finance* (p. 22-4).

Poole, A. D., & Geller, H. (1997, March). *The emerging ESCO industry in Brazil*. Retrieved from the ACEEE website: http://www.consiliariuslocalis.com/pdfindex204en.pdf

Porter, M. E. (2008). The five competitive forces that shape strategy. *Harvard Business Review*, *86*(1), 78–93.

PricewaterhouseCoopers (2004, October). *Risk management guideline*. Retrieved from the PwC webite: https://www.setsustainability.com/download/zx1t6qbafkg7h28

Proctor, P. E., McKibben, D., & Oliva, V. (2008). *A risk hierarchy for enterprise and IT risk managers*. Gartner Research.

professional-actuarial-specialty-guides/enterprise-risk- management/2005/august/

management/2005/august/spg0605erm.pdf

publications/energy-efficiency-asean-trends-financing-schemes

Quon, T. K., Zeghal, D., & Maingot, M. (2012). Enterprise risk management and firm performance. *Procedia – Social and Behavioral Sciences*, *62*(0), 263-267.

Rahman, M., & Kumaraswamy, M. (2002). Joint risk management through transactionally efficient relational contracting. *Construction Management & Economics, 20*(1), 45–54.

Raithel, S., & Schwaiger, M. (2014). The effects of corporate reputation perceptions of the general public on shareholder value. *Strategic Management Journal*, *36*(6), 945-956.

Rao, S., & Goldsby, T. (2009). Supply chain risks: A review and typology. *International Journal of Logistics Management, 20*(1), 97-123.

ReEx Capital Asia Pte Ltd. (2011). *South East Asia energy efficiency market report*. Retrieved from the ReEx Capital Asia website: http://www.reexasia.com/reports/ReEx-SE-Asia-Energy-Efficiency-Market-Report.pdf

Regan, P. J., & Patè-Cornell, M. E. (1997). Normative engineering risk management systems. *Reliability Engineering and System Safety, 57*(2), 159-169. Retrieved May 13, 2013 from http://www.Erisk.com/Learning/Research/011_lamriskoff.pdf

Risk and Insurance Management Society (2011). *RIMS Executive Report-the Risk Perspective: An overview of widely used risk management standard and guidelines*. Retrieved from https://www.rims.org/about-us/newsroom/an-overview-of-widely-used-risk-management-standards-guidelines

Roberts, P., & Dowling, G. R. (2002). Corporate reputation and sustained superior financial. *Performance Strategic Management Journal, 20*, 691-710.

Roland Berger Strategy Consultants. (2011). *Market Potential in Energy Efficiency in South East Asia: A systematic approach to opportunities and challenges in Southeast Asian Countries*. Retrieved from the EuroCham, Singapore website: https://eurocham.org.sg/wp-content/uploads/2015/07/EuroCham-Roland-Berger-Market-Potential-in-Energy-Efficiency-in-Southeast-Asia-3-Nov-2011.pdf

Romney, M. B. & Steinbart, P, J. (2012). *Accounting information systems* (12th ed.). London: Pearson.

Rovinelli, R. J., & Hambleton, R. K. (1977). On the use of content specialists in the assessment of criterion-referenced test item validity. *Dutch Journal of Educational Research, 2*, 49-60.

Rowe, W. (1977). *An anatomy of risk*, NY: Wiley.

Sarbanes-Oxley Act of 2002. (2002). *The public company accounting reform and investor protection Act*, United States Congress. WA: Government Printing Office.

Sarkar, A. & Moin, S. (2018). Transforming energy efficiency markets in developing countries: the emerging possibilities of super ESCOs. *Live Wire*. The World Bank Group. Retrieved from the World Bank Group website:https://openknowledge.worldbank.org/handle/10986/30385

Schumacker, R. E., & Lomax, R. G. (2010). *A beginner's guide to structural equation modeling* (3rd ed.). NY: Routledge.

Scott, S. V. & Walsham, G. (2005). Reconceptualizing and managing reputation risk in the knowledge economy: Toward reputable action. *Organization Science, 16*(3), 308-322.

Shane, S. & Cable, D. (2002). Network ties, reputation, and the financing of new ventures. *Management Science, 48*(3) 364–381.

Shang, T., Liu, L., Zhang, L., & Pan, Z. (2008). Energy performance contracting project evaluation and b-s model. *Networking and mobile computing: Proceedings of 2008 4th international Conference on wireless communications* (p. 1-4). China: Dalian.

Shavell, S. (1982). Suit, settlement, and trial: A theoretical analysis under alternative methods for the allocation of legal costs. *Journal of Legal Studies*, *11*, 55-82.

Shaw, G. K. (2010). *A risk management model for the tourism industry in South Africa* (Doctoral dissertation). North-West University.

Sheffi, Y. (2007). *The resilient enterprise: Overcoming vulnerability for competitive advantage*. Cambridge: MIT Press.

Sherman, M., Weston, H., Willey, S. & Mansfield, N. (2014). Risky business: Managing risk in a complex and connected world. *Management & Avenir, 74*(8), 159-173.

Shields, M. D. (1995). An empirical analysis of forms' implementation experience with activity-based costing. *Journal of Management Accounting Research, 7*, 148-166.

Shimpi, P. (2001). *Integrating corporate risk management*. NY: Texere.

Silitonga, R. J. P. (2016, Aug 4). *Energy service company in ASEAN: Potentials and challenges*. Retrieved from the ASEAN Centre for Energy website: https://aseanenergy.org/energy-service-company-in-asean-potentials-and-challenges/

Singh, J. (2018). Energy Efficiency in the Public Sector, *Live Wire*, World Bank Group. Retrieved from the World Bank Group website: https://openknowledge.worldbank.org/handle/10986/31023

Sithipolvanichgul, J. (2016). *Enterprise risk management and firm performance: Developing risk management measurement in accounting practice*. (Doctoral thesis, The University of Edinburgh, United Kingdom). Retrieved from https://era.ed.ac.uk/handle/1842/20949

Skipper, H. D. (1997). *Foreign insurers in emerging markets: Issues and concerns*. WA: International Insurance Foundation.

Skipper, H. D., & Kwon, J. W. (2007). *Risk management and insurance*: *Perspectives in a global economy.* Victoria, Australia: Blackwell Publishing.

Slywotzky, A., & Drzik, J. (2005, April). Countering the biggest risk of all. *Harvard Business Review*, 78-88.

Sobel, M. E. (1982). Asymptotic confidence intervals for indirect effects in structural equation models. *Sociological Methodology, 13*, 290-312.

Sobel, P. J., & Reding, K. F. (2004). Aligning corporate governance with enterprise risk management. *Management Accounting Quarterly, 5*, 29-37.

Sprčić, D. M., Kožul, A., & Pecina, E. (2015). State and perspectives of enterprise risk management system development – the case of Croatian companies. *Procedia Economics and Finance, 30*, 768–779.

Standard & Poor's. (2008). *European insurers continue to develop their enterprise risk management capabilities*. Retrieved August, 12 2014, from www.standardandpoors.com

Stroh, P. J. (2005). Enterprise risk management at united health group. *Strategic Finance, 87*(7), 26-35.

Subramaniam, N., Collier, P., Phang, M., & Burke, G. (2011). The effects of perceived business uncertainty, external consultants and risk management on organizational outcomes. *Journal of Accounting & Organizational Change, 7*(2), 132-157.

Sustainable Energy Authority of Ireland (2013). *Energy performance contracts handbook, sample document: Risk management guide*, Retrieved December 10, 2017, from http://www.seai.ie/

Tallman, S., & Li, J. (1996). Effects of international diversity and product diversity on the performance of multinational firms. *Academy of Management Journal, 39*(1), 179-196.

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's Alpha. *International Journal of Medical Education, 2*, 53-55.

The Committee of European Banking Supervisors. (2006). *Guidelines on the application of the supervisory review process under Pillar 2*. Retrieved from https://www.eba.europa.eu/cebs-publishes-guidelines-on-supervisory-review-process

The Committee of Sponsoring Organizations of the Treadway Commission. (2004). *Enterprise risk management – Integrated framework*. Jersey City, NJ: COSO.

The Committee of Sponsoring Organizations of the Treadway Commission. (2017). *Enterprise risk management: Integrating with strategy and performance*. Retrieved June 1, 2018 from https://www.coso.org/Documents/2017-COSO-ERM-Integrating-with-Strategy-and-Performance-Executive-Summary.pdf

The Committee of Sponsoring Organizations of the Treadway Commission. (2018). *Enterprise risk management: Applying enterprise risk management to environmental, social and governance-related risks*. Retrieved from https://www.coso.org/Documents/COSO-WBCSD-ESGERM-Guidance-Full.pdf

The Consulting Engineers Association of Thailand (2018). *Members list all*. Retrieved December 10, 2018, from http://www.ceat.or.th/2010/index.php/member/member-list-all.html

The Institute of Energy Economics, Japan. (2009). *The 2nd ASEAN energy demand outlook prepared in conjunction with the energy supply security planning*. Retrieved December 10, 2014, from https://www.energycommunity.org/documents/ SecondASEANEnergy Outlook.pdf

The Secretariat of the Senate. (2011). *Risk management plan for key projects annual fiscal year 2011*. Retrieved from https://www.senate.go.th/assets/portals/1/files/ Plan_risk_ coso54.pdf

The Secretariat of the Senate. (2016, February). *COSO (Committee of Sponsoring Organization of the Tread Way Commission) Risk management plan for key projects based on the strategic issues of the senate secretariat annual fiscal year 2016*. Retrieved from https://www.senate.go.th

Thevendran, V., & Mawdesley, M. J. (2004). Perception of human risk factors in construction projects: an exploratory analysis. *International Journal of Project Management, 22*, 131-137.

Theweerat, P. (2003). *Research methods in behavioral sciences and social sciences* (7th ed.). Bangkok: Srinakharinwirot University Prasarnmit.

Thompson, R. S. (1984). Diversification strategy and systematic risk: An empirical inquiry. *Managerial and Decision Economics, 5*, 98–103.

Thumann, A. & Woodroof, E. A. (2009). *Energy project financing: Resources and strategies for success*. Lilburn, GA: Fairmont Press.

Trochim, W. M., & Donnelly, J. P. (2006). *The research methods knowledge base* (3rd ed.). Cincinnati, OH: Atomic Dog.

Tsegba, I. N., & Ezi-herbert, W. (2011). The relationship between ownership structure and firm performance: Evidence from Nigerian. *African Journal of Accounting, Economics, Finance and Banking Research, 7*(7), 51–63.

Tufano, P. (1996). Who manages risk? An empirical examination of risk management practices in the gold mining industry. *Journal of Finance, 51*(4), 1097-1137.

Turban, D. B. & Cable, D. M. (2003). Firm reputation and applicant pool characteristics, *Journal of Organizational Behavior, 24*(6), 733-751.

Tymon, W. G., Stout, D. E., & Shaw, K. N. (1998). Critical analysis and recommendations regarding the role of perceived environmental uncertainty in behavioral accounting research. *Behavioral Research in Accounting, 10*, 23-46.

Ullman, J. B. (2001). Structural equation modeling. In B. G. Tabachnick & L. S. Fidell (Eds.). *Using multivariate statistics* (4th ed.). Boston, MA: Allyn & Bacon.

United Nations Economic Commission for Europe. (2017). *Overcoming Barriers to Investing in Energy Efficiency*. NY: United Nations.

Urge-Vorsatz, D., Koppel, S., Liang, C., Kiss, B., Nair, G. G. & Celikyilmaz, G. (2007). *An assessment of energy service (ESCOs) worldwide* (p. 40-42). World Energy Council.

Van den Bogaerd, M., & Aerts, W. (2015). Does media reputation affect properties of accounts payable? *European Management Journal*, *33*(1), 19-29.

Vechakij, A. (2015, October). *Energy service company (ESCO): Executive energy program (EEP)*. Paper presented at the meeting of Thai ESCO Association. Bangkok, Thailand.

Verbano, C., & Turra, F. (2010). A human factors and reliability approach to clinical risk management: Evidences from Italian cases. *Safety Science*, *48*(59), 625–39.

Verbano, C., & Venturini, K. (2013). Managing risks in SMEs: A literature review and research agenda. *Journal of Technology Management & Innovation*, *8*(3), 186-197.

Verbrugge, J., Smith, C., Niehaus, G., Briscoe, C., Coleman, W., Lawder, K., Ramamurtie, S., & Chew, D., (2003). University of Georgia roundtable on enterprise-wide risk management. *Journal of Applied Corporate Finance*. *15*(4), 8-26.

Wagner, S. M., & Bode, C. (2008). An empirical examination of supply chain performance along several dimensions of risk. *Journal of business logistics*, *29*(1), 307-325.

Walker, K. (2010). A systematic review of the corporate reputation literature: Definition, measurement, and theory. *Corporate Reputation Review*. *12*(4), 357-387.

Walker, R. (2013). *Winning with risk management*. Singapore: World Scientific.

Walsh, G., Bartikowski, B. & Beatty, S.E. (2012). Impact of customer-based corporate reputation on non-monetary and monetary outcomes. *British Journal of Management*, *25*, 166-185.

Walsh, G., Mitchell, V. W., Jackson, P. R., & Beatty, S. E. (2009). Examining the antecedents and consequences of corporate reputation: A customer perspective. *British Journal of Management, 20*(2), 187-203.

Walshe, K., & Dineen, M. (1998). *Clinical risk management: Making a difference?* UK, London: The National Health Service Confederation.

Wang, J., & Chen, X. (2008). Estimation of the risks of energy performance contract projects based on the unascertained measure model. *Proceedings of 2008 IEEE International Conference on Automation and Logistics* (p. 1043-1047). Qingdao, China.

Wang, Y., Berens, G., & van Riel, C. B. M. (2012). Competing in the capital market with a good reputation. *Corporate Reputation Review, 15*(3), 198-221.

Wanichbancha, K., (2009). *Multivariate data analysis* (3rd ed.). Bangkok: Dharmasarn Printing.

Wanichbancha, K., (2011). *Statistics for research* (6th ed.). Bangkok: Chulalongkorn University Press.

Wanichbancha, K., (2013). *Structural equation model analysis (SEM) with AMOS* (1st ed.). Bangkok: Chulalongkorn University Press.

Woon, L. F., Azizan, N. A., & Samad, M. F. A. (2010). Shareholders value creation through enterprise risk management. *International Journal of Business Research, 10*(1), 44-57.

Woon, L. F., Azizan, N. A., & Samad, M. F. A. (2011). A strategic framework for value enhancing enterprise risk management. *Journal of Global Business and Economics, 2*(1), 23-47.

World Energy Council. (2008). *Energy efficiency policies around the world: Review and evaluation*. London: Author.

World Energy Council. (2013). *World Energy Perspective, Energy efficiency policies: What works and does not work*. London: Author.

Yang, S., Ishtiaq, M., & Anwar, M. (2018). Enterprise risk management practices and firm performance, the mediating role of competitive advantage and the moderating role of financial literacy. *Journal of Risk and Financial Management, 11*, 35.

Yoon, E., Guffey, H. J., & Kijewski V. (1993). The effects of information and company reputation on intentions to buy a business service. *Journal of Business Research*, 27(3), 215-228.

Yusoff, H. & Janor, R. M. (2014). Generation of an Interval Metric Scale to Measure Attitude. *SAGE Open, 4*(1). Retrieved from https://journals.sagepub.com/doi/10.1177/2158244013516768

Zhao, X., Hwang, B., & Low, S. P. (2013). Developing fuzzy enterprise risk management maturity model for construction firms. *Journal of Construction Engineering & Management, 139*(9), 1179–1189.

Zou, X., & Hassan, C. H. (2015). Practicality and potential value of enterprise risk management in the manufacturing sector in China. *Pertanika Journal of Social Sciences & Humanities, 23*, 1-12.

APPENDIX

APPENDIX A

List of Names and Addresses of Experts Determining the Research Questionnaire

APPENDIX A: List of Names and Addresses of Experts Determining the Research Questionnaire

Table1 List of Names and Addresses of Experts Determining the Research Questionnaire

No	Name-Surname	Position	Contact Address	Telephone	e-mail
1	Assoc. Prof. Dr. Apichit Therdyothin	Dean	King Mongkut's University of Technology Thonburi Faculty Division of Energy Management Technology 126 Pracha Uthit Rd., Bang Mod, Thung Khru, Bangkok 10140, Thailand	0-2 470-8631, 8039	apichit.the@kmutt.ac.th
2	Dr. Janthana Kunchornrat	Lecturer	King Mongkut's University of Technology Thonburi Faculty Division of Energy Management Technology 126 Pracha Uthit Rd., Bang Mod, Thung Khru, Bangkok 10140, Thailand	0-2470-8695-8 ext 215	janthana.kun@kmutt.ac.th

Table1 (Continue)

No	Name-Surname	Position	Contact Address	Telephone	e-mail
3	Asst. Prof. Dr. Puris Sornsarut	Lecturer	King Mongkut's Institute of Technology Ladkrabang Faculty of Business Administration 1 Soi Chalongkrung 1, Ladkrabang, Ladkrabang, Bangkok 10520	090-429-6225	puris.s@hotmail.com
4	Mr. Arthit Vechakij	President of Thai ESCO Association and Managing Director	Excellent Energy International Company Limited 12/F, Siripinyo Bldg. 475 Sri-Ayudthaya Rd., Ratchathewi, Bangkok 10400, Thailand	02 201-3466-7	arthit@eei.co.th
5	Mr. Anan Tapaneeyasorn	Fund Manager	The Energy Conservation Foundation of Thailand Management Division, ESCO Revolving Fund Building 9, 17 Rama 1 Rd., Rong Mueang, Pathum Wan, Bangkok 10330, Thailand	02-621-8530	erf_anant@ecft.org

Expertise invitation letter1

ที่ ศธ ๐๕๒๔.๒๕ (๓) / ๐๔๐๑

คณะการบริหารและจัดการ
สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหาร
ลาดกระบัง ถนนฉลองกรุง เขตลาดกระบัง
กรุงเทพฯ ๑๐๕๒๐

๑๒ กันยายน ๒๕๖๐

เรื่อง ขอเชิญเป็นผู้ทรงคุณวุฒิตรวจแบบสอบถามเพื่อการวิจัย

เรียน รองศาสตราจารย์ ดร.อภิชิต เทอดโยธิน
คณบดีคณะพลังงานสิ่งแวดล้อมและวัสดุ มหาวิทยาลัยเทคโนโลยีพระจอมเกล้าธนบุรี

สิ่งที่ส่งมาด้วย แบบสอบถามเพื่อการวิจัย

ด้วย นายพิชญ ฉัตรพลรักษ์ นักศึกษาระดับปริญญาเอก หลักสูตรปรัชญาดุษฎีบัณฑิต สาขาวิชาบริหารธุรกิจอุตสาหกรรม คณะการบริหารและจัดการ สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง อยู่ในระหว่างการทำดุษฎีนิพนธ์ เรื่อง “การพัฒนาแบบจำลองปัจจัยเชิงสาเหตุที่ส่งผลต่อการบริหารความเสี่ยงทั่วทั้งองค์กรและผลการดำเนินงานด้านการเงินขององค์การสำหรับอุตสาหกรรมจัดการพลังงานในประเทศไทย” โดยมี อาจารย์ ดร.สรศักดิ์ แตงทอง เป็นอาจารย์ที่ปรึกษาดุษฎีนิพนธ์

คณะการบริหารและจัดการ สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง พิจารณาแล้วเห็นว่าท่านเป็นผู้มีความรู้ความสามารถเกี่ยวกับเรื่องดังกล่าวเป็นอย่างดี จึงขอเชิญท่านเป็นผู้ทรงคุณวุฒิตรวจแบบสอบถามดังที่แนบมาพร้อมนี้ว่ามีเนื้อหาถูกต้องและเหมาะสมมากน้อยเพียงใด ซึ่งผลการตรวจของท่านจะช่วยให้งานวิจัยของ นายพิชญ ฉัตรพลรักษ์ มีความสมบูรณ์ยิ่งขึ้น

จึงเรียนมาเพื่อโปรดพิจารณา หวังว่าจะได้รับความอนุเคราะห์จากท่านด้วยดีและขอขอบคุณเป็นอย่างยิ่งมา ณ โอกาสนี้ด้วย

ขอแสดงความนับถือ

(รองศาสตราจารย์ ดร.วรนารถ แสงมณี)
รองคณบดีฝ่ายวิชาการและวิจัย
กำกับดูแลงานด้านบัณฑิตศึกษา

งานบัณฑิตศึกษา ภาควิชาการจัดการ
โทร ๐ ๒๓๒๙ ๘๐๐๐ ต่อ ๖๓๗๙
โทรสาร ๐ ๒๓๒๙ ๘๔๖๑

Expertise invitation letter2

ที่ ศธ ๐๕๒๔.๒๕ (๓) / ๐๕๐๓

คณะการบริหารและจัดการ
สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหาร
ลาดกระบัง ถนนฉลองกรุง เขตลาดกระบัง
กรุงเทพฯ ๑๐๕๒๐

๑๒ กันยายน ๒๕๖๐

เรื่อง ขอเชิญเป็นผู้ทรงคุณวุฒิตรวจแบบสอบถามเพื่อการวิจัย

เรียน อาจารย์ ดร.จันทนา กุญชรรัตน์
อาจารย์พิเศษสายวิชาเทคโนโลยีการจัดการพลังงาน คณะพลังงานสิ่งแวดล้อมและวัสดุ
มหาวิทยาลัยเทคโนโลยีพระจอมเกล้าธนบุรี

สิ่งที่ส่งมาด้วย แบบสอบถามเพื่อการวิจัย

ด้วย นายพิชญ ฉัตรพลรักษ์ นักศึกษาระดับปริญญาเอก หลักสูตรปรัชญาดุษฎีบัณฑิต สาขาวิชาบริหารธุรกิจอุตสาหกรรม คณะการบริหารและจัดการ สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง อยู่ในระหว่างการทำดุษฎีนิพนธ์ เรื่อง “การพัฒนาแบบจำลองปัจจัยเชิงสาเหตุที่ส่งผลต่อการบริหารความเสี่ยงทั่วทั้งองค์กรและผลการดำเนินงานด้านการเงินขององค์การสำหรับอุตสาหกรรมจัดการพลังงานในประเทศไทย” โดยมี อาจารย์ ดร.สรศักดิ์ แดงทอง เป็นอาจารย์ที่ปรึกษาดุษฎีนิพนธ์

คณะการบริหารและจัดการ สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง พิจารณาแล้วเห็นว่าท่านเป็นผู้มีความรู้ความสามารถเกี่ยวกับเรื่องดังกล่าวเป็นอย่างดี จึงขอเชิญท่านเป็นผู้ทรงคุณวุฒิตรวจแบบสอบถามดังที่แนบมาพร้อมนี้ว่ามีเนื้อหาถูกต้องและเหมาะสมมากน้อยเพียงใด ซึ่งผลการตรวจของท่านจะช่วยให้งานวิจัยของ นายพิชญ ฉัตรพลรักษ์ มีความสมบูรณ์ยิ่งขึ้น

จึงเรียนมาเพื่อโปรดพิจารณา หวังว่าจะได้รับความอนุเคราะห์จากท่านด้วยดีและขอขอบคุณเป็นอย่างยิ่งมา ณ โอกาสนี้ด้วย

ขอแสดงความนับถือ

(รองศาสตราจารย์ ดร.วรนารถ แสงมณี)
รองคณบดีฝ่ายวิชาการและวิจัย
กำกับดูแลงานด้านบัณฑิตศึกษา

งานบัณฑิตศึกษา ภาควิชาการจัดการ
โทร ๐ ๒๓๒๙ ๘๐๐๐ ต่อ ๖๓๗๙
โทรสาร ๐ ๒๓๒๙ ๘๔๖๑

Expertise invitation letter3

ที่ ศธ ๐๕๒๔.๒๕ (๓) / ๐๕๐๒

คณะการบริหารและจัดการ
สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหาร
ลาดกระบัง ถนนฉลองกรุง เขตลาดกระบัง
กรุงเทพฯ ๑๐๕๒๐

๑๒ กันยายน ๒๕๖๐

เรื่อง ขอเชิญเป็นผู้ทรงคุณวุฒิตรวจแบบสอบถามเพื่อการวิจัย

เรียน คุณอาทิตย์ เวชกิจ
กรรมการผู้จัดการ บริษัท เอ็กซ์เซลเลนท์ เอ็นเนอร์ยี่ อินเตอร์เนชั่นแนล จำกัด
นายกสมาคมบริษัทจัดการพลังงานไทย

สิ่งที่ส่งมาด้วย แบบสอบถามเพื่อการวิจัย

ด้วย นายพิชญ ฉัตรพลรักษ์ นักศึกษาระดับปริญญาเอก หลักสูตรปรัชญาดุษฎีบัณฑิต สาขาวิชาบริหารธุรกิจอุตสาหกรรม คณะการบริหารและจัดการ สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง อยู่ในระหว่างการทำดุษฎีนิพนธ์ เรื่อง "การพัฒนาแบบจำลองปัจจัยเชิงสาเหตุที่ส่งผลต่อการบริหารความเสี่ยงทั่วทั้งองค์กรและผลการดำเนินงานด้านการเงินขององค์การสำหรับอุตสาหกรรมจัดการพลังงานในประเทศไทย" โดยมี อาจารย์ ดร.สรศักดิ์ แตงทอง เป็นอาจารย์ที่ปรึกษาดุษฎีนิพนธ์

คณะการบริหารและจัดการ สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง พิจารณาแล้วเห็นว่าท่านเป็นผู้มีความรู้ความสามารถเกี่ยวกับเรื่องดังกล่าวเป็นอย่างดี จึงขอเชิญท่านเป็นผู้ทรงคุณวุฒิตรวจแบบสอบถามดังที่แนบมาพร้อมนี้ว่ามีเนื้อหาถูกต้องและเหมาะสมมากน้อยเพียงใด ซึ่งผลการตรวจของท่านจะช่วยให้งานวิจัยของ นายพิชญ ฉัตรพลรักษ์ มีความสมบูรณ์ยิ่งขึ้น

จึงเรียนมาเพื่อโปรดพิจารณา หวังว่าจะได้รับความอนุเคราะห์จากท่านด้วยดีและขอขอบคุณเป็นอย่างยิ่งมา ณ โอกาสนี้ด้วย

ขอแสดงความนับถือ

(รองศาสตราจารย์ ดร.วรนารถ แสงมณี)
รองคณบดีฝ่ายวิชาการและวิจัย
กำกับดูแลงานด้านบัณฑิตศึกษา

งานบัณฑิตศึกษา ภาควิชาการจัดการ
โทร ๐ ๒๓๒๙ ๘๐๐๐ ต่อ ๖๓๗๙
โทรสาร ๐ ๒๓๒๙ ๘๔๖๑

Expertise invitation letter4

ที่ ศธ ๐๕๒๔.๒๕ (๓) / ๐๕๐๐

คณะการบริหารและจัดการ
สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหาร
ลาดกระบัง ถนนฉลองกรุง เขตลาดกระบัง
กรุงเทพฯ ๑๐๕๒๐

๑๒ กันยายน ๒๕๖๐

เรื่อง ขอเชิญเป็นผู้ทรงคุณวุฒิตรวจแบบสอบถามเพื่อการวิจัย

เรียน คุณอนันต์ ตปนียสร
ฝ่ายบริหารกองทุน ESCO Revolving Fund มูลนิธิอนุรักษ์พลังงานแห่งประเทศไทย

สิ่งที่ส่งมาด้วย แบบสอบถามเพื่อการวิจัย

ด้วย นายพิชญ ฉัตรพลรักษ์ นักศึกษาระดับปริญญาเอก หลักสูตรปรัชญาดุษฎีบัณฑิต สาขาวิชาบริหารธุรกิจอุตสาหกรรม คณะการบริหารและจัดการ สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง อยู่ในระหว่างการทำดุษฎีนิพนธ์ เรื่อง “การพัฒนาแบบจำลองปัจจัยเชิงสาเหตุที่ส่งผลต่อการบริหารความเสี่ยงทั่วทั้งองค์กรและผลการดำเนินงานด้านการเงินขององค์การสำหรับอุตสาหกรรมจัดการพลังงานในประเทศไทย” โดยมี อาจารย์ ดร.สรศักดิ์ แตงทอง เป็นอาจารย์ที่ปรึกษาดุษฎีนิพนธ์

คณะการบริหารและจัดการ สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง พิจารณาแล้วเห็นว่าท่านเป็นผู้มีความรู้ความสามารถเกี่ยวกับเรื่องดังกล่าวเป็นอย่างดี จึงขอเชิญท่านเป็นผู้ทรงคุณวุฒิตรวจแบบสอบถามดังที่แนบมาพร้อมนี้ว่ามีเนื้อหาถูกต้องและเหมาะสมมากน้อยเพียงใด ซึ่งผลการตรวจของท่านจะช่วยให้งานวิจัยของ นายพิชญ ฉัตรพลรักษ์ มีความสมบูรณ์ยิ่งขึ้น

จึงเรียนมาเพื่อโปรดพิจารณา หวังว่าจะได้รับความอนุเคราะห์จากท่านด้วยดีและขอขอบคุณเป็นอย่างยิ่งมา ณ โอกาสนี้ด้วย

ขอแสดงความนับถือ

(รองศาสตราจารย์ ดร.วรนารถ แสงมณี)
รองคณบดีฝ่ายวิชาการและวิจัย
กำกับดูแลงานด้านบัณฑิตศึกษา

งานบัณฑิตศึกษา ภาควิชาการจัดการ
โทร ๐ ๒๓๒๙ ๘๐๐๐ ต่อ ๖๓๗๙
โทรสาร ๐ ๒๓๒๙ ๘๔๖๑

APPENDIX B

1. The Item-objective Congruence (IOC) of Research Questionnaire

2. A List of Comments of IOC Assessment by Expertise

APPENDIX B: 1. The Item-objective Congruence (IOC) of Research Questionnaire

Questionnaire for IOC

Research topic:

A Development of ERM Model that affects Firm Financial Performance for Energy Efficiency Services in Thailand

Explanation

This questionnaire is developed for the purpose of a Ph.D. research study, Doctor of Philosophy Program in Industrial Business Administration, King Mongkut's Institute of Technology Ladkrabang Business School (KBS).

There are 53 question items grouped into 3 parts as follows,

Part 1. Background information of respondents 5 items;

Part 2. Information of the company that you are working for 11 items;

Part 3. Enquiry into impact levels of problems and obstacles in providing efficiency services 37 items.

Notes:

1. Courtesy request to respondents to answer all queries in relation to actual situations
2. This document is the instrument of research that intend to investigate as follows;
   - 2.1 to survey impacts of observed variables of problems and obstacles, and risks in various categories from providing energy efficiency services in Thailand;
   - 2.2 to analyze and assess impact levels of problems and obstacles that affect enterprise risks in each category;

2.3 to develop relationship model between enterprise risks, together with contingent variables, and enterprise risk management (ERM) that affect firm financial performance of energy efficiency service industry in Thailand;

3. Data obtained from this questionnaire will be used in conjunction with data obtained from other sets of questionnaires by processing into statistical reports. The responded information will be kept confidentially and analyzed the results as a whole without disclosing information of each company and each respondent. In addition, there will be no reference to the name of any department or individual in particular and this information will be used for academic research purposes only;

4. If any respondents would like the obtain results of this study, please specify your name, surname, address, and e-mail in order for the researcher to send a summary document once the research has been published in an international academic journal.

The researcher would like to pay high gratitude to all the respondents for giving your time and support the information for the benefits of the energy efficiency service industry in Thailand.

Researcher name:

Mr. Pijaya Chartpolrak,

A Ph.D. student in Industrial Business Administration,

King Mongkut's Institute of Technology Ladkrabang Business School (KBS),

King Mongkut's Institute of Technology Ladkrabang Bangkok, Thailand (KMITL)

Mobile phone number: 061-632-6555 E-mail: pijayac@gmail.com

Part 3 Enquiries into levels of problems and obstacles, or causes of risks, that your energy efficiency service company has been experiencing for enterprise risk management over the past three years.

Additional explanation

The following is the description for the meaning of impact levels in your opinions on problems and obstacles that your energy efficiency service company has experienced in providing energy efficiency services by rating from 1 to 5.

"5" score means the impact of problems and obstacles that your energy efficiency service company has experienced is "**the highest**".

"4" score means the impact of problems and obstacles that your energy efficiency service company has experienced is "**high**".

"3" score means the impact of problems and obstacles that your energy efficiency service company has experienced is "**moderate**".

"2" score means the impact of problems and obstacles that your energy efficiency service company has experienced is "**low**".

"1" score means the impact of problems and obstacles that your energy efficiency service company has experienced is "**the lowest or trivial**".

Part 3 (Continue)

Items for your opinion		Items for your opinion			IOC
		Congruent 1	Questionable 0	Incongruent -1	
1. Strategic Risk					
Business risk					
1	Customers had limited insight of energy efficiency technology and credit ability of ESCOs prior undertaking such as data originality, limitation, conditions and etc. which lead to over concern on ESCOs' exploitation.				**1**
2	Customers' top management required high return on investment project to energy efficiency or has no policy on the latter.				**1**
3	Negative attitudes of customers' operation staff towards ESCOs' employment for fear of work interference or jobs uncertainty.				**0.6**

Part 3 (Continue)

Items for your opinion		Items for your opinion			IOC
		Congruent 1	Questionable 0	Incongruent -1	
4	Small customers lacked interest in ESCOs' employment due to limited financial resources, non-sizeable saving amount, and less financial attractiveness on energy efficiency projects.				**0.6**
5	Small customers shorted staff and knowledge to oversee and verify ESCOs' performance.				**0.8**
6	ESCOs' proposal derived from different basis. So, it is difficult for customers to compare, evaluate, and decide.				**0.8**
7	Customers collaborated by moral obligation while ESCOs expected full collaboration under contract obligation.				0.6

Part3 (Continue)

Items for your opinion		Items for your opinion			IOC
		Congruent 1	Questionable 0	Incongruent -1	
8	High net worth customers owned technical and financial competency hence likely implement by themselves.				**0.8**
9	Customers required highly experienced third-party inspectors or consultants to ensure fairness in saving and cost.				**1**
Policy risk					
10	Public policies on supporting ESCOs lacked clarity and continuity.				**1**
11	Public fiscal tax and financial support were ambiguous, but unanswerable to ESCOs' needs.				**0.8**
12	Public procurement regulations awarded bidding on lowest price basis not on life cycle cost.				**0.8**

Part3 (Continue)

Items for your opinion		Items for your opinion			IOC
		Congruent 1	Questionable 0	Incongruent -1	
Technology risk					
13	New technologies with better efficiency and return continuously emerged. Hence, reaping maximum benefits of projects was unlikely.				**1**
14	Trustworthy proven evidence based on continuous and long-time operation rarely existed, hence, posing risks on saving evaluation and guarantee.				**1**
2. Operation Risk					
Human resource risk					
15	ESCOs' shortage of experienced technical staff rendered unimpressive outcomes.				**1**
16	Inadequate qualified staff to execute deals and monitor projects en masse particularly in SMEs which are numerous, but costly.				**1**

Part 3 (Continue)

Items for your opinion		Items for your opinion			IOC
		Congruent 1	Questionable 0	Incongruent -1	
Technical & operational risk					
17	ESCOs' absence of unified and simplified measurement and verification standard rendered sophisticated and costly expediting.				**1**
18	ESCOs' disability on measurement and verification accuracy leaded to unacceptable results by customers.				**1**
19	Improper use and maintenance or equipment failure rendering to lower than expected saving.				**1**
20	Discrepancies on guarantee issue between ESCOs and technology suppliers.				**1**
21	ESCOs high reliance on external technologies resulted in high cost and complicated management.				**1**

Part 3 (Continue)

Items for your opinion		Items for your opinion			IOC
		Congruent 1	Questionable 0	Incongruent -1	
22	ESCOs' difficulties in accessing customers' real energy usage information leaded to inaccurate and uncertain saving estimation.				**1**
3. Financial Risk					
23	Customers intentionally dishonored payment to ESCOs.				**0.8**
24	Long term payment nature of energy projects was unattractive to customers and financial institutes.				**0.8**
25	ESCOs needed long terms and large funding, hence exposing to high and fluctuated cost change i.e., interest rates, or bank guarantee fee.				**1**
26	Regulated or subsidized energy prices distorted saving and payback periods.				**1**

Part 3 (Continue)

Items for your opinion		Items for your opinion			IOC
		Congruent 1	Questionable 0	Incongruent -1	
27	Accounting rules rendered compliance difficulties in book entry and tax management to obtain tax privileges i.e., capital expenditures (Board of Investment) or expenses (Department of Revenue).				**1**
Financing risk					
28	Financial institutes lending criteria based on securities rather than project financing. Thus, ESCOS with limited collaterals faced difficulties to gain credit lines.				**1**
29	ESCOs with small registered capital were hardly qualified to bid large scale projects.				**1**
30	ESCOs' operating cash flow was inadequate and access to funding sources was limited.				

Part 3 (Continue)

Items for your opinion		Items for your opinion			IOC
		Congruent 1	Questionable 0	Incongruent -1	
Project risk					
31	ESCOs excessive lead time in project and contract preparation caused extra unforeseen expenses.				**1**
32	ESCOs' saving estimation error, or customers' energy consumptions deviation from the base line, relocation, or operation ceased were detrimental to financial performance.				**1**
33	ESCOs delayed project operation brought extra burden on expenses, project costs, and overhead costs later.				**1**

Part 3 (Continue)

Items for your opinion		Items for your opinion			IOC
		Congruent 1	Questionable 0	Incongruent -1	
4. Reputation Risk					
Reputational risk					
34	Customers were unfamiliar with roles and importance of ESCOs in materializing significant energy saving.				**1**
35	Financial institutes possessed limited ESCOs information and staff who understood ESCOs' business and presumed ESCO as high risk business.				**0.8**
36	ESCOs' past performance record and reputation in view of customers were under par.				**1**
37	Failures of some ESCOs in the past tarnished ESCO industry reputation.				**0.8**

For data of Contingent Variables (CoV), Enterprise Risk Management (ERM), and Firm Financial Performance, the researcher will use data provided in part 2 of this questionnaire and data on your company financial statements to support calculation. Value obtained from the calculation will be compared and rated among peer companies in the energy efficiency service company in the same range from 1-5.

Other recommendations

.....

.....

.....

.....

.....

.....

.....

Thank you for providing valuable information

Pijaya Chartpolrak

APPENDIX B: 2. A List of Comments of IOC Assessment by Expertise

Part 1 Background information of the respondent

Items for your opinion	Comments
1. Current position ☐ Chief Executive Officer ☐ Managing Director ☐ Chief Financial/Accounting Officer/Manager ☐ Chief Operating Officer/ Project Manager/ Engineering or Technical Manager ☐ Others.....	
2. Gender ☐ 1. Male ☐ 2. Female	
3. Age.....years	
4. Highest education level ☐ 1. Bachelor's degree ☐ 2. Master's degree ☐ 3. Doctoral degree ☐ 4. Others.....	
5. Working experience with current company..... years	

Part 2 Respondent's company information

Items for your opinion	Comments
6. Years of providing energy efficiency services.....years	
7. Registered with Ministry of Finance or The Institute of Industrial Energy ☐ 1. as an ESCO with The Institute of Industrial Energy ☐ 2. as an energy consultant firm, with the Ministry of Finance ☐ 3. both	
8. Average numbers of Board of Directors monitoring risk management over the past years since 2013 …….. persons	
9. Average numbers of employees over the past Years since 2013..... persons	

Part 2 (Continue)

Items for your opinion	Comments
10. Shareholder structure ☐ 1. 100% Thai nationality ☐ 2. Thai > foreigners i.e., Thai 51%: Foreigners 49% ☐ 3. Foreigners > Thai i.e., foreigners 51%: Thai 49% ☐ 4. 100% foreigners ☐ 5. Others (please specify).....	
11. Average energy efficiency projects undertaken.....years	

Part 2 (Continue)

Items for your opinion	Comments
12. Energy efficiency contracts types undertaken (can select more than 1 item) ☐ 1. Energy Contract (EC) or Shared Saving ☐ 2. Energy Performance Contract (EPC) or guaranteed saving ☐ 3. Energy Supply Contract (ESC): your company is responsible for the investment cost of the project, operation, and maintenance of equipment and energy supply used in all counterparties' establishments. Your company is the Energy supplier. ☐ 4. None contracts: your company sell equipment only (merchandise or broker). ☐ 5. Other type of contract (please specify).....	EC, EPC, and ESC existed in Thailand, not Chauffage.

Part 2 (Continue)

Items for your opinion	Comments
13. Auditor's fee over the past years since 2013 as % of Total Assets ..... Has auditor's fee been charged to your company been increased, decreased, or unchanged over the past years since 2013? ☐ Decreased ☐ unchanged ☐ increased but less than 5% ☐ increased between 5-10% ☐ increased over 10%	

Part 2 (Continue)

Items for your opinion	Comments
14. Net fine, reimbursement, or product claim from counterparties (clients) Net fines, reimbursements or product claims by the counterparty (customers) in providing energy efficiency services appeared in your company financial statements over the past years since 2013, on average as a percentage of your company's total sales. ☐ Never reimbursed or been fined or claimed ☐ less than 1% ☐ between 1-3% ☐ between 3-5% ☐ over 5 %	

Part 2 (Continue)

Items for your opinion	Comments
15. Revenue from energy efficiency services over the past years since 2013. ☐ Almost (> 80%) ☐ major (50-79%) ☐ significant (15-49%) ☐ minor (<15%)	
16. Average business units/ sectors/ products over the past years since 2013 ……units	

Part 3

Items for your opinion		Items for your opinion			Comments
		+1	0	-1	
1. Strategic Risk					
Business risk					
1	Customers had limited insight of energy efficiency technology and credit ability of ESCOs prior undertaking such as data originality, limitation, conditions and etc. which lead to over concern on ESCOs' exploitation.				
2	Customers' top management required high return on investment project to energy efficiency or has no policy on the latter.				
3	Negative attitudes of customers' operation staff towards ESCOs' employment for fear of work interference or jobs uncertainty.				

Additional comments

All items in the negative sentence questionnaire (i.e., contained word "not") should be re-edited into positive.

Explanation

Corrected.

Part 3 (Continue)

Items for your opinion		Items for your opinion			Comments
		+1	0	-1	
4	Small customers lacked interest in ESCOs' employment due to limited financial resources, non-sizeable saving amount, and less financial attractiveness on energy efficiency projects.				
5	Small customers shorted staff and knowledge to oversee and verify ESCOs' performance.				
6	ESCOs' proposal derived from different basis. So, it is difficult for customers to compare, evaluate, and decide.				
7	Customers collaborated by moral obligation while ESCOs expected full collaboration under contract obligation.				The result was from unclear communication between ESCOs and customers.

Part3 (Continue)

Items for your opinion		Items for your opinion			Comments
		+1	0	-1	
8	High net worth customers owned technical and financial competency hence likely implement by themselves.				
9	Customers required highly experienced third-party inspectors or consultants to ensure fairness in saving and cost.				
Policy risk					
10	Public policies on supporting ESCOs lacked clarity and continuity.				
11	Public fiscal tax and financial support were ambiguous, but unanswerable to ESCOs' needs.				Collaboration to exchange views is needed.
12	Public procurement regulations awarded bidding on lowest price basis not on life cycle cost.				

Part3 (Continue)

Items for your opinion		Items for your opinion			Comments
		+1	0	-1	
Technology risk					
13	New technologies with better efficiency and return continuously emerged. Hence, reaping maximum benefits of projects was unlikely.				
14	Trustworthy proven evidence based on continuous and long-time operation rarely existed, hence, posing risks on saving evaluation and guarantee.				Savings deteriorate by time lapse, guarantee saving agreements should address the related conditions.
2. Operation Risk					
Human resource risk					
15	ESCOs' shortage of experienced technical staff rendered unimpressive outcomes.				Additional external expertise to support implementation should be acquired.
16	Inadequate qualified staff to execute deals and monitor projects en masse particularly in SMEs which are numerous, but costly.				

Part 3 (Continue)

Items for your opinion		Items for your opinion			Comments
		+1	0	-1	
Technical & operational risk					
17	ESCOs' absence of unified and simplified measurement and verification standard rendered sophisticated and costly expediting.				Government should formulate standard M&V protocol.
18	ESCOs' disability on measurement and verification accuracy leaded to unacceptable results by customers.				
19	Improper use and maintenance or equipment failure rendering to lower than expected saving.				
20	Discrepancies on guarantee issue between ESCOs and technology suppliers.				
21	ESCOs high reliance on external technologies resulted in high cost and complicated management.				

Part 3 (Continue)

	Items for your opinion	Items for your opinion			Comments
		+1	0	-1	
22	ESCOs' difficulties in accessing customers' real energy usage information leaded to inaccurate and uncertain saving estimation.				Depend on ESCOs' capability to convince their customers the importance of accurate and deep information for guaranteed savings.
3. Financial Risk					
23	Customers intentionally dishonored payment to ESCOs.				**Comments** ESCOs share saving benefits with customers hence customers are not liable for additional payment. **Explanation** Customers pay no additional payment, but may withhold those ESCOs' portions.
24	Long term payment nature of energy projects was unattractive to customers and financial institutes.				
25	ESCOs needed long terms and large funding, hence exposing to high and fluctuated cost change i.e., interest rates, or bank guarantee fee.				

26	Regulated or subsidized energy prices distorted saving and payback periods.				

Part 3 (Continue)

Items for your opinion		Items for your opinion			Comments
		+1	0	-1	
27	Accounting rules rendered compliance difficulties in book entry and tax management to obtain tax privileges i.e., capital expenditures (Board of Investment) or expenses (Department of Revenue).				
Financing risk					
28	Financial institutes lending criteria based on securities rather than project financing. Thus, ESCOS with limited collaterals faced difficulties to gain credit lines.				
29	ESCOs with small registered capital were hardly qualified to bid large scale projects.				
30	ESCOs' operating cash flow was inadequate and access to funding sources was limited.				

Part 3 (Continue)

Items for your opinion		Items for your opinion			Comments
		+1	0	-1	
Project risk					
31	ESCOs excessive lead time in project and contract preparation caused extra unforeseen expenses.				
32	ESCOs' saving estimation error, or customers' energy consumptions deviation from the base line, relocation, or operation ceased were detrimental to financial performance.				
33	ESCOs delayed project operation brought extra burden on expenses, project costs, and overhead costs later.				

Additional comments

Majority of projects characterized long payback period, but some are short term.

Explanation

This study focuses on risks which are threats resulted from long payback period projects. Therefore, short-term payback period projects which offered opportunities or benefits were not taken into account.

Part 3 (Continue)

Items for your opinion		Items for your opinion			Comments
		+1	0	-1	
4. Reputation Risk					
Reputational risk					
34	Customers were unfamiliar with roles and importance of ESCOs in materializing significant energy saving.				
35	Financial institutes possessed limited ESCOs information and staff who understood ESCOs' business and presumed ESCO as high risk business.				
36	ESCOs' past performance record and reputation in view of customers were under par.				
37	Failures of some ESCOs in the past tarnished ESCO industry reputation.				

Additional comments

There is no difference between suppliers and ESCOs in acquiring projects, should they process in distinguish technology capabilities and both can guarantee similar savings.

Explanation

This study concentrated on ESCOs and energy consultants due to their accreditation by public authorities. Hence, suppliers were excluded from being the research population.

APPENDIX C

Reliability and Discriminant of Tryout Questionnaire

APPENDIX C: Reliability and Discriminant of Tryout Questionnaire

RELIABILITY

/VARIABLES=SR1 SR2 SR3 SR4 SR5 SR6 SR7 SR8 SR9 SR10 SR11 SR12 SR13 SR14 OR15 OR16 OR17 OR18 OR19 OR20 OR21 OR22 FR23 FR24 FR25 FR26 FR27 FR28 FR29 FR30 FR31 FR32 FR33 RR34 RR35 RR36 RR37

Reliability

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	37	100.0
	Excluded[a]	0	.0
	Total	37	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.898	37

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
SR1	137.76	250.245	.538	.893
SR2	137.46	259.533	.353	.896
SR3	138.03	263.471	.156	.899
SR4	137.57	250.641	.448	.895
SR5	137.70	259.604	.277	.897
SR6	137.95	251.275	.458	.894
SR7	137.86	256.453	.372	.896
SR8	137.49	250.312	.459	.894

Item-Total Statistics (Continue)

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
SR9	137.59	248.970	.555	.893
SR10	137.78	263.508	.117	.900
SR11	137.57	261.474	.176	.899
SR12	137.43	267.141	.025	.901
SR13	137.92	257.743	.449	.895
SR14	137.81	259.658	.303	.897
OR15	137.68	247.170	.630	.891
OR16	138.00	245.444	.702	.890
OR17	137.76	248.967	.636	.892
OR18	137.78	247.674	.701	.891
OR19	137.89	255.321	.317	.897
OR20	137.49	244.257	.630	.891
OR21	137.35	249.401	.594	.892
OR22	137.51	252.979	.550	.893
FR23	138.00	262.667	.175	.899
FR24	137.38	253.908	.424	.895
FR25	137.57	254.474	.416	.895
FR26	137.24	259.800	.280	.897
FR27	137.62	259.464	.260	.897
FR28	137.59	259.248	.346	.896
FR29	137.65	252.956	.581	.893
FR30	137.24	257.300	.523	.894
FR31	137.30	258.381	.461	.895
FR32	137.51	259.535	.307	.897
FR33	137.30	253.437	.619	.893

Item-Total Statistics (Continue)

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
RR34	137.24	263.634	.193	.898
RR35	137.43	252.474	.483	.894
RR36	137.43	255.530	.426	.895
RR37	137.68	248.281	.578	.892

APPENDIX D

Research Questionnaire

APPENDIX D: Research Questionnaire

Research topic

A Development of ERM Model that affects Firm Financial Performance for Energy Efficiency Services in Thailand

Explanation

This questionnaire is prepared for the executives or respondents who are responsible for various departments in providing energy efficiency services in Thailand, totaling 3 persons, which are

1. Chief Executive Officer or Managing Director
2. Chief Financial/Accounting Officer/Manager, and
3. Chief Operating Officer/Project Manager/Engineering or Technical Manager

to express your opinions on related 1) problems and hindrances (Enterprise Risk: ER) in providing energy efficiency services and 2) Contingent Variables that have been affecting (Enterprise Risk Management: ERM) and consecutively to Firm Financial Performance: FFP) of your company.

The information obtained from this research results will be useful to senior management for understanding the impacts of problems and obstacles that are causes of risks in providing energy efficiency services in Thailand and will lead to a review of formulating business strategies for risk management and reducing the problems and obstacles that energy efficiency service companies have been facing. In addition, it will help the energy efficiency service industry to be sustainable.

There are 53 question items in 3 parts as follows,

Part 1. Background information of respondents 5 items;

Part 2. Information of the company that you are working for 11 items;

Part 3. Enquiry into impact levels of problems and obstacles in providing efficiency services

37 items.

Notes:

1. Courtesy request to respondents to answer all queries in relation to actual situations
2. This document is the instrument of research that intend to investigate as follows;
   2.1 to survey impacts of observed variables of problems and obstacles, and risks in various categories from providing energy efficiency services in Thailand;
   2.2 to analyze and assess impact levels of problems and obstacles that affect enterprise risks in each category;
   2.3 to develop relationship model between enterprise risks, together with contingent variables, and enterprise risk management (ERM) that affect firm financial performance of energy efficiency service industry in Thailand;
3. Data obtained from this questionnaire will be used in conjunction with data obtained from other sets of questionnaires by processing into statistical reports. The responded information will be kept confidentially and analyzed the results as a whole without disclosing information of each company and each respondent. In addition, there will be no reference to the name of any department or individual in particular and this information will be used for academic research purposes only;
4. If any respondents would like the obtain results of this study, please specify your name, surname, address, and e-mail in order for the researcher to send a summary document once the research has been published in an international academic journal.

The researcher would like to pay high gratitude to all the respondents for giving your time and support the information for the benefits of the energy efficiency service industry in Thailand.

Researcher name: Mr. Pijaya Chartpolrak,

A Ph.D. student in Industrial Business Administration,

King Mongkut's Institute of Technology Ladkrabang Business School (KBS)

King Mongkut's Institute of Technology Ladkrabang Bangkok, Thailand (KMITL)

E-mail: pijayac@gmail.com

Mobile phone: 061-632-6555

Questionnaire

Part 1. Background information of the respondent

Description: Please mark ☐ on the check box in front of each questionnaire item according to actual current information and fill data in the provided space.

1. Current position

☐ Chief Executive Officer ☐ Managing Director

☐ Chief Financial/Accounting Officer/Manager

☐ Chief Operating Officer/Project Manager/Engineering or Technical Manager

☐ Others.....

2. Gender ☐ 1. Male ☐ 2. Female

3. Age..... years

4. Highest education level

☐ 1. Bachelor's degree ☐ 2. Master's degree ☐ 3. Doctoral degree

☐ 4. Others.....

5. Working experience with current company..... years

Part 2. Respondent's company information

Description: Please mark ☐ on the check box in front of each questionnaire item according to actual current information and fill data in the provided space.

6. Years of providing energy efficiency services.....years

7. Your company has been registered with Ministry of Finance or The Institute of Industrial Energy

☐ 1. as an ESCO with The Institute of Industrial Energy

☐ 2. as an energy consultant firm, with the Ministry of Finance

☐ 3. both

8. Average numbers of Board of Directors monitoring risk management over the past years since 2013 …….. persons

9. Average numbers of employees over the past years since 2013..... persons

10. Shareholder structure

☐ 1. 100% Thai nationality ☐ 2. Thai > foreigners i.e., Thai 51%: Foreigners 49%

☐ 3. Foreigners > Thai i.e., foreigners 51%: Thai 49% ☐ 4. 100% foreigners

☐ 5. Others (please specify).....

11. Average energy efficiency projects undertaken.....years

12. Energy efficiency contracts types undertaken (can select more than 1 item)

☐ 1. Energy Contract (EC) or Shared Saving

☐ 2. Energy Performance Contract (EPC) or guaranteed saving

☐ 3. Energy Supply Contract (ESC): your company is responsible for the investment cost of the project, operation, and maintenance of equipment and energy supply used in all counterparties' establishments. Your company is the energy supplier.

☐ 4. None contracts: your company sell equipment only (merchandise or broker).

☐ 5. Other type of contract (please specify).....

13. Auditor's fee over the past years since 2013 as % of Total Assets ……

Has auditor's fee charged to your company been increased, decreased, or unchanged over the past years since 2013?

☐ decreased ☐ unchanged

☐ increased but less than 5% ☐ increased between 5-10%

☐ increased over 10%

14. Net fine, reimbursement, or product claim from counterparties (clients)

Net fines, reimbursements or product claims by the counterparty (customers) in providing energy efficiency services appeared in your company financial statements over the past years since 2013, on average as a percentage of your company's total sales.

☐ Never reimbursed or been fined or claimed ☐ less than 1%

☐ between 1-3% ☐ between 3-5%

☐ over 5 %

15. Revenue from energy efficiency services over the past years since 2013

☐ Almost (> 80%) ☐ major (50-79%)

☐ significant (15-49%) ☐ minor (<15%)

16. Average business units/sectors/products over the past years since 2013 ……units

Part 3. Enquiries into levels of problems and obstacles, or causes of risks, that your energy efficiency service company has been experiencing for enterprise risk management over the past three years.

Description: Please mark ☐ that best matches your opinion by rating your opinion levels between 1-5 scores.

Additional explanation

The following is the description for the meaning of impact levels in your opinions on problems and obstacles that your energy efficiency service company has experienced in providing energy efficiency services by rating from 1 to 5.

"5" score means the impact of problems and obstacles that your energy efficiency service company has experienced is "**the highest**".

"4" score means the impact of problems and obstacles that your energy efficiency service company has experienced is "**high**".

"3" score means the impact of problems and obstacles that your energy efficiency service company has experienced is "**moderate**".

"2" score means the impact of problems and obstacles that your energy efficiency service company has experienced is "**low**".

"1" score means the impact of problems and obstacles that your energy efficiency service company has experienced is "**the lowest or trivial**".

1. Strategic Risk

No	Question items	Opinion rating on impact				
		Highest ---> Lowest				
		5	4	3	2	1
1	Customers had limited insight of energy efficiency technology and credit ability of ESCOs prior undertaking such as data originality, limitation, conditions and etc. which lead to over concern on ESCOs' exploitation.					
2	Customers' top management required high return on investment project to energy efficiency or has no policy on the latter.					
3	Negative attitudes of customers' operation staff towards ESCOs' employment for fear of work interference or jobs uncertainty.					
4	Small customers lacked interest in ESCOs' employment due to limited financial resources, non-sizeable saving amount, and less financial attractiveness on energy efficiency projects.					
5	Small customers shorted staff and knowledge to oversee and verify ESCOs' performance.					
6	ESCOs' proposal derived from different basis. So, it is difficult for customers to compare, evaluate, and decide.					
7	Customers collaborated by moral obligation while ESCOs expected full collaboration under contract obligation.					

1. Strategic Risk (Continue)

No	Question items	Opinion rating on impact				
		Highest ---> Lowest				
		5	4	3	2	1
8	High net worth customers owned technical and financial competency hence likely implement by themselves.					
9	Customers required highly experienced third-party inspectors or consultants to ensure fairness in saving and cost.					
10	Public policies on supporting ESCOs lacked clarity and continuity.					
11	Public fiscal tax and financial support were ambiguous, but unanswerable to ESCOs' needs.					
12	Public procurement regulations awarded bidding on lowest price basis not on life cycle cost.					
13	New technologies with better efficiency and return continuously emerged. Hence, reaping maximum benefits of projects was unlikely.					
14	Trustworthy proven evidence based on continuous and long-time operation rarely existed, hence, posing risks on saving evaluation and guarantee.					

2. Operation Risk

No	Question items	Opinion rating on impact				
		Highest ---> Lowest				
		5	4	3	2	1
15	ESCOs' shortage of experienced technical staff rendered unimpressive outcomes.					
16	Inadequate qualified staff to execute deals and monitor projects en masse particularly in SMEs which are numerous, but costly.					
17	ESCOs' absence of unified and simplified measurement and verification standard rendered sophisticated and costly expediting.					
18	ESCOs' disability on measurement and verification accuracy leaded to unacceptable results by customers.					
19	Improper use and maintenance or equipment failure rendering to lower than expected saving.					
20	Discrepancies on guarantee issue between ESCOs and technology suppliers.					
21	ESCOs high reliance on external technologies resulted in high cost and complicated management.					
22	ESCOs' difficulties in accessing customers' real energy usage information leaded to inaccurate and uncertain saving estimation.					

3. Financial Risk

No	Question items	Opinion rating on impact				
		Highest ---> Lowest				
		5	4	3	2	1
23	Customers intentionally dishonored payment to ESCOs.					
24	Long term payment nature of energy projects was unattractive to customers and financial institutes.					
25	ESCOs needed long terms and large funding, hence exposing to high and fluctuated cost change i.e., interest rates, or bank guarantee fee.					
26	Regulated or subsidized energy prices distorted saving and payback periods.					
27	Accounting rules rendered compliance difficulties in book entry and tax management to obtain tax privileges i.e., capital expenditures (Board of Investment) or expenses (Department of Revenue).					
28	Financial institutes lending criteria based on securities rather than project financing. Thus, ESCOS with limited collaterals faced difficulties to gain credit lines.					
29	ESCOs with small registered capital were hardly qualified to bid large scale projects.					

3. Financial Risk (Continue)

No	Question items	Opinion rating on impact				
		Highest ---> Lowest				
		5	4	3	2	1
30	ESCOs' operating cash flow was inadequate and access to funding sources was limited.					
31	ESCOs excessive lead time in project and contract preparation caused extra unforeseen expenses.					
32	ESCOs' saving estimation error, or customers' energy consumptions deviation from the base line, relocation, or operation ceased were detrimental to financial performance.					
33	ESCOs delayed project operation brought extra burden on expenses, project costs, and overhead costs later.					

4. Reputation Risk

No	Question items	Opinion rating on impact				
		Highest ---> Lowest				
		5	4	3	2	1
34	Customers were unfamiliar with roles and importance of ESCOs in materializing significant energy saving.					
35	Financial institutes possessed limited ESCOs information and staff who understood ESCOs' business and presumed ESCO as high risk business.					
36	ESCOs' past performance record and reputation in view of customers were under par.					
37	Failures of some ESCOs in the past tarnished ESCO industry reputation.					

For data of Contingent Variables (CoV), Enterprise Risk Management (ERM), and Firm Financial Performance, the researcher will use data provided in part 2 of this questionnaire and data on your company financial statements to support calculation. Value obtained from the calculation will be compared and rated among peer companies in the energy efficiency service company in the same range from 1-5.

Thank you for providing valuable information

Pijaya Chartpolrak

Name-surname_____

Company name_____

Contact number/e-mail _____

APPENDIX E

General Information of Respondents

APPENDIX E: General Information of Respondents

Frequency and Percentage of Status Data of Respondents

Respondents' general information	Frequency	Percent
Current position in company		
Chief executive officer/managing director	88	39.11%
Chief financial/accounting officer/manager	51	22.67%
Chief operating/engineering/technical/project officer/manager	86	38.22%
Total	225	100.00%
Sex		
Male	175	77.78%
Female	50	22.22%
Total	225	100.00%
Age (years)		
< 25	0	0.00%
25-35	7	3.11%
36-45	119	52.89%
46-55	67	29.78%
> 55	32	14.22%
Total	225	100.00%
Education		
Bachelor's	100	44.44%
Master's	124	55.11%
Doctorate	1	0.44%
Total	225	100.00%

Frequency and Percentage of Status Data of Respondents (Continue)

Respondents' general information	Frequency	Percent
Work experience with current company (years)		
< 5	11	4.89%
5-10	73	32.44%
11-15	72	32.00%
16-20	50	22.22%
> 20	19	8.44%
Total	225	100.00%

APPENDIX F

List of Symbols

APPENDIX F: List of Symbols

1)	β	Beta
2)	Δ	Change
3)	χ^2	Chi-square
4)	μ	Mean value
5)	χ^2/df	Relative Chi-square
6)	$\sqrt{}$	Square Root
7)	σ	Standard deviation
8)	Σ	Summation

APPENDIX G

List of Abbreviations

APPENDIX G: List of Abbreviations

1)	**C**	Compliance
2)	**CI**	Industry Competition
3)	**CoV**	Contingent Variables
4)	**EPS**	Earnings Per Share
5)	**ER**	Enterprise Risks
6)	**EU**	Environmental Uncertainty
7)	**ERM**	Enterprise Risk Management
8)	**FC**	Firm Complexity
9)	**FFP**	Firm Financial Performance
10)	**FR**	Financial Risk
11)	**FS**	Firm Size
12)	**MBD**	Monitoring by Board of Directors
13)	**O**	Operation
14)	**OR**	Operational Risk
15)	**R**	Reporting
16)	**ROA**	Return on Assets
17)	**ROE**	Return on Equity
18)	**RR**	Reputation Risk
19)	**S**	Strategy
20)	**SR**	Strategic Risk

AUTHOR BIOGRAPHY

Author: Mr. Pijaya Chartpolrak

Date of Birth: March 4th, 1972

Place of Birth: Bangkok

Current Address 23 On-nut17 Ally, Lane9, Sukhumvit77
Suanluang Sub-district, Suanluang District,
Bangkok 10250

Education

- Bachelor degree in Mechanical Engineering,
Chulalongkorn University, Bangkok, 1994
- General Business Administration,
University of Hull, Hull, UK, 1996

Work Experience

- 2021 – present, energy consultant
Able Consultant Co., Ltd.
- 2005 – 2020, Vice President, Portfolio Manager,
Fund Management Department
BBL Asset Management Co., Ltd.

Professional Certificate

-The Chartered Financial Analyst (CFA)
CFA Institute, USA
- The Financial Risk Manager (FRM)
Global Association of Risk Professional (GARP), USA