A STRUCTURAL EQUATION MODEL OF FACTORS INFLUENCING SUSTAINABILITY OF CHEMICAL INDUSTRY IN THAILAND

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ABSTRACT

The primary aim of this study is to study a structural equation model of factors influencing sustainability of chemical industry in Thailand. The structure equation of factors influencing sustainability of chemical industry in Thailand was developed with empirical data. Data were collected from the top management of the chemical industry in Thailand, totaling 317 companies using a multi-stage sampling technique. In the relationship analysis among the variables, AMOS is the main program to use, and another is Pearson's correlation coefficient. The study found that the factors influencing sustainability the most were transformational leadership, organizational culture, and corporate social responsibility, respectively. The characteristics of outstanding transformational leaders in the chemical industry in Thailand include paying close attention to the needs of employees, treating employees as family, and inspiring employees with individual career advancement plans. The prominent characteristics of the organizational culture of the chemical industry in Thailand include a commitment to creating a culture focused on proactive competition and excellent results. The distinctive feature of CSR in the chemical industry in Thailand includes the continuous effort to operate for the benefit of stakeholders and society by developing quality products at a reasonable price. Companies should consider investing in transformational leadership training to support leadership behaviors that promote an organizational culture that supports sustainability and overcomes resistance caused by change and

challenges. Shared values in an organization's culture increase sustainability awareness, which affects sustainability behavior in the workplace. Finally, companies must consider social responsibility by helping the community rather than just looking for profits. CSR programs should involve employees and take action on sustainability and responsibility in planning, implementation, and evaluation. Future studies should adopt qualitative methods and longitudinal studies as this will avoid ambiguity in causal relationships and should expand the sample to other industries, areas, and countries to increase the generalizability of the findings.

Keywords: Sustainability, Transformational leadership, Organizational culture, Corporate social responsibility.

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Suradetch Wangthong

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CHAPTER 1

INTRODUCTION

1.1 Background and Significance

Throughout the years of the development of Thailand's manufacturing industry, entrepreneurs or business owners have focused only on economic returns or "Economic Performance", also known as “Last Line Return or Bottom Line” (Pokpong, 2020). For this reason, even though the country's industrial sector is developing rapidly, which is already having a positive impact, it is also clearly having a negative impact. That is the release of pollutants into the atmosphere and competition for natural resources used as production factors both directly and indirectly lead to various problems such as water shortages, deteriorating water quality, increased industrial waste, and fewer forests. All of this affects biodiversity and ecosystems, causing the problem of global climate change, which not only the Thai industry but industrial sectors around the world are widely aware of (Modern Manufacturing, 2017).

Sustainability is now a key business goal for every organization that aims to achieve and maintain its business position. Due to the changing business environment and global competition, business sustainability has become an increasingly important industry focus. It can be seen that many business organizations are interested in getting certifications in areas such as ISO14001, ISO50001, and OHSAS18001. However, properly creating long-term business sustainability should create sustainable profits for shareholders while being responsive to the social and environmental interests of other business stakeholders (Saeed, 2017). Companies that do not consider the impact of their decisions on all stakeholders will experience decreased sales and profits. Profit maximization is not the only measure of success because one-dimensional profit is not enough. The larger economic and social system needs more than the company needs. One way to think about sustainability is to consider the systems needed to support the triple bottom line of the three Ps: people, planet, and profit. (Heizer, Render, & Munson, 2017).

The Triple Bottom Line concept was first presented in 1994 by British sustainability expert, John Elkington. Elkington (1994) states that the Triple Bottom Line (TBL) measures the

performance of business organizations in three areas: Economic, Social, and Environmental. Also known as the 3Ps principle, which is Profit, People, and Planet. Overall, TBL or 3Ps emphasize seeing the value and balancing organizational success in 3 areas of operation business growth, supporting people and society, and caring for the environment and world resources. It also includes business operations with transparency and good governance as well.

Triple Bottom Line allows businesses to examine both social and environmental outcomes without conflicting with economic outcomes. This concept is widely accepted because it shows a transparent vision, policy, and operational guidelines (Pokpong, 2020). Effective and successful implementation of TBL concepts can be a measure of an organization's sustainability. If top executives have paradigmatic characteristics “Transformational leadership”. Insights, attitudes, and abilities to create value for all business stakeholders. It is believed that environmental friendliness and the sustainability of an organization's business are inextricably linked (Saeed, 2017). Additionally, Swink, Melnyk, and Hartley (2020) said that corporate culture plays a vital role in meeting sustainability goals. People within the organization must embrace and support the organization's perspective on sustainability to achieve its goals. Leadership plays an important role in shaping the culture and the sustainability goals involved. Most of the time, the company's commitment to sustainability stems from the values and corporate culture created by the leader or founder. Finally, many scholars have also referred to corporate social responsibility as an important aspect related to sustainability, with Heizer, Render, and Munson (2017) stating that companies that practice corporate social responsibility (CSR) introduce policies that consider environmental, societal, and financial impacts in their decision-making. As managers consider approaches to CSR, they find it helpful to consider the concept of creating shared value.

For Thailand, the industrial development policy of the country has been established in 2018 to create an economic, social, and environmental balance under the concept of sustainable development. Therefore, the Thai industrial sector must accelerate the development of physical, economic, social, environmental, and management dimensions by focusing on the industrial plant that has a good management system, is safe, uses resources and energy cost-effectively, creates the least waste, and most importantly, is contributing to society and stakeholders. Therefore, the development of the eco-industry is an important mechanism for fulfilling sustainability to be truly concrete (Modern Manufacturing, 2017).

The chemical industry is considered an important industry for the Thai economy. In the first quarter of 2020, there was an export value of 1,974 million US dollars, the 2nd quarter of 2020 had a value of 1,848 million US dollars and the 3rd quarter of 2020 had a value of 2,110 million US dollars, respectively, which overall shrank compared to a year ago. Due to the outbreak of the COVID-19 virus, the industry has slowed down, causing demand in both domestic and international markets to decrease (Ministry of Industry, Office of Industrial Economics, Division of Industrial Economics Research, 2021). Details are shown in Figure 1.1.

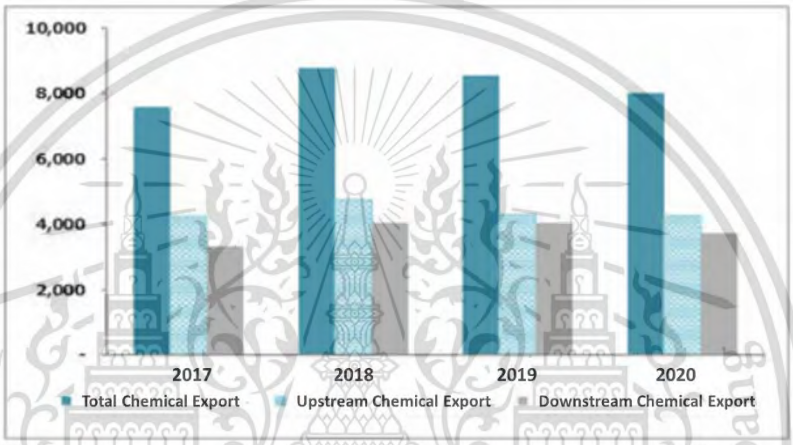


Figure 1.1 Export value (million USD)

Source: Ministry of Industry, the Office of Industrial Economics, Division of Industrial Economics Research, 2021.

The chemical industry covers many industrial activities. It is an industry that uses chemicals to produce finished products such as plastics, paints, medicines, detergents, explosives, artificial stains, dyes, fabrics, pesticides, etc. The chemical industry uses various raw materials such as rocks, ore, and coal which are mined from under the ground. And using logs and raw materials from many other plants. Most important the chemical industry requires crude oil, which is at the heart of two things: both as raw material and as a fuel. The worrisome is that crude oil may not be used for long. The chemical industry uses various chemical processes to turn raw materials into useful products. One method called disintegration is to make objects with complex elements more easily composed. The other way around is to make objects with simple elements become objects with complex elements (Knowledge of Chemical Industry, 2013).

The chemical industry operates within the community living area because that community is the customer of the product that is created. Although the main customers of the company are other chemical companies the endpoint of all chemical products is the whole community. So chemical companies only produce products that people need. Demand can arise in one or both ways: The usability of the user is increasing, and the products of the competitor are none. This requirement applies to every organization and will be even better if advertising is involved or by increasing influence in society or the world. The driving force behind manufacturing enterprises is profits, whose profits are theoretically limited by competition between manufacturing companies. We could say that part of this cheap price and profit comes from the environmental losses. Pollution and loss of nature and the impact of the chemical industry are also part. Although it is a minority eliminating or solving pollution problems influences the work of engineers, that is, it makes work more difficult, but prevention is very necessary for the safety and happiness of every life (Knowledge of Chemical Industry, 2013).

The Bureau of Occupational and Environmental Diseases (BOED), Department of Disease Control, Ministry of Public Health have compiled a list of chemical accidents or incidents for the year 2020 chemical incident surveillance data. (Ministry of Public Health, Department of Disease Control, Bureau of Occupational and Environmental Diseases (BOED), 2020; Ministry of Public Health, Department of Disease Control, Bureau of Occupational and Environmental Diseases (BOED), 2021).

1) A total of 59 chemical disasters occurred, of which the nature of the incident was caused by landfill fires, leaks, and transportation accidents.

2) Objects that cause chemical disasters. It was found that the objects that caused the incident were fuel oil, natural gas, ammonia, and unknown chemicals.

3) The place where the chemical disaster occurred. It was found that the site of the incident was a factory, landfill, traffic/transportation, and occurred in the community.

4) People affected by chemical disasters. A total of 67 people were affected by the incident, of which 59 were injured and 8 were fatal.

This research uses structural equation modeling (SEM) to examine the relationships between multiple variables, often different variables, measured for a single group of people over

time to identify possible causal relationships (paths) between variables (Leedy & Ormrod, 2016). SEM has several advantages: (1) SEM allows for a more accurate estimation of the effects of latent and moderating variables on mediating and outcome variables. Because the algorithm can distinguish variance resulting from incomplete measurement of variables from variance resulting from misspecification of the theoretical model and (2) the effects of latent variables, mediation, and moderation on more than one outcome variable may be assessed simultaneously (Ghauri, Grønhaug, & Strange, 2020).

Based on the above information, the researcher provides more detail in the literature review on the Introduction to the Chemical Industry in Thailand. In addition, the above information also shows the economic, social, and environmental problems and obstacles in operating in Thailand's chemical industry. Therefore, it is necessary to study the factors influencing the sustainability of the chemical industry in Thailand. The researcher believes that developing the sustainability of the chemical industry in Thailand through triple bottom line indicators will help solve the problem of the chemical industry having better performance in terms of Economic, Social, and Environmental. Additionally, there hasn't been much research exploring this.

Of all the importance mentioned above. Therefore, the researcher is of great interest in studying “A Structural Equation Model of Factors Influencing Sustainability of Chemical Industry in Thailand”. The researcher has applied a quantitative research methodology to this research and formulated questions for further research.

1.2 Research Questions

1.2.1 What is the model of factors influencing sustainability of chemical industry in Thailand?

1.2.2 What are the impacts of direct, indirect, and combined influences of factors on sustainability of chemical industry in Thailand?

1.3 Research Objectives

The primary aim of this study is to study a structural equation model of factors influencing sustainability of chemical industry in Thailand. This can be divided into sub-objectives as follows:

1.3.1 To examine the confirmatory factor analysis of the model to develop a structural equation model of factors influencing sustainability of chemical industry in Thailand with empirical data.

1.3.2 To examine the direct, indirect, and combined influence of factors on sustainability of chemical industry in Thailand.

1.4 Research Hypotheses

The research hypotheses derived from the literature review are detailed in Chapter 2, which can be summarized as follows.

1.4.1 Hypothesis 1 (H1): Transformational Leadership has a positive influence on Sustainability.

1.4.2 Hypothesis 2 (H2): Transformational Leadership has a positive influence on Organizational Culture.

1.4.3 Hypothesis 3 (H3): Transformational Leadership has a positive influence on Corporate Social Responsibility.

1.4.4 Hypothesis 4 (H4): Organizational Culture has a positive influence on Sustainability.

1.4.5 Hypothesis 5 (H5): Corporate Social Responsibility has a positive influence on Sustainability.

1.4.6 Hypothesis 6 (H6): Organizational Culture has a positive influence on Corporate Social Responsibility.

1.5 Research Benefits

1.5.1 This research contributes to the sustainability model of chemical industry in Thailand for further academic and professional development.

1.5.2 The industry sectors can use research findings and recommendations to formulate an organizational strategy for further sustainability development.

1.5.3 The stakeholders in the chemical industry can use the research findings and recommendations to monitor and recommend further sustainability development for the organization.

1.5.4 The government can use research findings and recommendations as a guideline for reviewing sustainability development for the industrial sector in Thailand.

1.6 Scope of Research

For the research of a structural equation model of factors influencing sustainability of chemical industry in Thailand, the scope of this research is as follows:

1.6.1 Population

The population of this research is top management or delegates from the top management of the chemical industry in Thailand. According to the Ministry of Industry, Department of Industrial Works (2021) has stated that the downstream chemical industry in Thailand has factories authorized to operate under the Factory Act 1992 at the end of 2020. There are a total of 2,573 factories, divided into 5 industrial groups, namely, Chemical Fertilizer Industry, Chemical or Other Chemical Materials Industry, Pharmaceutical Industries, Cosmetic Industry, and Paint Industry and its associated products. Most of them are concentrated mainly in the central region, followed by the eastern, western, northeastern, southern, and northern regions, respectively.

1.6.2 Variables

For the variables in this research, the researcher has studied and reviewed literature can be summarized as follows: (Details are shown in Chapter 2).

1.6.2.1 Exogenous Latent Variables consists of the following:

(1) Transformational Leadership, which consists of 3 observed variables:

1) Charisma and Inspiration

2) Intellectual Stimulation

3) Individual Consideration

1.6.2.2 Mediator Latent Variables consists of the following:

(1) Organizational Culture, which consists of 4 observed variables:

1) Clan

2) Adhocracy

3) Market

4) Hierarchy

(2) Corporate Social Responsibility, which consists of 4 observed variables:

1) Economic responsibility

2) Legal responsibility

3) Ethical responsibility

4) Philanthropic responsibility

1.6.2.3 Endogenous Latent Variables consists of the following:

(1) Sustainability, which consists of 3 observed variables:

1) Profit

2) People

3) Planet

1.6.3 Data collection

The research period was divided into three parts as follows:

Part 1: The study of secondary data from various sources both national and international sources.

Part 2: Develop research instruments and quality. The research instruments were improved for better with content validity testing and reliability testing.

Part 3: The collection of quantitative data by a set of questionnaires as an instrument and analysis of whether there is any statistically significant relationship among variables.

1.6.4 Statistics for data analysis

This study relied on statistical testing to ascertain that the findings would represent the entire population with a confidence level of 95%. The program AMOS was used for the analysis of the relationship of all the variables through structural equation modeling (SEM) to confirm the research study based on all observed variables in the conceptual framework.

1.7 Definition of Terms

1.7.1 ***Sustainability*** refers to developing an economy that meets the needs of the present without compromising the ability of future generations to meet their own needs in terms of economic, environmental, and social challenges and to undertake activities in a way that contributes to the long-term well-being of the natural environment without destroying our environmental, social and economic resources (Bateman, Snell, & Konopaske, 2019).

1.7.2 ***Triple Bottom Line (TBL)*** refers to the measure of performance in 3 areas or 3Ps: Profit, People, and Planet. TBL emphasizes seeing the value and balancing organizational success in operation for business growth, supporting people and society, and caring for the environment and world resources. It also includes business operations with transparency and good governance (Elkington, 1994).

1.7.3 ***Profit*** refers to the measurement and display of business performance. It is an economic return based on the components. The measurement results are quite accurate and most accurate with the accounting standards that have been developed to support them. Economic performance, therefore, emphasizes the value that can be measured as money also known as the "Net Worth" (Swink, Melnyk, & Hartley, 2020).

1.7.4 ***People*** refer to measuring and showing the performance. It is a social reward, but they are more complex than measuring economic performance because the term social performance must be defined clearly or must specify appropriate and acceptable criteria and methods for measuring social performance (Swink, Melnyk, & Hartley, 2020).

1.7.5 ***Planet*** refers to measuring the performance from various contributions such as environmental conservation, environmental remedies, and caring for the environment. That includes reducing the impact on the environment. The operations in this section emphasize the measure that the organization has considered the end-to-end business cycle fully and comprehensively to see how products and services have negative environmental impacts and how relevant CSR activities are in the environment (Swink, Melnyk, & Hartley, 2020).

1.7.6 ***Transformational Leadership*** refers to the ability to help leaders recognize the need for transformation to create a vision to guide that change and implement change effectively (Ebert, Griffin, Dracopoulos, & Starke, 2020). There is a very clear behavior with a pattern of perception that is clear and easy to understand for the follower (Bass, 1985). Raising awareness of the mission and vision of teams and organizations and creating incentives for followers (Bass & Avolio, 1993). Leaders and followers help each other to advance to higher levels of morale and motivation, and leaders are willing to change patterns by taking advice from followers, improving or changing work patterns (Burns, 1978).

1.7.7 ***Charisma and Inspiration*** refer to the charismatic leadership relationship creates an intense emotional bond between leaders and followers. The result is loyalty and trust in, as well as emulation of the leader. Followers are inspired to implement the leader's vision. The strong loyalty and respect that define a charismatic relationship pave the way for undertaking major change by reducing resistance (Bass, 1985; Bass & Avolio, 1993).

1.7.8 ***Intellectual Stimulation*** refers to the ability of leaders to motivate followers to solve problems by challenging them intellectually and empowering them to innovate and develop creative solutions. Leaders and groups question existing values and assumptions and search for new answers, encouraging them to look at problems in new ways and new solutions by stimulating debate and debate. Leaders push followers to perform beyond what they ever thought possible (Shin & Zhou, 2003).

1.7.9 ***Individual Consideration*** refers to developing a personal relationship with each follower. Leaders treat each follower differently but equally, providing individualized attention to everyone. As a result, followers feel special, encouraged, inspired, developed, and perform better.

Leaders' consideration also allows them to match each follower's skills and abilities to the needs of the organization (Dvir et al., 2002).

1.7.10 ***Organizational Culture*** refers to the system in which backgrounds, norms, values, traditions, philosophies, rules, beliefs, and routines work together to influence the way individuals, groups, and teams interact for organizing actions, language, and other symbols to demonstrate mutual understanding and work together to achieve the goals of the organization (Schein, 1985).

1.7.11 ***Clan*** refers to a sense of cohesiveness is characterized by a group or affiliation culture, coupled with shared values and a high level of participation and consensus building. Clan believes that the path to success is rooted in teamwork, loyalty, and caring for the people within the organization and their ongoing development (Cameron & Quinn, 2011).

1.7.12 ***Adhocracy*** refers to adapt to the transition from the industrial age to the information age. This type of organizational culture is most responsive to the turbulent and rapidly changing conditions of today. Adhocracy's culture is dynamic and dynamic by nature to foster creativity, entrepreneurship, and the ability to stay ahead of the curve. This requires a culture that emphasizes individual initiative and freedom (Cameron & Quinn, 2011).

.**1.7.13** ***Market*** refers to being competitive and results-oriented, and results that count most often are financial measures of success, such as profits, ensuring discipline in achieving these goals. Therefore, there is a strong emphasis on achieving measurable goals and targets. Essentially what marks marketing culture is the pervasive emphasis on winning, which is often defined simply as beating the competition (Cameron & Quinn, 2011).

1.7.14 ***Hierarchy*** refers to their attention inward on how people interact with each other, on whether internal operating procedures are followed, and so forth, have a hierarchy culture. Organizations with a hierarchy culture or consistency tend to have formalized rules and procedures; they tend to be highly structured places to work. Following standard operating procedures or SOPs, is the rule of the day. The emphasis is on ensuring continuing efficiency, smooth functioning, and dependable operations (Cameron & Quinn, 2011).

1.7.15 ***Corporate Social Responsibility*** refers to the commitment to behave ethically and create interactions between the business and the existing social environment (Whittington, et.al., 2019). In particular, the commitments the organization has to society by recognizing, accepting,

and managing the broad impact of corporate decisions taking into account the economic, social, and environmental impacts (Hartman, DesJardins, & MacDonald, 2018).

1.7.16 ***Economic Responsibilities*** refers to producing goods and services that society wants at a price that perpetuates the business and satisfies its obligations to investors (Carroll, 2004).

1.7.17 ***Legal Responsibilities*** refer to complying with applicable local, state, federal, and international laws. Laws affecting cover a wide range of requirements, from filing tax returns to meeting worker safety standards (Carroll, 2004).

1.7.18 ***Ethical Responsibilities*** refer to meeting other social expectations that are not written down in law. The industry adheres to common beliefs about behavior in society. Affected people may feel very dissatisfied if the organization's management does not adhere to general ethical values (Carroll, 2004).

1.7.19 ***Philanthropic Responsibilities*** refer to additional behaviors and activities that society views as desirable and worthy of the businesses that support them. For example, supporting community projects and donating to charity. Charitable activities are more than just altruism and proper management. Strategic philanthropy cannot become the opposite but rather a way to build goodwill among various stakeholders and increase shareholder wealth. Another difference between ethical responsibility and decision-making responsibility is that: few people expect organizations to live up to their decision-making responsibilities while many expect organizations to live up to their ethical responsibilities (Carroll, 2004).

1.7.20 ***Chemical Industry*** refers to the downstream chemical industry which is an industry that produces finished chemical products using raw materials from intermediate and upstream chemicals. The downstream chemical industry in Thailand has a total of 2,573 factories, divided into 5 industrial groups, namely, Chemical Fertilizer Industry, Chemical or Other Chemical Materials Industry, Pharmaceutical Industries, Cosmetic Industry, and Paint Industry and its associated products (Ministry of Industry, Office of Industrial Economics, Division of Industrial Economics Research, 2012).

CHAPTER 2

LITERATURE REVIEW

In the study “A Structural Equation Model of Factors Influencing Sustainability of Chemical Industry in Thailand”, the researcher has researched from related research and various online information. This is to be able to define a more comprehensive and clearer conceptual framework that will guide the study. The details of the study are classified in order as follows.

2.1 Theories and Concepts of Sustainability

2.2 Theories and Concepts of Transformational Leadership

2.3 Theories and Concepts of Organizational Culture

2.4 Theories and Concepts of Corporate Social Responsibility

2.5 Introduction to Chemical Industry in Thailand

2.6 Variable Relationship Analysis

2.7 Conceptual Framework Diagram

2.1 Theories and Concepts of Sustainability

In 1987, the United Nations' World Commission on Environment and Development by The Brundtland Commission (1987) published a report entitled “Our Common Future” giving the concept of sustainable development for the first time. It defines sustainable development as "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs". After the report called “Our Common Future” or the Brundtland Report has been defined. Although accepted, most concepts that arise are based on this definition.

In addition, many scholars have given many definitions of sustainability, many of which are consistent with the definitions of the Brundtland Commission by Wisner, Tan, and Leong (2019) as Sustainability is defined as the ability to meet the needs of the current supply chain members without hindering the ability to meet the needs of future generations in terms of economic, environmental, and social challenges. Peng (2018) has stated that Global sustainability is defined

as the ability to meet the needs of the present without compromising the ability of future generations to meet their needs. It not only refers to a sustainable social and natural environment but also sustainable capitalism. Heizer, Render, and Munson (2017) have defined the term sustainability refers to meeting the needs of the present without compromising the ability of future generations to meet their needs.

However, many scholars have defined sustainability in many other ways. Bateman, Snell, and Konopaske (2019) define sustainability, at its most basic as the efforts are made to minimize the use and wastage of resources, especially polluting and non-renewable resources. Sustainability is about protecting our choices. When done correctly, sustainability enables people to live and work in a way that can be sustained over the long term (generations) without destroying or destroying our environmental, social, and economic resources. In addition, Rothaermel (2018) has a strategic definition of focusing on maintaining a competitive advantage at all times. Sustainable strategies refer to strategies that can be implemented over time without harmful consequences for people or the planet. Kinicki and Williams (2020) state that our economic system brings prosperity but also leads to unsustainable business practices because natural resources are assumed to be limitless. Which isn't the case at all. Sustainability means economic development that meets current needs without compromising the ability of future generations to meet their own needs. Ferrell, Hirt, and Ferrell (2019) define it, we define sustainability as conducting activities in a way that provides for the long-term well-being of the natural environment, including all biological organisms. Sustainability involves the interaction between nature and people, organizations, and business strategies. This includes evaluating and improving business strategies, economic sectors, work practices, technologies, and lifestyles to preserve the health of the natural environment. In recent years, business has played a key role in adopting, using, and maintaining the quality of sustainability.

The literature review can summarize the definition of sustainability as shown in Table 2.1.

Table 2.1 Definition of Sustainability

Scholar/Researcher	Definitions
The Brundtland Commission (1987)	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs
Heizer, Render, and Munson (2017)	Sustainability refers to meeting the needs of the present without compromising the ability of future generations to meet their needs.
Peng (2018)	The ability to meet current needs without compromising the ability of future generations to meet their needs. It refers not only to a sustainable social and natural environment but also to a sustainable capitalism.
Rothaermel (2018)	A strategy that can be pursued over time without detrimental effects on people or the planet.
Bateman, Snell, and Konopaske (2019)	Protecting our choices. When done correctly, sustainability enables people to live and work in a manner that can be sustained over the long term without depleting or damaging our environmental, social, and economic resources.
Ferrell, Hirt, and Ferrell (2019)	The interaction among nature and individuals, organizations, and business strategies includes the assessment and improvement of business strategies, economic sectors, work practices, technologies, and lifestyles so that they maintain the health of the natural environment.
Wisner, Tan, and Leong (2019)	The ability to meet the needs of today's supply chain members without impeding the ability to meet the needs of future generations in light of economic, environmental, and social challenges.

Table 2.1 (Continue)

Scholar/Researcher	Definitions
Kinicki and Williams (2020)	Economic development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

From Table 2.1, the scholar and researcher gave various definitions of sustainability. In summary, in the context of the chemical industry in Thailand; Sustainability refers to developing an economy that meets the needs of the present without compromising the ability of future generations to meet their own needs in terms of economic, environmental, and social challenges and to undertake activities in a way that contributes to the long-term well-being of the natural environment without destroying our environmental, social, and economic resources of the chemical industry.

In terms of the importance of sustainability, sustainability has attracted attention and is given to the attention of academics, leadership, management, and practitioners. However, in holistic business sustainability management through economic, social, and environmental fundamentals, not enough attention has been received (Saeed, 2017). True sustainability involves thinking not only about environmental resources but also about employees, customers, communities, and a company's reputation. Three concepts can be useful when managers consider sustainability decisions: the systems perspective, the big picture, and the triple bottom line (Heizer, Render, and Munson, 2017).

Triple Bottom line

Triple Bottom Line is a business accounting term coined by Elkington (1994) using abbreviations such as TBL, 3BL, 3Ps (People, Profit, Planet), and Three Pillars. The term Triple Bottom Line differs from traditional accounting terminology. It is commonly used to show profit or loss. Elkington intends TBL to support the goal of holistic sustainability in business operations in a broader context, which means that companies should be held accountable for their economic, social, and environmental performance.

In other words, "People" means evaluating how satisfying and fair business practices are for society. For example, a company employs disadvantaged or disabled people. The company has

fair compensation and appropriate social welfare. The term "Profit" refers to the economic value generated by a company's operations, and the term "Planet" refers to the environmental measures the company uses as a standard to manage its potential environmental impacts. Figure 2.1 illustrates the Triple Bottom Line relationship.

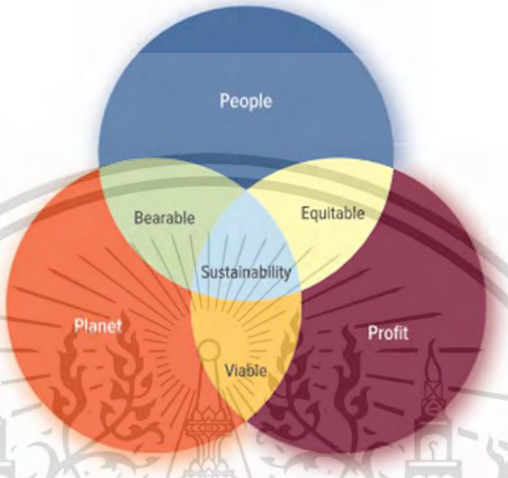


Figure 2.1 The Triple Bottom Line relationship

Source: Swink, Melnyk, and Hartley, 2020

Profit

Swink, Melnyk, and Hartley (2020). Profit is one of the top priorities for operations managers and business organizations. In the past, profit was critically important to an organization's long-term sustainability. Regardless of how lofty corporate ambitions are, it cannot survive without consistent profitability, and maintaining profit can be difficult in a rapidly changing environment. Ultimately, the corporate business model must change if it is to maintain a sustainable competitive advantage. The use of the word “sustainable” in this context is no less important than the other in the meaning of good for the environment and society.

People

Swink, Melnyk, and Hartley (2020). The second element of TBL is focused on people. Especially on human rights, health, safety, and quality of life in the community. This includes the stakeholders of a business enterprise, that is, customers, employees, suppliers, and investors. In addition, doing business can have an indirect effect on larger communities and society as a whole. Each stakeholder group has different needs and priorities.

Planet

Swink, Melnyk, and Hartley (2020). Environmental sustainability involves more than reducing air or water pollution according to the definition provided by the United Nations Brundtland Commission above. With the growth of the world population and the increasing economic development, there is a greater demand for resources including metals, petroleum, and natural gas. The more people today use it, the less there will be left to future generations. Leading global companies such as Unilever, Dell, Steelcase, Philips, Walmart, Coca-Cola, Ford, Toyota, Disney, and Inter-Continental Hotels take environmental sustainability and implement environmental management practices as an integral part of planning. Strategic and operational for the company.

Balancing the TBL

Today, environmental and social concerns are increasingly important drivers in customer dynamics, value proposition, and operational capabilities. These investments can affect a company's bottom line in two basic ways. First, the company's efforts to maintain the environment and society sustainably can improve the presentation of value and associated sales revenue. Because customers value these points and are willing to pay more. Second, sustainable operations can reduce or increase the cost of providing goods or services. For example, minimizing product transportation could reduce both costs and carbon emissions at the same time, which is a “win-win”. In other cases, however, companies may have to choose between options that are higher in cost and highly sustainable with lower cost and less sustainable. The value presented and the impact on profits should not be wasted in the company's efforts to be environmentally and socially sustainable.

In a nutshell, environmental regulations and policies should be holistic to support the ecological part, ensuring that ecological integrity and biodiversity are preserved in very clear terms and conditions. Therefore, ecologically sustainable development should be embedded in the concept of environmental sustainability, and this is included in the sustainability of the TBL. Included, which will prevent irreversible environmental degradation or serious environmental damage. The objective of environmental sustainability should not just be conservation. It is important to consider community and public social morality. It is extremely important to influence governments to promote and reward action-oriented values that support the term ecological

sustainability benefits. Longer than short-term profit or gross income (Saeed, 2017). As shown in Table 2.2

Table 2.2 Literature review of Sustainability

Scholar/Researcher	Latent variables	Observed variables
Elkington (1994)	Sustainability	1. Economy 2. Social 3. Environment
Bamgbade, Kamaruddeen, and Nawi (2015)	Sustainable Construction	1. Environmental Protection 2. Social well being 3. Economic prosperity
Dhakal (2017)	Sustainability	1. Social 2. Economy 3. Environment
Heizer, Render, and Munson (2017)	Sustainability	1. People 2. Planet 3. Profit
Saeed (2017)	Sustainability	1. Economy 2. Social 3. Environment
Rothaermel (2018)	Sustainability	1. Profit 2. People 3. Planet
Burawat (2019)	Sustainability	1. People 2. Profit 3. Planet
Wisner, Tan, and Leong (2019)	Sustainability	1. People 2. Planet 3. Profit

Table 2.2 (Continue)

Scholar/Researcher	Latent variables	Observed variables
Zhang, Morse, and Ma (2019).	Sustainable Development	1. Economic Dimension 2. Social Dimension 3. Environmental Dimension
Jacobs and Chase (2020)	Sustainability	1. Social responsibility 2. Economic prosperity 3. Environmental stewardship
Swink, Melnyk, and Hartley (2020)	Sustainability	1. Planet 2. People 3. Profit

From Table 2.2, it can be concluded that the observed variables for sustainability comprised 3 variables: 1) Profit, 2) People, and 3) Planet. The following model comprised of 3 components was obtained, as shown in Figure 2.2.

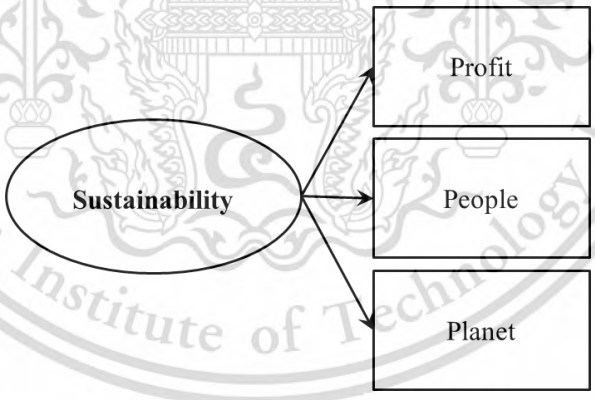


Figure 2.2 Model of Sustainability

2.2 Theories and Concepts of Transformational Leadership

Burns (1978) first introduced the concept of transforming leadership in his descriptive research on political leaders, but this term is now used in organizational psychology as well. According to Burns, transforming leadership is a process in which "leaders and followers help each

other to advance to a higher level of morale and motivation". According to Burns, a transforming approach creates major changes in the lives of people and organizations, redesigns perceptions and values, and changes employee expectations and aspirations, unlike a transactional approach. It is not based on a "give and take" relationship, but rather on a leader's personality, character, and ability to change through example, conveying a powerful vision, and challenging goals. Transforming leaders are idealized in the sense that they are an example of working for the benefit of the team, organization, and/or community. Burns theorizes that transforming and transactional leadership are separate forms. Transactional leaders usually do not strive to change the culture in the organization, but they work within the existing culture, while transformational leaders can strive to change the organizational culture (Roberts, 2018).

Another researcher, Bass (1985), extended the work of Burns (1978) by explaining the psychological mechanisms that underlie transforming and transactional leadership; Bass also used the term "transformational" instead of "transforming." Bass added to the initial concepts of Burns (1978) to help explain how transformational leadership could be measured, as well as how it impacts follower motivation and performance.

In addition, many scholars have given many definitions of transformational leadership. Ebert, Griffin, Dracopoulos, and Starke (2020) have stated that Transformational leadership is the set of abilities that allows a leader to recognize the need for change, create a vision to guide that change and execute the change effectively. Bateman, Snell, and Konopaske (2019) said: Charisma contributes to transformational leadership. Transformational leaders motivate people to transcend their interests for the sake of the larger community. They generate excitement and revitalize organizations. Jones and George (2019) define it as Leadership that makes subordinates aware of the importance of their jobs and performance to the organization and aware of their own needs for personal growth and that motivates subordinates to work for the good of the organization. Boddy (2017) said: Transformational leaders aim to change the status quo by infusing work with meaning that encourages followers to increase their aspirations by appealing to higher ideals and moral values. They energize people by conveying a compelling vision for the organization, reinforcing the value of that vision, and empowering subordinates to express new ideas. Another comparison is that transactional leaders motivate followers to meet the leader's expectations while transformational leaders motivate followers to exceed them. The two styles are mutually exclusive,

managers are featured in both styles but the amount varies with some being transactional and some being transformational.

Transformational leadership is a style of leadership that changes the status quo by appealing to followers' values and a sense of a higher purpose. Transformational leaders speak clearly about the problems in the current system and have a clear vision of what the new society or organization will be like. This new vision of society is closely linked to the values of both leaders and followers. It represents an ideal that is consistent with its value system. (Hughes, Ginnett, & Curphy, 2019).

The literature review can summarize the definition of transformational leadership as shown in Table 2.3.

Table 2.3 Definition of Transformational Leadership

Scholar/Researcher	Definitions
Burns (1978)	A process in which leaders and followers help each other to advance to a higher level of morale and motivation.
Bass (1985)	Transformational leadership has a very clear behavior with a clear and easy-to-understand perception model for followers, and leaders are willing to work to change the pattern using suggestions from followers to improve or change their work style rather than relying on their ideas.
Bass and Avolio (1993)	The process by which leaders influence stakeholders and followers by developing the capacity of stakeholders and followers to become more potent. It raises awareness of the mission and vision of the team and the organization and incentivizes stakeholders and followers to work.

Table 2.3 (Continue)

Scholar/Researcher	Definitions
Boddy (2017)	Transformational leaders are leaders who view leadership as a matter of motivation and commitment, inspiring followers by appealing to higher ideals and moral values.
Bateman, Snell, and Konopaske (2019)	Leaders who encourage people to transcend their interests for the good of the group.
Jones and George (2019)	Leadership that makes subordinates aware of the importance of their work and performance to the organization, recognizes their own need for personal growth and motivates subordinates to work for the benefit of the organization.
Ebert, Griffin, Dracopoulos, and Starke (2020)	A set of competencies that help leaders recognize the need for change, create a vision to guide that change, and effectively implement change.

From Table 2.3, the scholar and researcher gave various definitions of transformational leadership. In summary, in the context of the chemical industry in Thailand; Transformational Leadership refers to the ability to help leaders in the chemical industry recognize the need for transformation to create a vision to guide that change and implement change effectively. There is a very clear behavior with a pattern of perception that is clear and easy to understand for the follower. Raising awareness of the mission and vision of teams and organizations and creating incentives for followers Leaders and followers help each other to advance to higher levels of morale and motivation, and leaders are willing to change patterns by taking advice from followers, improving or changing work patterns.

Leadership scholars and practitioners suggest that today's organizations need leadership that inspires followers and enables them to create revolutionary change. Transformational CEOs from the business and not-for-profit sectors have been praised for having significantly transformed their organizations and are also being praised. Transformational leadership is comprised of three

factors: charisma and inspiration, intellectual stimulation, and individual consideration, which together enable leaders to achieve large-scale change (Nahavandi, 2015). Figure 2.3 illustrates the Transformational Leadership Factors.

Figure 2.3 Transformational Leadership Factors

Source: Nahavandi, 2015

Elements of Transformational Leadership Charisma and Inspiration are one of three central elements of transformational leadership (Bass, 1985; Bass & Avolio, 1993). The charismatic leadership relationship creates an intense emotional bond between leaders and followers. The result is loyalty and trust in, as well as emulation of, the leader. Followers are inspired to implement the leader's vision. The strong loyalty and respect that define a charismatic relationship pave the way for undertaking major change by reducing resistance. The second factor is Intellectual Stimulation, which is the leader's ability to motivate followers to solve problems by challenging them intellectually and empowering them to innovate and develop creative solutions. The leaders and the group question existing values and assumptions and search for new answers (Shin & Zhou, 2003). By encouraging them to look at problems in new ways, requiring new solutions, and by triggering controversial discussions and debates, the leader pushes followers to perform beyond what they previously considered possible (Boerner, Eisenbeiss, & Griesser, 2007). The charismatic bond provides support and encouragement in this endeavor and prevents followers from feeling isolated. Intellectual stimulation includes a strong empowerment component, which assures followers of

their abilities and capabilities and enables them to search for new solutions. Transformational leadership has been shown to create empowerment that, in turn, increases team effectiveness (Kark, Shamir, & Chen, 2003).

The last factor of transformational leadership is Individual Consideration, which leads to the development of a personal relationship with each follower. The leader treats each follower differently but equitably, providing everyone with individual attention. As a result, followers feel special, encouraged, motivated, and developed, and they perform better (Dvir et al., 2002). The leader's individual consideration further allows for matching each follower's skills and abilities to the needs of the organization.

The three factors, charisma and inspiration, intellectual stimulation, and individual consideration combine to allow the leader to undertake the necessary changes in an organization. Transactional leadership behaviors support the maintenance of the routine aspects of the organization necessary to maintain internal health. Some research suggests that the two go hand in glove, one building on the other to make leaders effective (Wang et al., 2011).

The literature review can summarize the elements of transformational leadership as shown in Table 2.4.

Table 2.4 Literature review of Transformational Leadership

Scholar/Researcher	Latent variables	Observed variables
Bass (1985)	Transformational Leadership	1. Charisma and Inspiration 2. Intellectual Stimulation 3. Individual Consideration
Bass and Avolio (1993)	Transformational Leadership	1. Charisma and Inspiration 2. Intellectual Stimulation 3. Individual Consideration
Nahavandi (2015)	Transformational Leadership	1. Charisma and Inspiration 2. Intellectual Stimulation 3. Individual Consideration

Table 2.4 (Continue)

Scholar/Researcher	Latent variables	Observed variables
Bateman, Snell, and Konopaske (2019)	Transformational Leadership	1. Charisma 2. Individualized attention 3. Intellectually Stimulating
Jones and George (2019)	Transformational Leadership	1. Charismatic Leader 2. Intellectual Stimulation 3. Developmental Consideration
Kinicki and Williams (2020)	Transformational Leadership	1. Inspirational Motivation 2. Idealized Influence 3. Individualized Consideration 4. Intellectual Stimulation

From Table 2.4, it can be concluded that the observed variables for transformational leadership comprised 3 variables: 1) Charisma and Inspiration, 2) Intellectual Stimulation, and 3) Individual Consideration. The following model comprised of 3 components was obtained, as shown in Figure 2.4.

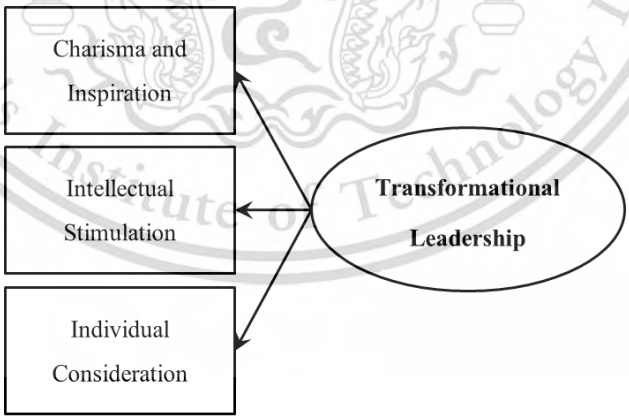


Figure 2.4 Model of Transformational Leadership

2.3 Theories and Concepts of Organizational Culture

Organizational culture refers to the patterns of values and norms that are shared among people in an organization. Swink, Melnyk, and Hartley (2020) said that corporate culture plays a vital role in meeting sustainability goals. People within the organization must embrace and support the organization's perspective on sustainability to achieve its goals. This is not always easy. There are conflicts about certain sustainability issues, such as global warming. Leadership plays an important role in shaping the culture and the sustainability goals involved. Most of the time, the company's commitment to sustainability stems from the values and corporate culture created by the leader or founder.

Interest in organizational culture has grown as academics and managers have come to believe that it influences behavior. Several claim that a strong and distinct culture helps to integrate individuals into the team or organization, and so helps performance (Deal & Kennedy, 1982; Peters & Waterman, 1982). Deal and Kennedy (1982) refer to culture as 'the way we do things around here and Hofstede (1991) sees it as the 'collective programming of the mind', distinguishing one group from another. Peng (2018) extended this concept to define organizational culture as the collective programming of the mind that distinguishes members of one organization from another. Mergers frequently experience disruption when management tries to integrate distinct cultures (Teerikangas & Very, 2006).

Schein (1985) has been defined as a system of shared backgrounds, norms, values, or beliefs among members of a group, and organizational climate concerns members' subjective reactions to the organization. Later, Schein (1996) stated that organizational culture, sometimes called corporate culture, is defined as the set of shared, taken-for-granted implicit assumptions that a group holds and that determines how it perceives, thinks about, and reacts to its various environments. Lewis, Goodman, Fandt, and Michlitsch (2007) have stated that culture guides the behavior of and gives meaning to organizational members. Therefore, it has a direct and powerful influence on what the organization does and on what the people in the organization do. Organizational culture is the shared beliefs, values, and norms that bind people together and help them make sense of the systems within an organization. The beliefs, values, and norms tell people "what is to be done" and "how it is to be done." Cultures develop within organizations as their

people interact and share ways of managing and coping. Jones and George (2019) define it as the shared set of beliefs, expectations, values, norms, and work routines that influence how members of an organization relate to one another and work together to achieve organizational goals.

In addition, many scholars have given many definitions of organizational culture. Nahavandi (2015) has stated that organizational culture (sometimes referred to as corporate culture)—is the set of values, norms, and beliefs shared by members of an organization. Ferrell, Hirt, and Ferrell (2019) have stated that one of the most important aspects of organizing a business is determining its organizational culture, a firm's shared values, beliefs, traditions, philosophies, rules, and role models for behavior. Also called corporate culture, organizational culture exists in every organization, regardless of size, organizational type, product, or profit objective. Bateman, Snell, and Konopaske (2019) have defined the term organizational culture as the set of important assumptions about the organization and its goals and practices that members of the company share. It is a system of shared values about what is important and beliefs about how the world works.

The literature review can summarize the definition of organizational culture as shown in Table 2.5.

Table 2.5 Definition of Organizational Culture

Scholar/Researcher	Definitions
Jaques (1952)	The culture of the factory is its customary and traditional way of thinking and doing things, which is shared to a greater or lesser degree by all its members, and which new members must learn, and at least partially accept, to be accepted into service in the firm.
Pettigrew (1979)	A system of publicly and collectively accepted meanings operating for a given group at a given time. This system of terms, forms, categories, and images interprets a people's situation to themselves.

Table 2.5 (Continue)

Louis (1983)	Organizations [are] culture-bearing milieu, that is, [they are] distinctive social units possessed of a set of common understandings for organizing action (e.g., what we're doing together in this particular group, appropriate ways of doing in and among members of the group) and languages and other symbolic vehicles for expressing common understandings.
Schein (1985)	A system of shared backgrounds, norms, values, or beliefs among members of a group, and organizational climate concerns members' subjective reactions to the organization.
Van Maanen (1988)	The knowledge members of a given group are thought to more or less share; knowledge of the sort that is said to inform, embed, shape, and account for the routine and not-so-routine activities of the members of the culture . . . Culture is expressed (or constituted) only through the actions and words of its members and must be interpreted by, not given to, a fieldworker . . . Culture is not itself visible, but is made visible only through its representation.
Trice and Beyer (1993)	Cultures are collective phenomena that embody people's responses to the uncertainties and chaos that are inevitable in human experience. These responses fall into two major categories. The first is the substance of a culture—shared, emotionally charged belief systems that we call ideologies. The second is cultural forms—observable entities, including actions, through which members of a culture express, affirm, and communicate the substance of their culture to one another.

Table 2.5 (Continue)

Scholar/Researcher	Definitions
Schein (1996)	The set of shared, taken-for-granted implicit assumptions that a group holds and that determines how it perceives, thinks about, and reacts to its various environments.
Lewis, Goodman, Fandt, and Michlitsch (2007)	The shared beliefs, values, and norms in an organization.
Nahavandi (2015)	The set of values, norms, and beliefs shared by members of an organization.
Peng (2018)	The collective programming of the mind that distinguishes members of one organization from another.
Bateman, Snell, and Konopaske (2019)	The set of important assumptions about the organization and its goals and practices that members of the company share. It is a system of shared values about what is important and beliefs about how the world works.
Ferrell, Hirt, and Ferrell (2019)	A firm's shared values, beliefs, traditions, philosophies, rules, and role models for behavior.
Jones and George (2019)	The shared set of beliefs, expectations, values, norms, and work routines influence how individuals, groups, and teams interact with one another and cooperate to achieve organizational goals.

From Table 2.5, the scholar and researcher gave various definitions of organizational culture. In summary, in the context of the chemical industry in Thailand; the system of the chemical industry in which backgrounds, norms, values, traditions, philosophies, rules, beliefs, and routines work together to influence the way individuals, groups, and teams interact to organize actions, language, and other symbols to demonstrate mutual understanding and work together to achieve the goals of the organization.

Someone entering a department or organization for the first time can usually sense and observe the surface elements of the culture. Some buzz with life and activity, others seem asleep;

some welcome and look after visitors, others seem inward-looking; some work by the rules, while others are entrepreneurial and risk-taking; some have regular social occasions while other staff rarely meet except at work.

Organizational cultures are not usually designed intentionally. That's one reason that people tend not to be consciously aware of their own organization's culture. It's usually only when an organization's culture is impeding organizational performance (typically in a changing competitive environment) that people become aware of any need for culture change. It's at just such times that it can be useful for people within an organization to consider something different. The Competing Values Framework was designed to help organizations be more deliberate in identifying a culture more likely to be successful given their respective situations, and in transitioning to it (Hughes, Ginnett, & Curphy, 2019).

As shown in Figure 2.5, the intersection of the competing values axes creates four quadrants describing four different combinations of values. The distinctive sets of values in these quadrants define four unique organizational cultures (Hughes, Ginnett, & Curphy, 2019).

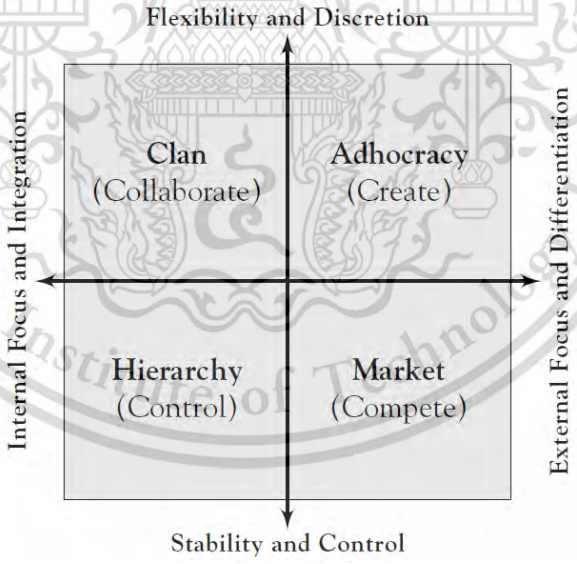


Figure 2.5 The Competing Values Framework

Source: Cameron & Quinn, 2011.

Cameron and Quinn (2011) have stated that each quadrant in Figure 2.5 has been given a label to distinguish its most notable characteristics — clan, adhocracy, market, and hierarchy.

The competing values framework (CVF) provides a practical way for managers to understand, measure, and change organizational culture. The CVF, which has been validated by extensive research involving 1,100 companies, classifies organizational cultures into four types: (1) clan, (2) adhocracy, (3) market, and (4) hierarchy, as we'll explain (Cameron & Quinn, 2011).

Organizations that emphasize stability and control, and also focus their attention inward (on how people within the organization interact with each other, on whether internal operating procedures are followed, and so forth), have a hierarchical culture. Organizations with a hierarchy culture (or consistency) tend to have formalized rules and procedures; they tend to be highly structured places to work. Following standard operating procedures or SOPs, is the rule of the day. The emphasis is on ensuring continuing efficiency, smooth functioning, and dependable operations (Cameron & Quinn, 2011).

Organizations that, like hierarchy cultures, emphasize stability and control but focus their attention primarily on the external environment (outside the organization itself) are called market cultures (or missions). Their interest is more in interactions with external constituencies like customers and suppliers. Market cultures are competitive and results-oriented, and the results that count most are typically financial measures of success such as profit. To ensure discipline in achieving these ends, there is great emphasis on achieving measurable goals and targets. Fundamentally, what characterizes market cultures is a pervasive emphasis on winning, often defined simply as beating the competition (Cameron & Quinn, 2011).

Organizations that emphasize having a high degree of flexibility and discretion, and that also focus primarily inward rather than outward, are known as clan cultures because in many ways they can be thought of as an extended family. A strong sense of cohesiveness characterizes clan cultures (or involvement) along with shared values and a high degree of participativeness and consensus-building. Clan cultures believe their path to success is rooted in teamwork, loyalty, and taking care of people within the organization, including their continuing development. In a real sense, clan cultures can be thought of as relationship cultures (Cameron & Quinn, 2011).

Finally, organizations that emphasize having a high degree of flexibility and discretion, and that focus primarily on the environment outside the organization, are called adhocracy cultures. In many ways, adhocracy cultures (or adaptability) represent an adaptation to the transition from the industrial age to the information age in that this form of organizational culture is most

responsive to the turbulent and rapidly changing conditions of the present age. The name adhocracy has roots in the phrase ad hoc, which means temporary or specialized. Adhocracy cultures are by nature dynamic and changing to best foster creativity, entrepreneurship, and the ability to stay on the cutting edge. This requires a culture that emphasizes individual initiative and freedom (Cameron & Quinn, 2011).

In actuality, these four cultures represent idealized forms; no real organization probably exists whose culture can be completely described by just one quadrant. The complexities and necessities of organizational life and survival inevitably require that all cultures include elements from all four of the cultures (that is, all cultures put some value on all the competing values). What differentiates one culture from another, then, is the relative predominance of one culture type over the others. Nonetheless, it should be apparent that quite different approaches to leadership are called for based on which of these four distinctive cultures dominates any organization (Hughes, Ginnett, & Curphy, 2019).

Leadership in hierarchy cultures, for example, emphasizes carefully managing information, monitoring detailed aspects of operations, and assuring operational dependability and reliability. In contrast, leadership in market cultures places a premium on aggressiveness, decisiveness, productivity (which is not the same as stability or continuity), and outperforming external competitors. Leadership in a clan culture focuses on process more than output, especially as it pertains to minimizing conflict and maximizing consensus. A premium is placed on leadership that is empathetic and caring and that builds trust. Leadership in adhocracy cultures requires vision, creativity, and future-oriented thinking (Hughes, Ginnett, & Curphy, 2019).

A recent exploration of the role of culture in organizational performance uses these same four culture types, but rather than using them to distinguish between organizational cultures it instead suggests that to be effective, organizations must have capabilities characteristic of all four of these organizational cultures. In other words, effective organizations probably pay attention to all four dimensions of culture (Schneider & Barbera, 2014).

From the literature review, can summarize the components of organizational culture as shown in Table 2.6.

Table 2.6 Literature review of Organizational Culture

Scholar/Researcher	Latent variables	Observed variables
Cameron and Quinn (2011)	Organizational Culture	1. Clan 2. Adhocracy 3. Market 4. Hierarchy
Bamgbade, Kamaruddeen, and Nawi (2015)	Organizational Culture	1. Adhocracy 2. Market Orientation
Indarti and Wijayanto (2015)	Organizational Culture	1. Involvement 2. Adaptability 3. Mission 4. Consistency
Dubey, Gunasekaran, Childe, Papadopoulos, Hazen, Giannakis, and Roubaud (2017)	Organizational Culture	1. Group culture 2. Developmental culture 3. Rational culture 4. Hierarchical culture
Lee and Kim (2017)	Organizational Culture	1. Clan 2. Adhocracy 3. Market 4. Hierarchy
Aleksić, Braje, and Jelavić (2019)	Organizational Culture	1. Clan 2. Adhocracy 3. Market 4. Hierarchy
Chaabane (2019)	Organizational Culture	1. Involvement 2. Adaptability 3. Mission 4. Consistency

Table 2.6 (Continue)

Scholar/Researcher	Latent variables	Observed variables
Dyck, Walker, and Caza (2019)	Organizational Culture	1. Clan 2. Adhocracy 3. Market 4. Hierarchy
Hughes, Ginnett, and Curphy (2019)	Organizational Culture	1. Clan 2. Adhocracy 3. Market 4. Hierarchy
Rizki, Parashakti, and Saragih (2019)	Organizational Culture	1. Clan 2. Adhocracy 3. Market 4. Hierarchy
Hosseini, Hajipour, Kaffashpoor, and Darikandeh (2020)	Organizational Culture	1. Involvement 2. Adaptability 3. Mission 4. Consistency
Kinicki and Williams (2020)	Organizational Culture	1. Clan 2. Adhocracy 3. Market 4. Hierarchy
Muliati, Iqbal, and Mayapada (2020)	Organizational Culture	1. Involvement 2. Adaptability 3. Mission 4. Consistency

From Table 2.6, it can be concluded that the observed variables for organizational culture comprised 4 variables: 1) Clan, 2) Adhocracy, 3) Market, and 4) Hierarchy. The following model comprised of 4 components was obtained, as shown in Figure 2.6.

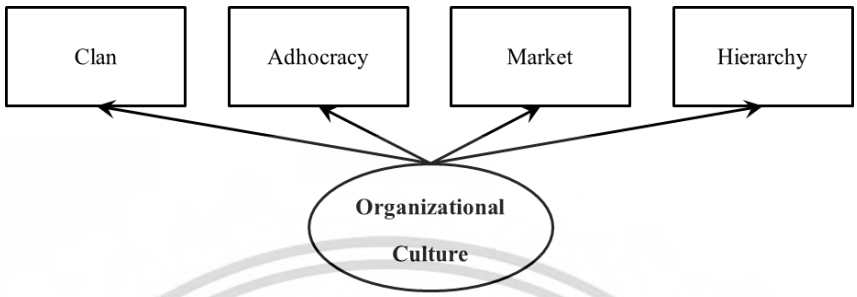


Figure 2.6 Model of Organizational Culture

2.4 Theories and Concepts of Corporate Social Responsibility

Corporate Social Responsibility means that companies should act in a way that enhances society and communities. And responsible for any action that affects people, communities, and the environment. This concept is rooted in the etymology of the word Responsibility, which means "committing", which is a commitment to giving back to society and the stakeholders of the organization. The company may have to forgo some of its profits if the social impacts seriously affect some of its stakeholders or if funds can be used to have a positive social impact (Lawrence & Weber, 2020). Thompson, Peteraf, Gamble, and Strickland III (2018) have stated that the essence of socially responsible business behavior is that a company should balance strategic actions to benefit shareholders against the duty to be a good corporate citizen.

Corporate social responsibility (CSR) is the obligation toward society assumed by businesses (Ferrell, Fraedrich, & Ferrell, 2017). Corporate social responsibility reflects the social imperatives and the social consequences of business practices; it consists broadly of policies and practices that reflect business responsibility for some wider societal good (Nalick, et al., 2016). This can range from local or small-scale problems to issues of politics, diplomacy, international relations, and peace through commerce (Westermann-Behaylo, Rehbein, & Fort, 2015). Interesting questions to contemplate include why past corporate irresponsibilities are easily forgotten, and

whether and how current managers of an organization should be held responsible for the irresponsible actions of the managers who came before them (Mena et al., 2016).

Lewis, Goodman, Fandt, and Michlitsch (2007) have stated that corporate social responsibility is a complex concept that resists precise definition. In a very general sense, corporate social responsibility can be thought of as the interaction between business and the social environment in which it exists. More specifically, it refers to the obligation that an organization has to operate in a way that benefits society. Most would agree that all organizations should act in a socially responsible manner. However, there are many views on the definition of what actions benefit society and to what degree. Whittington, et al. (2019) have stated that the regulatory environment may determine an organization's minimum obligations towards its stakeholders. However, stakeholders typically expect greater responsibility on the part of organizations, and managers' ethics are likely to set higher standards too. Corporate social responsibility (CSR) is the commitment by organizations to behave ethically and contribute to economic development while improving the quality of life of the workforce and their families as well as the local community and society at large. CSR is therefore concerned with how an organization exceeds its minimum legal obligations. Increasingly, a company's CSR stance becomes an integral part of the overall strategy itself: a reputation for social responsibility can be a source of competitive advantage. And Heizer, Render, and Munson (2017) have stated that companies that practice corporate social responsibility (CSR) introduce policies that consider environmental, societal, and financial impacts in their decision-making. As managers consider approaches to CSR, they find it helpful to consider the concept of creating shared value.

In addition, many scholars have given many definitions of corporate social responsibility. Hartman, DesJardins, and MacDonald (2018) have defined the responsibilities that businesses have to the societies within which they operate. In various contexts, it may also refer to the voluntary actions that companies undertake to address the economic, social, and environmental impacts of their business operations and the concerns of their principal stakeholders. Clegg, Kornberger, and Pitsis (2016) defined it as the explicit attempt by an organization to signal that it exceeds minimum legal obligations to stakeholders that are specified through regulation and corporate governance, often by extending the notion of stakeholders to be more inclusive. Ebert, Griffin, Dracopoulos, and Starke (2020) have stated that corporate social responsibility (CSR) refers to how a business

tries to balance its commitments to important individuals and groups in its external environment. Boddy (2017) defines it as the awareness, acceptance, and management of the wider implications of corporate decisions. Lawrence and Weber (2020) defined a corporation should act in a way that enhances society and its inhabitants and be held accountable for any of its actions that affect people, their communities, and their environment. And Peng (2018) has defined that corporate social responsibility (CSR) refers to the consideration of, and response to, issues beyond the narrow economic, technical, and legal requirements of the firm to accomplish social benefits along with the traditional economic gains that the firm seeks.

The literature review can summarize the definition of corporate social responsibility as shown in Table 2.7.

Table 2.7 Definition of Corporate Social Responsibility

Scholar/Researcher	Definitions
Lewis, Goodman, Fandt, and Michlitsch (2007)	The interaction between business and the social environment in which it exists. More specifically, the obligation that an organization has to society.
Clegg, Kornberger, and Pitsis (2016)	The explicit attempt by an organization to signal that it exceeds minimum legal obligations to stakeholders that are specified through regulation and corporate governance, often by extending the notion of stakeholders to be more inclusive.
Boddy (2017)	The awareness, acceptance, and management of the wider implications of corporate decisions.
Ferrell, Fraedrich, and Ferrell (2017)	The obligation toward society is assumed by businesses.
Heizer, Render, and Munson (2017)	Managerial decision-making that considers environmental, societal, and financial impacts.

Table 2.7 (Continue)

Scholar/Researcher	Definitions
Hartman, DesJardins, and MacDonald (2018)	The responsibilities that businesses have to the societies within which they operate. In various contexts, it may also refer to the voluntary actions that companies undertake to address the economic, social, and environmental impacts of their business operations and the concerns of their principal stakeholders.
Peng (2018)	Consideration of, and response to, issues beyond the narrow economic, technical, and legal requirements of the firm to accomplish social benefits along with the traditional economic gains that the firm seeks.
Thompson, Peteraf, Gamble, and Strickland III (2018)	A company's duty is to operate in an honorable manner, provide good working conditions for employees, encourage workforce diversity, be a good steward of the environment, and actively work to better the quality of life in the local communities where it operates and in society at large.
Whittington, et.al. (2019)	The commitment by organizations to behave ethically and contribute to economic development while improving the quality of life of the workforce and their families as well as the local community and society at large.
Ebert, Griffin, Dracopoulos, and Starke (2020)	The idea is that a business should balance its commitments to individuals and groups that are directly affected by the organization's activities.
Lawrence and Weber (2020)	A corporation should act in a way that enhances society and its inhabitants and be held accountable for any of its actions that affect people, their communities, and their environment.

From Table 2.7, the scholar and researcher gave various definitions of corporate social responsibility. In summary, in the context of the chemical industry in Thailand; Corporate Social

Responsibility refers to the chemical industry's commitment to behave ethically and create interactions between the business and the existing social environment. In particular, the commitments the organization has to society by recognizing, accepting, and managing the broad impact of corporate decisions taking into account the economic, social, and environmental impacts.

CSR actions and policies take into account stakeholders' expectations and often consider the triple bottom line of economic, social, and environmental performance (Flammer, 2013). The precise policies and practices underlying CSR lie at the discretion of the corporation. Some companies refer to their CSR practices in terms of sustainability, because these efforts maintain positive long-term relationships with communities, employees, customers, governments, and the natural environment (Matten & Moon, 2008).

According to University of Georgia business scholar Archie B. Carroll, corporate social responsibility rests at the top of a pyramid of a corporation's obligations, right up there with economic, legal, and ethical obligations. Some people might hold that a company's first and only duty is to make a profit. However, Carroll (2004) suggests the responsibilities of an organization in the global economy should take the following priorities, with profit being the most fundamental (base of the pyramid) and corporate citizenship at the top. These priorities are illustrated in the pyramid opposite. (See Figure 2.7)

Figure 2.7 Pyramid of Global Corporate Social Responsibility and Performance

Source: Carroll, 2004.

From Figure 2.7, Corporate Social Responsibility can be categorized (Carroll, 2004).

Economic responsibilities of a business organization's management are to produce goods and services that society wants at a price that perpetuates the business and satisfies its obligations to investors.

Legal responsibilities are to obey local, state, federal, and relevant international laws. Laws affecting corporation cover a wide range of requirements, from filing tax returns to meeting worker safety standards.

Ethical responsibilities include meeting other societal expectations, not written as law (Bateman, Snell, & Konopaske, 2019). An organization's management is to follow the generally held beliefs about behavior in a society. The affected people can get very upset if an organization's management fails to act according to generally prevailing ethical values (Wheelen, Hunger, Hoffman, & Bamford, 2018).

P**hilanthropic responsibilities** are additional behaviors and activities that society finds desirable and that the values of the business support. Examples include supporting community projects and making charitable contributions. Philanthropic activities can be more than mere altruism; managed properly, strategic philanthropy can become not an oxymoron but a way to build goodwill in a variety of stakeholders and even add to shareholder wealth (Godfrey, 2005: Wang & Qian, 2011). The difference between ethical and discretionary responsibilities is that few people expect an organization to fulfill discretionary responsibilities, whereas many expect an organization to fulfill ethical ones (Carroll, 1991).

Many believe that a 21st-century education must help students think about responsibilities beyond self-interest and profitability. Such an education teaches students to leave a legacy that extends beyond the bottom line (Giacalone, 2004). A transcendent education has five higher goals that balance self-interest with the responsibility to others: empathy (feeling your decisions as potential victims might feel them, to gain wisdom); generatively (learning how to give as well as take, to others in the present as well as to future generations); mutuality (viewing success not merely as personal gain, but a common victory); civil aspiration (thinking not just in terms of don'ts [lie, cheat, steal, kill], but also in terms of positive contributions); and intolerance of inhumanity (speaking out against unethical actions) (Bateman, Snell, & Konopaske, 2019).

The literature review can summarize the categories of corporate social responsibility as shown in Table 2.8.

Table 2.8 Literature review of Corporate Social Responsibility

Scholar/Researcher	Latent variables	Observed variables
Carroll (2004)	Corporate Social Responsibility	1. Economic responsibility 2. Legal responsibility 3. Ethical responsibility 4. Philanthropic responsibility
Lewis, Goodman, Fandt, and Michlitsch (2007)	Corporate Social Responsibility	1. Economic responsibility 2. Legal responsibility 3. Ethical responsibility 4. Philanthropic responsibility
Boddy (2017)	Corporate Responsibility	1. Economic responsibility 2. Legal responsibility 3. Ethical responsibility 4. Discretionary responsibility
Heizer, Render, and Munson (2017)	Corporate Social Responsibility	1. Environmental 2. Societal 3. Financial
Schermerhorn et al. (2017)	Corporate Social Responsibility	1. Economic responsibility 2. Legal responsibility 3. Ethical responsibility 4. Discretionary responsibility
Wheelen, Hunger, Hoffman, and Bamford (2018)	Social Responsibility	1. Economic 2. Legal 3. Ethical 4. Discretionary

Table 2.8 (Continue)

Scholar/Researcher	Latent variables	Observed variables
Achillas, Bochtis, Aidonis, and Folinas (2019)	Corporate Social Responsibility	1. Economic 2. Society 3. Environment
Bateman, Snell, and Konopaske (2019)	Corporate Social Responsibility	1. Economic responsibility 2. Legal responsibility 3. Ethical responsibility 4. Philanthropic responsibility
Kinicki and Williams (2020)	Corporate Social Responsibility	1. Economic responsibility 2. Legal responsibility 3. Ethical responsibility 4. Philanthropic responsibility
Lawrence and Weber (2020)	Corporate Social Responsibility	1. Social responsibility 2. Economic responsibility 3. Legal responsibility

From Table 2.8, it can be concluded that the observed variables for corporate social responsibility comprised 4 variables: 1) Economic responsibility, 2) Legal responsibility, 3) Ethical responsibility, and 4) Philanthropic responsibility. The following model comprised of 4 components was obtained, as shown in Figure 2.8.

Figure 2.8 Model of Corporate Social Responsibility

2.5 Introduction to Chemical Industry in Thailand

The chemical industry plays an important role in the sustainable development of the country by creating added value of agricultural products by bioprocessing them into environmentally friendly bio-based products containing Bio-Fuels, Bio-Chemicals, and Bio-Plastics. Encouraging research and development of products in the country continuously will have a positive effect on economic development society and the environment from the community level to the national level in a sustainable manner (Sukorndhaman, 2017).

The chemical industry uses various chemical and physical processes to turn raw materials into useful products. These processes help make raw materials more useful for chemical and commercial products. The chemical industry here covers many industries, the basic chemical industry, the petrochemical industry, and consumer chemical industry, etc (Knowledge of Chemical Industry, 2013).

"Chemical Industry" is a fundamental industry that is important in the development of the manufacturing and other service sectors of Thailand. At present, most of the chemical industry is an import substitution industry. Most of the operators are entrepreneurs in the downstream chemical industry of which approximately 75% are accounted for, and the remaining 25% are upstream and intermediate entrepreneurs. In addition, the downstream chemical industry is an industry that uses human resources, capital, and advanced manufacturing technology (Ministry of Industry, Office of Industrial Economics, Division of Industrial Economics Research, 2012). Therefore, this research will focus on studies in the downstream chemical industry only.

The upstream chemical industry uses relatively high raw materials and energy but has low labor costs. For example, in the production of sodium hydroxide and liquid chlorine, the proportion of raw material costs is 45%, energy is 50%, and labor is 5% (Ministry of Industry, Office of Industrial Economics, Division of Industrial Economics Research, 2012).

For the downstream chemical industry, raw material costs are also quite high. For example, the production of paints, pesticides, chemical fertilizers, detergents, and cosmetics, account for 82%, 80-90%, 85%, 73%, and 70% of raw material costs, respectively (Ministry of Industry, Office of Industrial Economics, Division of Industrial Economics Research, 2012).

The chemical industry has a high raw material cost. This is because most of the raw materials must be imported from foreign countries where they are monopolized or have few sellers in the world market. While the high energy costs are due to the production of the upstream chemical industry, it is a business that has to be produced 24 hours a day.

Chemical Industry Structure

The structure of the chemical industry originates from three major raw materials: oil and gas, minerals, and agricultural products.

1. Oil and Gas: The residual products from oil and natural gas refining are used as raw materials for the production of petrochemical products, plastic resins, polymers, other plastic raw materials, and plastic products.

2. Minerals: used as raw materials for the production of inorganic chemicals, organic chemicals, fertilizers, pesticides, and agricultural chemicals.

3. Agricultural products: used as raw materials for the production of biological chemicals.

The chemical industry can be classified according to the production process into 3 groups as follows (Suzuki, 1996):

1. Upstream Chemical Industry is a basic chemical industry that produces chemical products as raw materials for the production of various finished products. Upstream Chemical Industry is divided into 2 types:

1.1 Inorganic Chemicals a chemicals produced by chemical synthesis reactions such as acids, salts, alkalis, etc. In the past, the amount of chemical products has continued to increase due to the continuous demand for chemicals in the industry. The continual expansion of the economy has made the industry and investment sectors grow steadily. Most of the production of chemicals in Thailand is in the downstream chemical industry with the import of upstream chemical raw materials from abroad. This will be positive for the baht's tendency to appreciate. As a result, the cost of importing raw materials is reduced.

1.2 Organic Chemical is a chemical produced from carbon compounds present in living organisms such as citric acid, acetic acid, ethyl alcohol, etc.

2. Intermediate Chemical Industry is an industry that produces intermediate chemicals to be used as raw materials in the downstream chemical industry. Most of them are organic

chemicals derived from petroleum products such as vinyl chloride, ethylene glycol, linear alkylbenzene, and styrene, among others.

3. Downstream Chemical Industry is an industry that produces finished chemical products using raw materials from intermediate and upstream chemicals. According to the Ministry of Industry, Department of Industrial Works (2021) has stated that the downstream chemical industry in Thailand has factories authorized to operate under the Factory Act 1992 at the end of 2020. There are a total of 2,573 factories, divided into 5 industrial groups, namely, Chemical Fertilizer Industry, Chemical or Other Chemical Materials Industry, Pharmaceutical Industries, Cosmetic Industry, and Paint Industry and its associated products. Most of them are concentrated mainly in the central region, followed by the eastern, western, northeastern, southern, and northern regions, respectively. Details are shown in Table 2.9.

Table 2.9 Number of factories in Downstream Chemical Industry in Thailand

No.	Industrial Groups	Number of Factories in Downstream Chemical Industry							
		Region							
		Central	Eastern	Western	Northeastern	Southern	Northern	Sum	Percentage
1	Chemical Fertilizer Industry	459	70	139	81	22	19	790	30.70%
2	Chemical or Other Chemical Materials Industry	289	256	13	9	14	1	582	22.62%
3	Pharmaceutical Industries	391	54	7	17	2	11	482	18.73%
4	Cosmetic Industry	297	58	7	7	1	5	375	14.58%
5	Paint Industry and its associated products	267	56	8	10	2	1	344	13.37%
	Total	1,703	494	174	124	41	37	2,573	

Source: Ministry of Industry, Department of Industrial Works, 2021.

From Table 2.9, each industry group is as follows (Ministry of Industry, Office of Industrial Economics, Division of Industrial Economics Research, 2012):

1. Chemical Fertilizer Industry: There are 4 major operators with a market share of approximately 60-70% of the total market value, namely Chia Tai Company Limited, Thai Central Chemical Company Limited, Hydro Thai Company Limited, and Moseic International Company Limited. The demand for chemical fertilizers in 2011 was about 4.75 million tons, the import value in 2011 was about 83.4 billion baht, and the export value was 3.97 billion baht. Chemical fertilizers are divided into 2 types:

- Mono-element fertilizers are fertilizers that contain only one element of fertilizer, such as urea fertilizer, which contains only one nitrogen element, and potassium chloride, which contains only one element of potassium.

- Compound fertilizer is a fertilizer that contains 2 or 3 elements. For example, formula 16-20-0 contains only two elements nitrogen and phosphorus, while formula 15-15-15 contains nitrogen, phosphorus, and potassium.

2. Chemical or Other Chemical Materials Industry: especially chemical pesticides. Thailand does not produce upstream chemicals used for the production of pesticides. Therefore, the pesticides used in the country are mainly produced in foreign countries. Pesticide business operators in Thailand can be divided into two groups: multinational conglomerates and local conglomerates. Most multinational conglomerates will import active ingredients from their parent company abroad to mix with or import some ready-made pesticides that are used in a niche market. Most local companies import ready-made substances for sale.

3. Pharmaceutical Industries: Most of Thailand's pharmaceutical industry is in the downstream chemical industry, namely the production of finished drugs. Drugs produced in the country are generic drugs, which manufacturers will import active ingredients from abroad to mix and produce finished drugs in various forms. Most of the drugs produced are consumed mainly in the country (about 90% of the total production). In 2020, the value of drug sales in the country is expected to grow only 2.0-3.0% as a result of the decline in the number of hospital admissions, both Thais and foreigners. Due to concerns about infection during the COVID-19 outbreak and strict social distancing measures in the first half of 2020, drug sales through hospitals, which are the main market, slowed down (Krungsri Research, 2021).

4. Cosmetic Industry: Cosmetic products manufactured and sold locally include makeup or skincare preparations, hair preparations, oral and dental hygiene preparations, shaving preparations, take a shower, and deodorize including perfume. While the group that sells cosmetic products in the country is divided into 3 groups:

1) The group of distributors of products produced in the country and using the Thai brand. Most often it is a natural extract of cosmetics.

2) The group of distributors of cosmetics produced in the country with a license to use the trademark from the parent company abroad.

3) The group of cosmetic distributors produced abroad and imported directly from abroad. This group of cosmetics is a group of cosmetic brands that are well known widely and are popular and trusted by consumers for their product quality and long-established reputation, but they are quite expensive. Most of the popular products are cosmetic products for beauty, such as makeup or skincare products and perfumes.

5. Paint industry and its associated products: The paint industry is a downstream chemical industry. The growth of the paint industry depends on other industries that use paint as raw material, especially the automotive industry and the real estate industry. In the past, the automotive and real estate industries have grown continuously as a result of such factors affecting the expansion of the paint industry as well. The cost structure of paint production is approximately proportional to 1) Raw material cost 82%, 2) Labor cost 5%, 3) Energy cost 1%, and 4) Other expenses 12%.

The domestic paint market business can be classified into 4 main categories as follows:

1. Decorative Paint is a paint used for exterior and interior decoration of buildings used in the construction of homes, offices, and other buildings. The nature of the paint used to paint the building is water-based paint or plastic water-based paint.

2. Industrial Paint is a paint that is commonly used in various manufacturing industries such as the furniture manufacturing industry, electrical appliances, etc. It is also used in factory maintenance to prevent rust or prevent corrosion.

3. Heavy Duty Coating is a paint that is resistant to environmental conditions. Especially corrosive chemicals such as acids and alkalis are very good, for example, used in cement plants to prevent alkalis or some types must be resistant to abrasion, shockproof, and highly flexible, this type of paint is used for steel frameworks such as electric power plants, chemical factory, utilities such as pipe spray paint. It also includes the colors used to paint the boats.

4. Other products such as Varnish and Lacquer are used in combination with other paint products to create gloss, embossing cement. There is a mixture of latex and cement powder, used for spraying to create various patterns. As required traffic colors are used for traffic works that have both reflective and non-reflective types.

The Paint industry and its associated products in Thailand have approximately 301 operators registered with the Department of Industrial Works, totaling 9,308 workers, with a total investment of 10,179.39 million baht. There are approximately 5 large operators with a market share of about 90% in total Nippon Pend (Thailand) Co., Ltd., Jotun Thai Co., Ltd., Aichi Technical Services Co., Ltd., Thai Kansai Paint Co., Ltd., and TOA Paint (Thailand). Ltd.

Problems and obstacles.

The problems and obstacles of doing business in the chemical industry can be categorized into areas that are consistent with the Triple Bottom Line, economic, social, and environmental concepts. The details are as follows.

1. Economic: The overall chemical industry in 2020 is expected to expand by 0.73% compared to 2019, and exports are expected to contract by 6.60% due to the impact of the COVID-19 epidemic, causing the global economy to slow down. The cause of the decline in demand and imports is expected to contract by 7.53%, as detailed below (Ministry of Industry, Office of Industrial Economics, Division of Industrial Economics Research, 2021).

Yield index

In 2020, the index is expected to be 101.06, or 0.73% growth compared to 2019. Products that contributed to the production index expanded, such as chemical fertilizers, a 21.21% growth, shampoo, an 8.26% growth, and detergents, a 2.50% growth. Details are shown in Figure 2.9.

Shipping Index

In 2020, the index is expected to be 98.99, or a 1.80% contraction compared to 2019. The products that resulted in the contraction of the shipping index the most were industrial paints, a contraction of 15.23% due to the spread of COVID-19 affecting downstream industries such as the automotive industry which has slowed production causing the demand for the product to decrease. Details are shown in Figure 2.9.

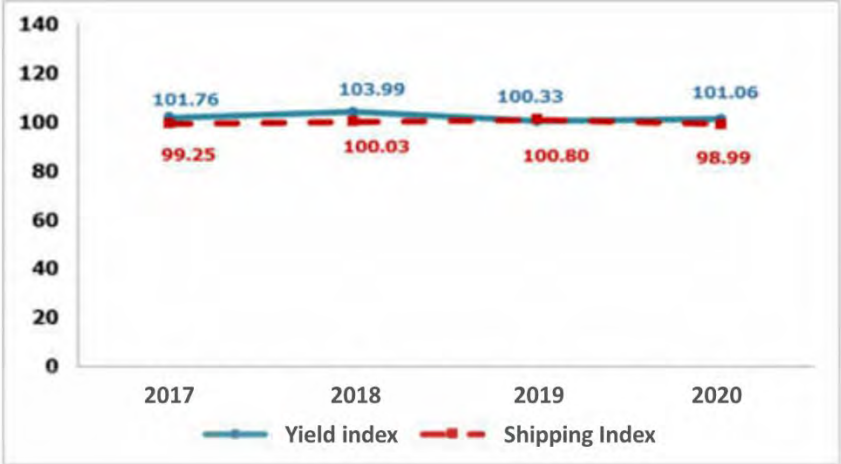


Figure 2.9 Yield Index – Shipping Index

Source: Ministry of Industry, the Office of Industrial Economics, Division of Industrial Economics Research, 2021.

Export of chemical products

In 2020, it is expected to be valued at $7,997.82 million, a contraction of 6.60% compared to 2019. Products with a contraction in value include cosmetics, a contraction of 22.03%, organic chemicals, a contraction of 12.33%, and inorganic chemicals a contraction of 9.65%. Details are shown in Figure 2.10.

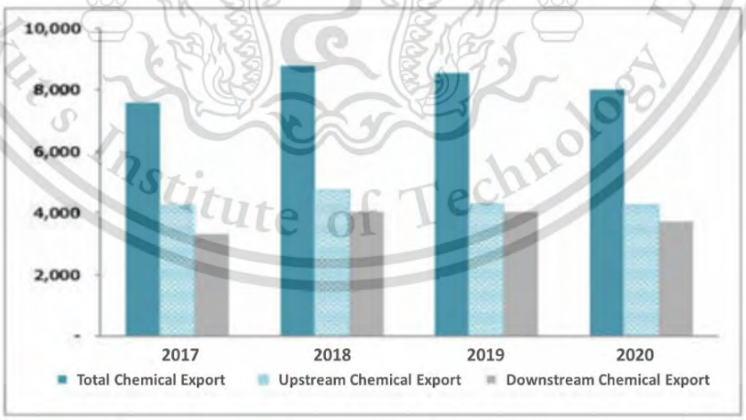


Figure 2.10 Export value (million USD)

Source: Ministry of Industry, the Office of Industrial Economics, Division of Industrial Economics Research, 2021.

Import of chemical products

In 2020, it is expected to be valued at $14.375.37 million, a contraction of 7.53% compared to 2019. The products with the biggest contraction in value are cosmetics, a contraction of 26.65%. Details are shown in Figure 2.11.

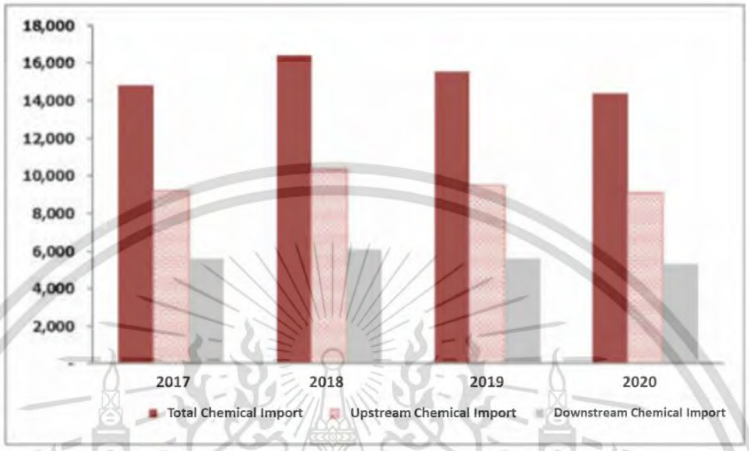


Figure 2.11 Import value (million USD)

Source: Ministry of Industry, the Office of Industrial Economics, Division of Industrial Economics Research, 2021.

Chemical Industry Trends in 2021

In the chemical industry in 2021, the yield index and exports are expected to grow by 2-3% compared to 2020. Factors affecting the expansion, such as curbing the spread of COVID-19, the recovery of the global economy, and government stimulus measures.

2. Social and environmental: Chemical events are likely to occur frequently and when they do occur often affect the health of workers, people living nearby, and the environment such as chemical spills, chemical transport accidents, landfill fires, and other incidents (Ministry of Public Health, Department of Disease Control, Bureau of Occupational and Environmental Diseases (BOED), 2020: Ministry of Public Health, Department of Disease Control, Bureau of Occupational and Environmental Diseases (BOED), 2021).

Chemical disaster incidents are classified by the nature of events

Data from January 1 to June 31, 2020, found that a total of 40 chemical disasters occurred, details are shown in Figure 2.12.

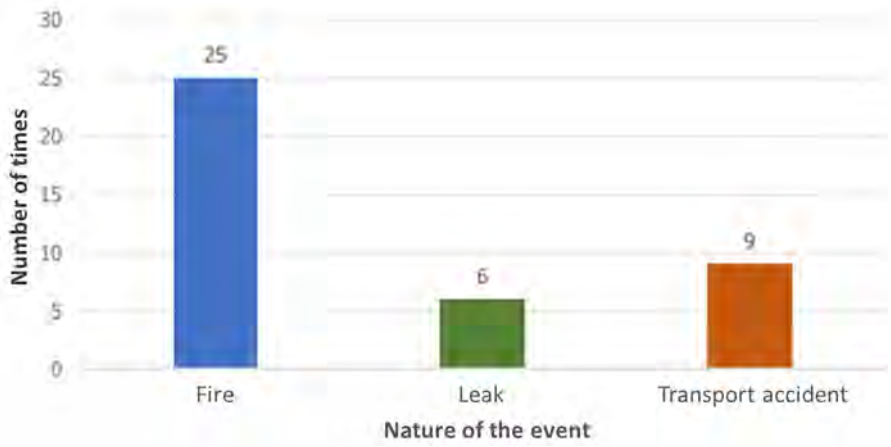


Figure 2.12 Nature of chemical disaster incidents in the first 6 months of 2020

Source: Ministry of Public Health, Department of Disease Control, Bureau of Occupational and Environmental Diseases (BOED), 2020.

Data from July 1 to December 31, 2020 found that a total of 19 chemical disasters occurred, details are shown in Figure 2.13.

Figure 2.13 Nature of chemical disaster incidents in the last 6 months of 2020

Source: Ministry of Public Health, Department of Disease Control, Bureau of Occupational and Environmental Diseases (BOED), 2021.

Chemical disaster incidents classified by type of causative material

Chemical disaster incidents classified by type of causative material, Data from January 1 to June 31, 2020, details are shown in Figure 2.14.

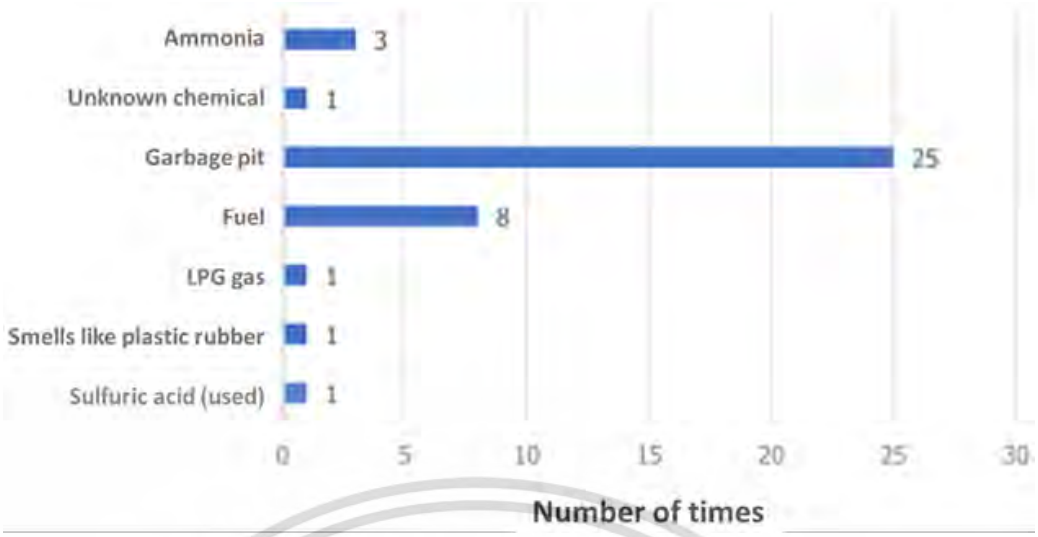


Figure 2.14 Materials that cause chemical disaster incidents in the first 6 months of 2020

Source: Ministry of Public Health, Department of Disease Control, Bureau of Occupational and Environmental Diseases (BOED), 2020.

Chemical disaster incidents classified by type of causative material, Data from July 1 to December 31, 2020, details are shown in Figure 2.15.

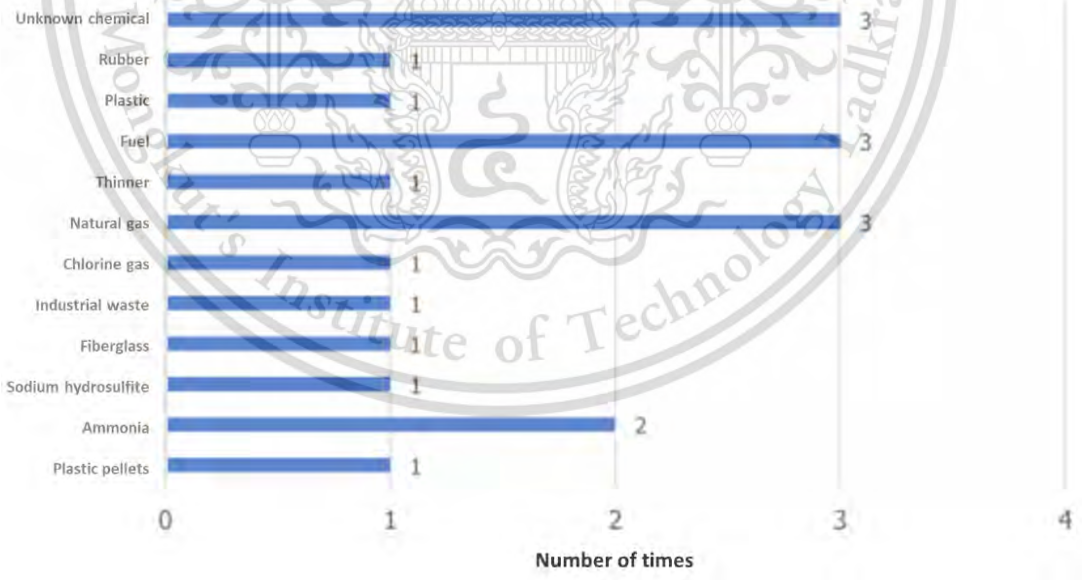


Figure 2.15 Materials that cause chemical disaster incidents in the last 6 months of 2020

Source: Ministry of Public Health, Department of Disease Control, Bureau of Occupational and Environmental Diseases (BOED), 2021.

Chemical disaster incidents classified by accident site

Chemical disaster incidents classified by accident site during January 1 to June 31, 2020, details are shown in Figure 2.16.

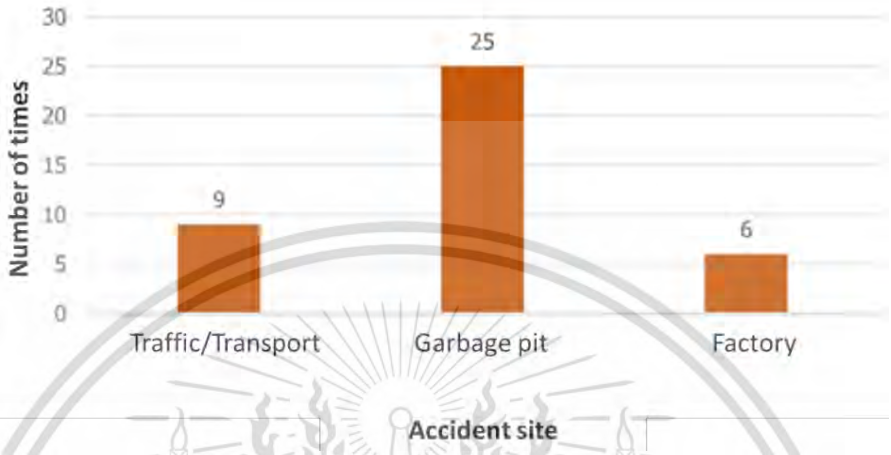


Figure 2.16 Chemical disaster site in the first 6 months of 2020

Source: Ministry of Public Health, Department of Disease Control, Bureau of Occupational and Environmental Diseases (BOED), 2020.

Chemical disaster incidents classified by accident site during July 1 to December 31, 2020, details are shown in Figure 2.17.

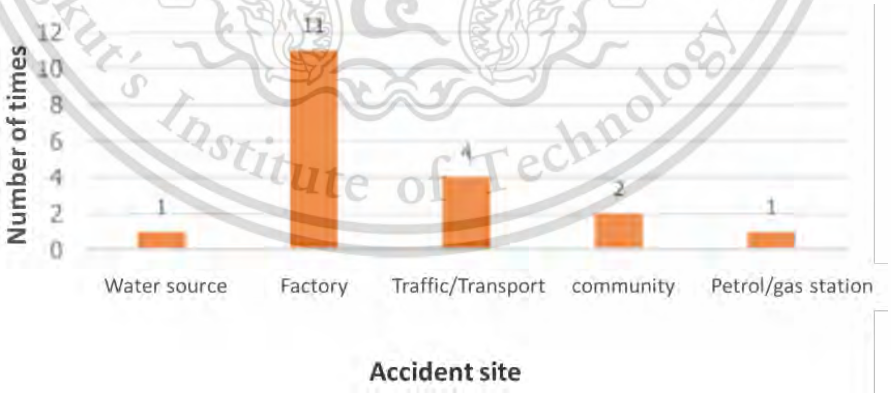


Figure 2.17 Chemical disaster site in the last 6 months of the year 2020

Source: Ministry of Public Health, Department of Disease Control, Bureau of Occupational and Environmental Diseases (BOED), 2021.

Chemical disaster incidents classified by area

Chemical disaster incidents classified by area during January 1 to June 31, 2020, details are shown in Figure 2.18.

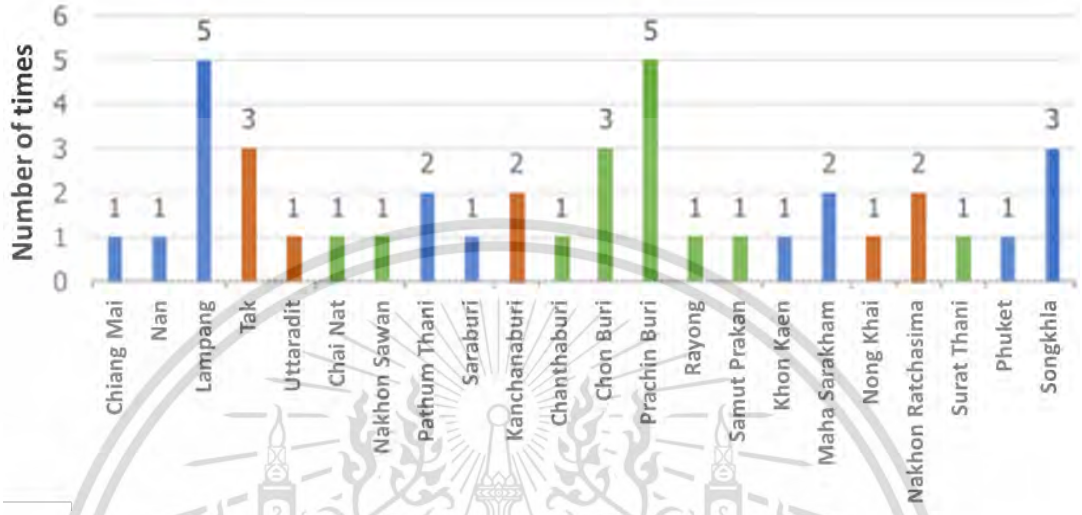


Figure 2.18 Chemical disaster area in the first 6 months of the year 2020

Source: Ministry of Public Health, Department of Disease Control, Bureau of Occupational and Environmental Diseases (BOED), 2020.

Chemical disaster incidents classified by area during July 1 to December 31, 2020, details are shown in Figure 2.19.

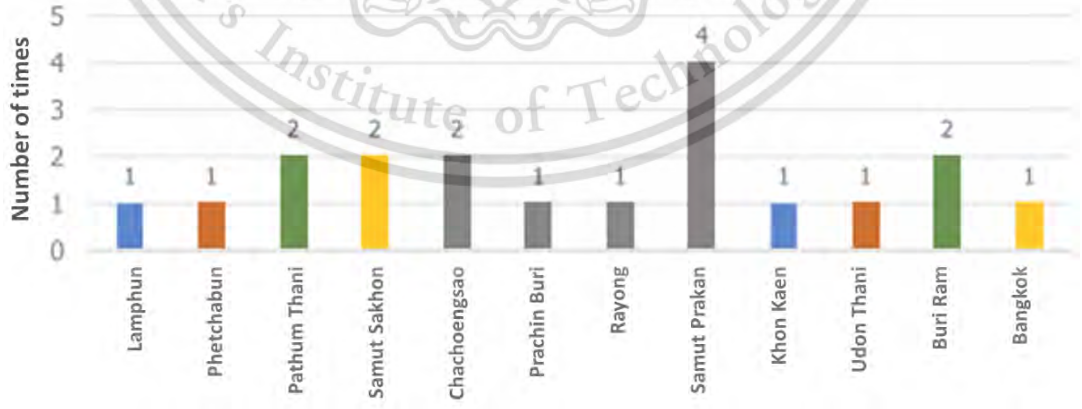


Figure 2.19 Chemical disaster area in the last 6 months of the year 2020

Source: Ministry of Public Health, Department of Disease Control, Bureau of Occupational and Environmental Diseases (BOED), 2021.

3. Production factors: Because chemical raw materials have a complex chemical structure. It requires high-tech research and development and Thailand has little investment in this area. In addition, raw materials produced in the country are still not up to standard, causing most of the chemical industry to rely on imports and high production costs.

4. Database aspect: Most of the chemical industry lacks a network of database links. This results in a lack of knowledge in the production process, trading, and marketing, which makes the development of the chemical industry rather slow and at a disadvantage in competition.

5. Regulatory: Nowadays, international trade patterns are changing more freely, leading many countries to try to set up non-tariff barriers (NTBs). As a barrier to trade more to protect yourself and reduce competition by trying to come up with various measures in trade negotiations, such as setting environmental measures, product standards, labor standards, etc. The world has begun to pay attention to environmental management and the rising energy crisis problem. Consumers in each country have become aware and turned to consuming environmentally friendly products. There is also a growing demand for products that have been through efficient energy management systems. This may partly be due to the importance of safety and health and the environment in the country. From such factors, many countries have begun to push for the issuance of various policies, measures, and regulations. By focusing on the issue of strict importing products which must have acceptable production standards from the production process level to the delivery of the product to maintain the quality of the product. The most obvious is European Union the regulations on chemical control in the European Union, REACH, have been issued. These regulations have many different effects on the Thai industry. This increases the cost of production because the information required by the regulations has to be prepared. Exports are more difficult or there may be trade diversions or relocation of production bases to other countries. Therefore, entrepreneurs need to improve and develop technology to produce products according to the said regulations. If not able to adapt, it will reduce the ability to compete. Therefore, the government has to play a role in helping Thai entrepreneurs.

2.6 Variable Relationship Analysis

From the study of the factors influencing sustainability of chemical industry in Thailand, the researcher examined and reviewed the literature and research related to the exogenous latent variables. The relationship between the variables was concluded as follows.

2.6.1 Relationship between Transformational Leadership and Sustainability

In recent years, managers have begun to address sustainability more directly as a competitive priority, rather than simply as a compliance issue. A priority on sustainability requires managers to maintain operations that are both profitable and not damaging to society or the environment. Governments, social groups, and consumers are placing increasing demands on companies to be more socially and environmentally responsible (Swink, Melnyk, & Hartley, 2020). From the literature review, various pieces of research were identified that examined transformational leadership and sustainability as follows.

Imran, Zahoor, and Zaheer (2012) studied "Leadership and Performance Relationship: Culture Matters". Transformational leadership was found to positively and significantly affect organizational performance along with the mediating role of organizational culture in the relationship between transformational leadership and organizational performance. The Structural equation model is shown in Figure 2.20.

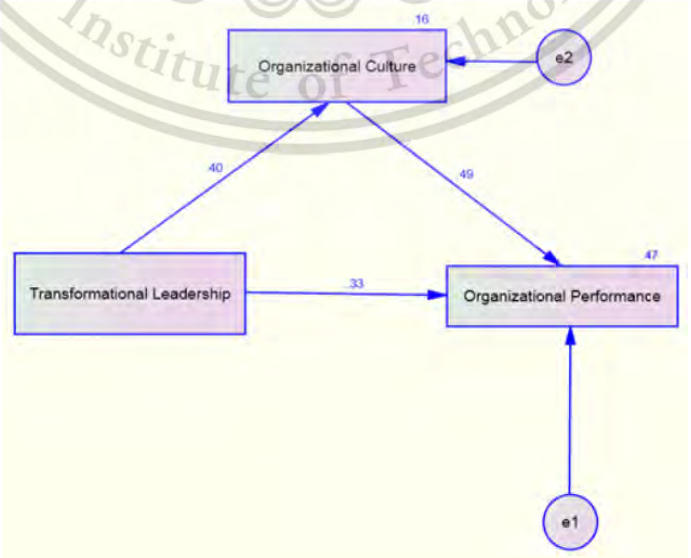


Figure 2.20 Structural equation model cited from Imran, Zahoor, and Zaheer (2012)

Alrowwad, Obeidat, Tarhini, and Aqqad (2017) studied "The Impact of Transformational Leadership on Organizational Performance via the Mediating Role of Corporate Social Responsibility: A Structural Equation Modeling Approach". The results of the data were transformational leadership did not have a positive influence on organizational performance. The proposed model is shown in Figure 2.21.

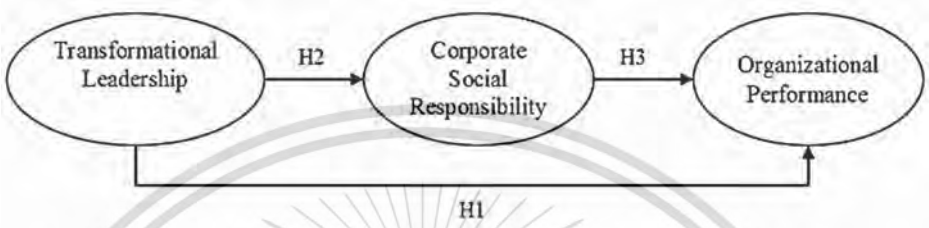


Figure 2.21 Proposed model cited from Alrowwad, Obeidat, Tarhini, and Aqqad (2017)

Khan, Ali, and Olya (2018) studied "Transformational Leadership, Corporate Social Responsibility, Organizational Innovation, and Organizational Performance: Symmetrical and Asymmetrical Analytical Approaches". The PLS-SEM results show that both the direct and indirect effects of transformational leadership on performance are significant.

Abbas and Bakr (2019) conducted a study "Transformational Leadership, Organizational Culture, and Sustainability at the Property Development Companies in Malaysia." The findings of this study revealed a positive and significant relationship between transformational leadership and sustainability. The conceptual model is shown in Figure 2.22

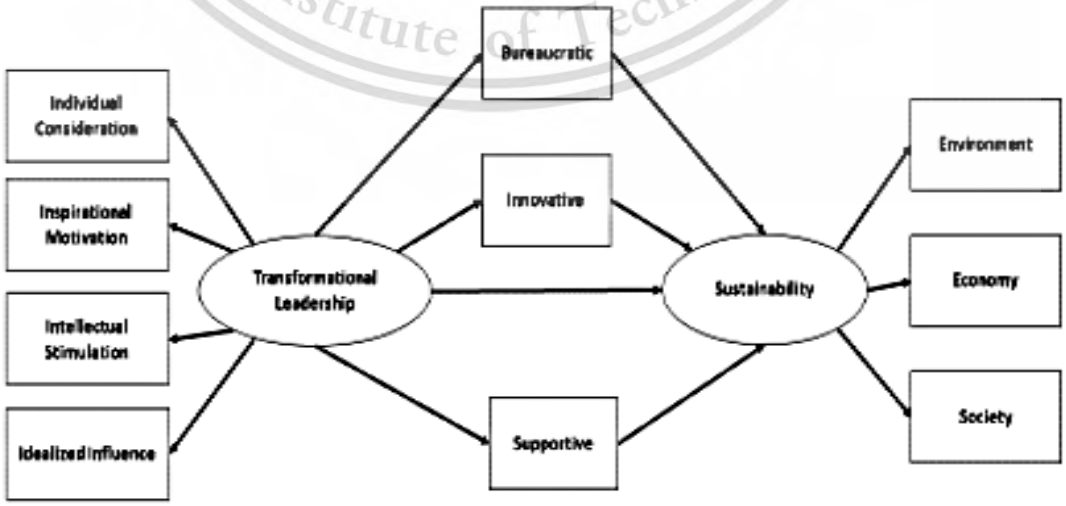


Figure 2.22 Conceptual model cited from Abbas and Bakr (2019)

Burawat (2019) conducted a study "The relationships among transformational leadership, sustainable leadership, lean manufacturing, and sustainability performance in the Thai SME manufacturing industry." The model reported that lean manufacturing has a partially mediated effect on the relationship between transformational leadership and sustainability performance. The proposed model is shown in Figure 2.23.

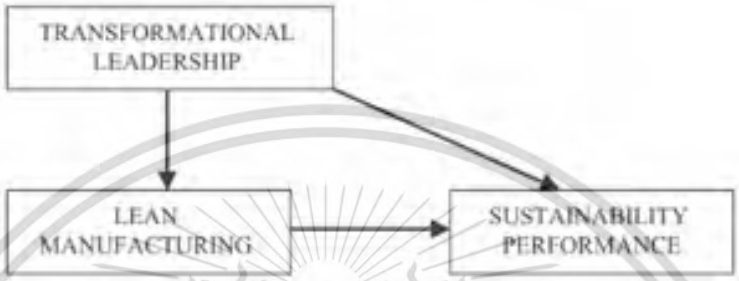


Figure 2.23 Proposed model cited from Burawat (2019)

Begum, Xia, Mehmood, Iftikhar, and Li (2020) conducted a study titled "The Impact of CEOs' Transformational Leadership on Sustainable Organizational Innovation in SMEs: A Three-Wave Mediating Role of Organizational Learning and Psychological Empowerment." The findings highlight the strategic significance of transformational leadership and its influence on sustainable organizational innovation for SMEs. The conceptual model is shown in Figure 2.24.

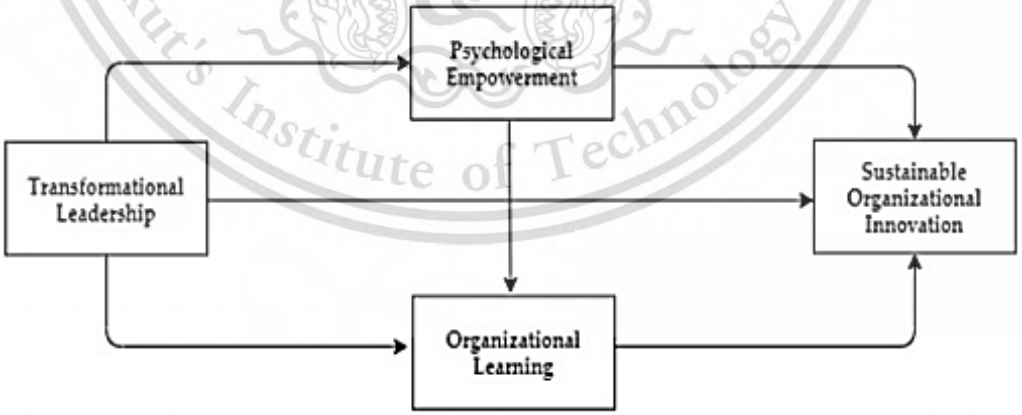


Figure 2.24 Conceptual model cited from Begum, Xia, Mehmood, Iftikhar, and Li (2020)

Mona, Suharto, and Subagja (2020) conducted a study "The Influence of Transformational Leadership Style and Organizational Culture on Organizational Performance with Emotional

Intelligence as a Mediation Variables: A Case Study at the Jatimelati Bekasi Village Office." Based on the result that partially, it shows that there is a positive and significant influence between transformational leadership style variables on organizational performance variables. The simultaneous path analysis model is shown in Figure 2.25.

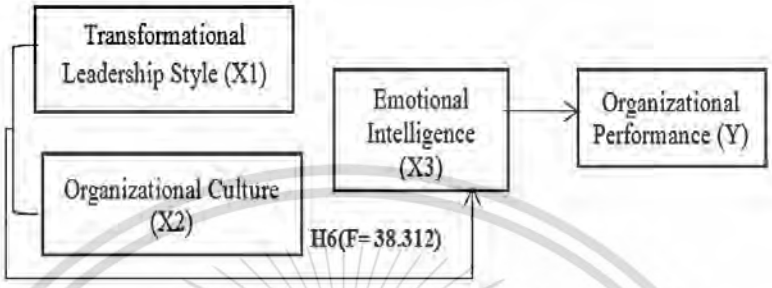


Figure 2.25 Simultaneous path analysis model cited from Mona, Suharto, and Subagja (2020)

Munford (2020) studied "Transformational Leadership and Fiscal Sustainability in Africa". The results of the multiple regression analysis indicated the model significantly predicted fiscal sustainability. Leaders who stimulate followers' critical thinking and problem-solving skills have a higher propensity for ensuring financial sustainability.

Shah, Jintian, Sukamani, and Kusi (2020) conducted a study "How Green Transformational Leadership Influences Sustainability? Mediating Effects of Green Creativity and Green Procurement." This study examined how green transformational leadership played for green building sustainability. The conceptual model is shown in Figure 2.26.

Figure 2.26 Conceptual model cited from Shah, Jintian, Sukamani, and Kusi (2020)

Villca and Castillo (2020) conducted a study. “Sustainable management model to strengthen competitiveness in “Supermarket” retail companies in the region of Coquimbo, Chile." The purpose of this research is to analyze the factors affecting sustainable management. It has been determined that the previously mentioned constructs account for 81.6% of the sustained management variance. The causal model is shown in Figure 2.27.

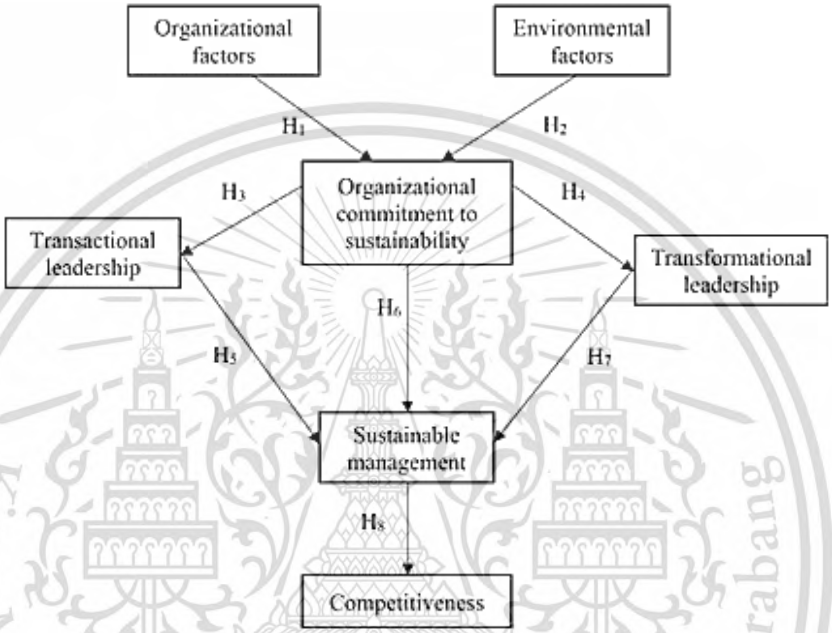


Figure 2.27 Conceptual framework cited from Villca and Castillo (2020)

Ullah et al. (2021) conducted a study “Achieving Organizational Social Sustainability through Electronic Performance Appraisal Systems: The Moderating Influence of Transformational Leadership.” Results confirmed the existence of definite contributions of the electronic performance appraisal system and transformational leadership towards organizational sustainability. The conceptual framework is shown in Figure 2.28.

Figure 2.28 Conceptual framework cited from Ullah et al. (2021)

From the literature review, it led to the hypothesis that transformational leadership has a positive influence on sustainability, as shown in the model in Figure 2.29.

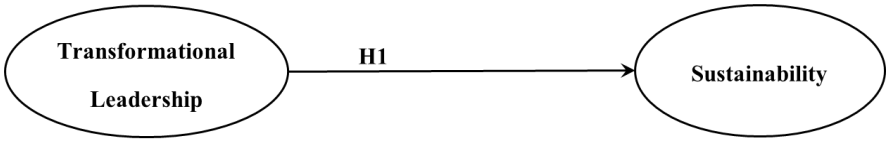


Figure 2.29 Model of hypothesis 1 (H1)

2.6.2 Relationship between Transformational Leadership and Organizational Culture

Transformational Leadership and Organizational Culture

All organizations develop a unique culture or character whereby employees share common values and beliefs about work-related issues. These organizational values typically include beliefs about leadership (Schein, 2004). In many cases, leaders, and particularly founders, are instrumental in creating and encouraging the culture (Nahavandi, 2015). From the literature review, various pieces of research were identified that examined transformational leadership and organizational culture as follows.

Imran, Zahoor, and Zaheer (2012) studied "Leadership and Performance Relationship: Culture Matters". Transformational leadership was found to positively and significantly affect organizational performance along with the mediating role of organizational culture in the relationship between transformational leadership and organizational performance. The Structural equation model is shown in Figure 2.30.

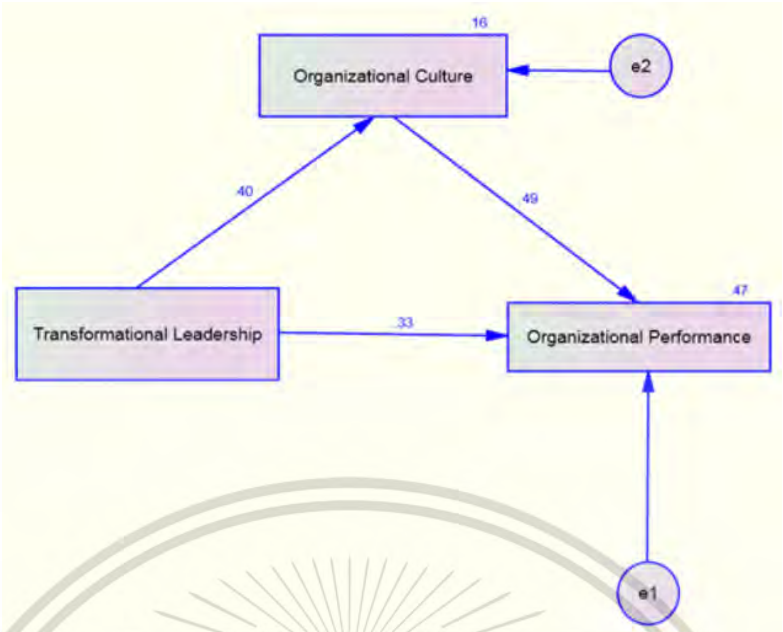


Figure 2.30 Structural equation model cited from Imran, Zahoor, and Zaheer (2012)

Shim, Jo, and Hoover (2015) conducted a study "Police Transformational Leadership and Organizational Commitment: Mediating Role of organizational culture." The linkage between transformational leadership and commitment appears to be fully mediated by group culture.

Elshanti (2017) studied "Transformational Leadership Style and Organizational Learning: The Mediate Effect of Organizational Culture". The results demonstrated that organizational culture functioned as a full mediator between the transformational leadership style and organizational learning. The conceptual model is shown in Figure 2.31.

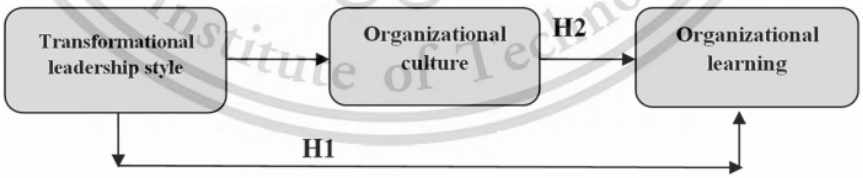


Figure 2.31 Conceptual model cited from Elshanti (2017)

Pradhan, Panda, and Jena (2017) conducted a study "Transformational leadership and psychological empowerment: The mediating effect of organizational culture in Indian retail industry." The purpose of this paper is to examine the role of transformational leadership in psychological empowerment in the Indian retail industry. The study also found partial mediation of organizational culture between transformational leadership and psychological empowerment.

Lutfi and Siswanto (2018) conducted a study "A Transformational Leadership and Its Implication on Employee Performance through Organizational Culture and Motivation." The result of this study showed that transformational leadership had an insignificant impact on employee performance through organizational cultural variables. The resulting model is shown in Figure 2.32.

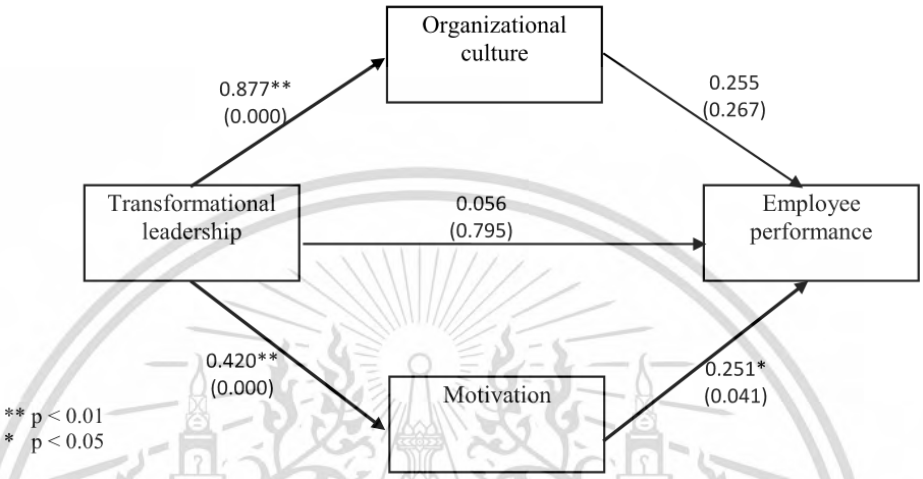


Figure 2.32 Result model cited from Lutfi and Siswanto (2018)

Chaabane (2019) Conducted a study on "The influence of organizational culture on the integration of CSR activities: Quantitative research within the Dutch oil and energy branch" Leadership can lead to the integration of CSR and organizational culture by providing meaning for employees, setting long-term goals, and raising awareness among employees about the importance of valuable outcomes. The conceptual model is shown in Figure 2.33.

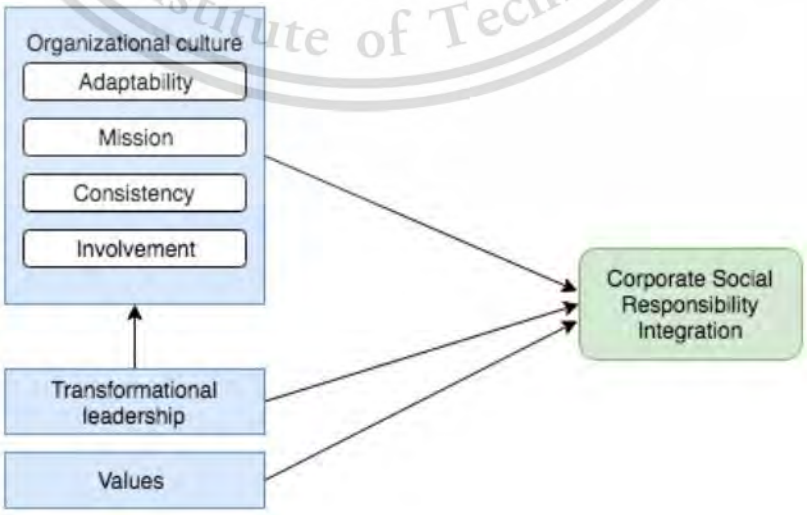


Figure 2.33 Conceptual model cited from Chaabane (2019)

Faraz, Yanxia, Estifo, and Kaukab (2019) conducted a study "The Impact of Transformational Leadership, Organizational Learning and Organizational Culture on Employee Innovative Work Behavior." Besides, emphasizes the importance of organizational culture and organizational learning as critical mediators between transformational leadership and employee innovative work behavior. The conceptual model is shown in Figure 2.34.

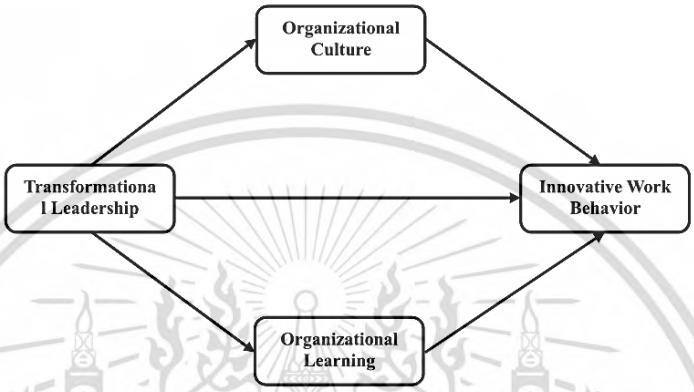


Figure 2.34 Conceptual model cited from Faraz, Yanxia, Estifo, and Kaukab (2019)

Rizki, Parashakti, and Saragih (2019) conducted a study "The Effect of Transformational Leadership and Organizational Culture towards Employees' Innovative Behavior and Performance." The conclusion is that transformational leadership has a significant effect on organizational culture. The Structural test model is shown in Figure 2.35.

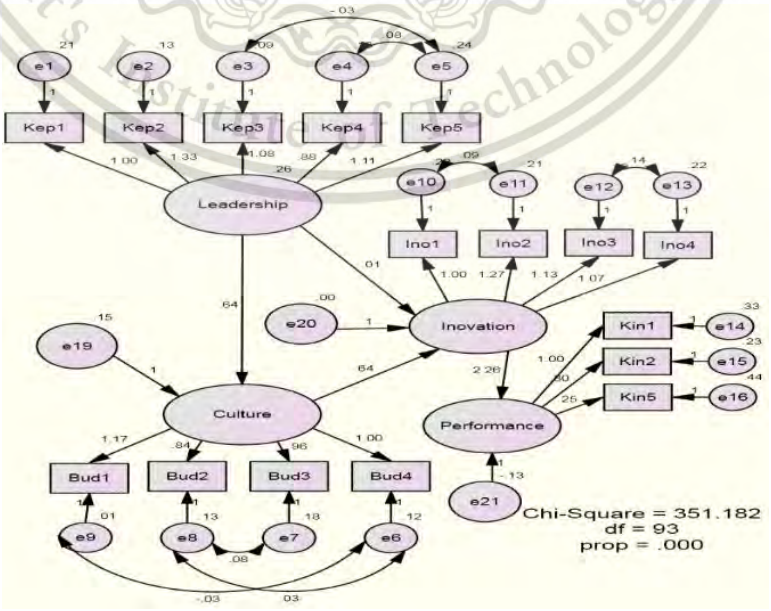


Figure 2.35 Structural test model cited from Rizki, Parashakti, and Saragih (2019)

Andreja, Kristijana, and SreČkoa (2020) conducted a study “How leaders can initiate knowledge management in organizations: Role of leadership style in building knowledge infrastructure.” Transformational leadership styles positively influence organizational culture.

Bakhsh, Aleem, Farooq, and Aziz (2020) conducted a study titled "The Mediating Effect of Organization Culture on the Relationship between Leadership Styles and Job Performance in Health Care Professionals at Tertiary Care Public Sector Hospital." The results of the Pearson Correlation were statistically significant. Multiple hierarchical regressions reveal leadership styles and common organizational cultures, explaining large variances in job performance and organization. Organizational culture mediates the relationship. The mediating effect model is shown in Figure 2.36.

Figure 2.36 Mediating effect model cited from Bakhsh, Aleem, Farooq, and Aziz (2020)

Hosseini, Hajipour, Kaffashpoor, and Darikandeh (2020) conducted a study “The mediating effect of organizational culture in the relationship of leadership style with organizational learning.” The result was leadership style had a positive and significant effect on organizational culture. Further, the results indicated that organizational culture significantly mediated the relationship between leadership style and organizational learning. The research model is shown in Figure 2.37.

Figure 2.37 Research model cited from Hosseini, Hajipour, Kaffashpoor, and Darikandeh (2020)

Khan, Ismail, Hussain, and Alghazali (2020) conducted a study "The Interplay of Leadership Styles, Innovative Work Behavior, Organizational Culture, and Organizational Citizenship Behavior." The statistical study exposes the mediating and moderating effects of organizational culture and OCB on a relationship. The conceptual model is shown in Figure 2.38.

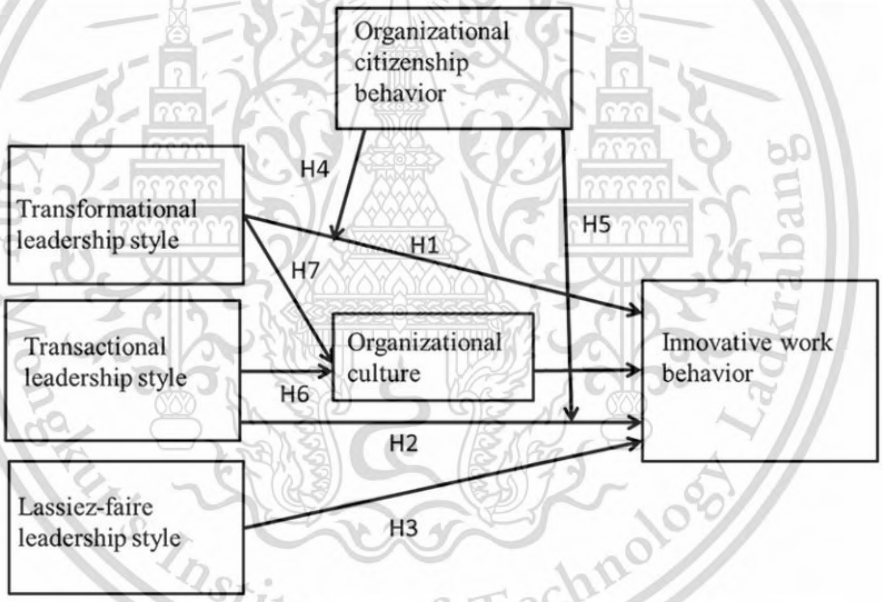


Figure 2.38 Conceptual model cited from Khan, Ismail, Hussain, and Alghazali (2020)

Park and Pierce (2020) conducted a study "Impacts of Transformational Leadership on Turnover Intention of Child Welfare Workers." The survey results indicated that the transformational leadership styles of local office directors had direct and negative effects on child welfare workers' turnover intentions. The conceptual model is shown in Figure 2.39.

Figure 2.39 Conceptual model cited from Park and Pierce (2020)

Acevedo and Avecillas (2021) study, "The Mediating Effect of Organizational Culture on Leadership and Performance in SME." This result suggests that SME leaders should focus on building a strong organizational culture because it will have a positive effect on the performance of the company.

From the literature review, led to the hypothesis that transformational leadership has a positive influence on organizational culture, as shown in the model in Figure 2.40.

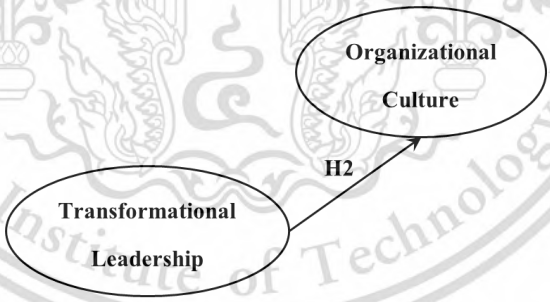


Figure 2.40 Model of hypothesis 2 (H2)

2.6.3 Relationship between Transformational Leadership and Corporate Social Responsibility

Corporate social responsibility is a manager's duty to take actions that will benefit the interests of society as well as the organization (Kinicki & Williams, 2020). The concept of social responsibility proposes that a private corporation has responsibilities to society that extend beyond making a profit. Such situations raise questions about the appropriateness of certain missions,

objectives, and strategies of business corporations. Managers must be able to deal with these conflicting interests ethically to formulate a viable strategic plan (Wheelen, Hunger, Hoffman, & Bamford, 2018). Companies that practice corporate social responsibility (CSR) introduce policies that consider environmental, societal, and financial impacts in their decision-making. As managers consider approaches to CSR, they find it helpful to consider the concept of creating shared value (Heizer, Render, & Munson, 2017). From the literature review, various pieces of research were identified that examined transformational leadership and corporate social responsibility as follows.

Alrowwad, Obeidat, Tarhini, and Aqqad (2017) studied "The Impact of Transformational Leadership on Organizational Performance via the Mediating Role of Corporate Social Responsibility: A Structural Equation Modeling Approach". The results of the data were transformational leadership did have a positive influence on corporate social responsibility. The proposed model is shown in Figure 2.41.

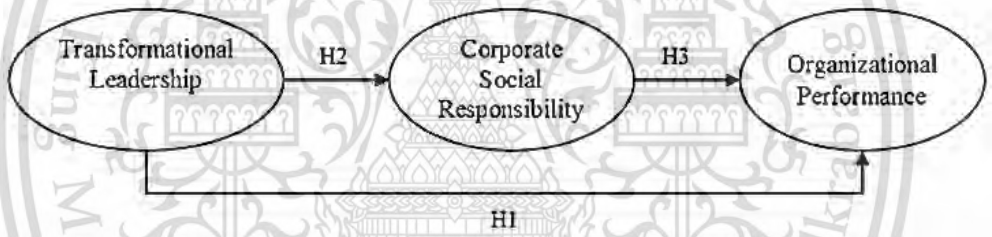


Figure 2.41 Proposed model cited from Alrowwad, Obeidat, Tarhini, and Aqqad (2017)

Khan, Ali, and Olya (2018) studied "Transformational Leadership, Corporate Social Responsibility, Organizational Innovation, and Organizational Performance: Symmetrical and Asymmetrical Analytical Approaches". The results reveal that a combination of CSR and transformational leadership leads to high performance.

Budur and Demir (2019) conducted a study "Leadership Effects on Employee Perception about CSR in the Kurdistan Region of Iraq." The results have shown us that ethical leadership plays a much more significant role in CSR practices toward employees than transformational leadership does. The study model is shown in Figure 2.42.

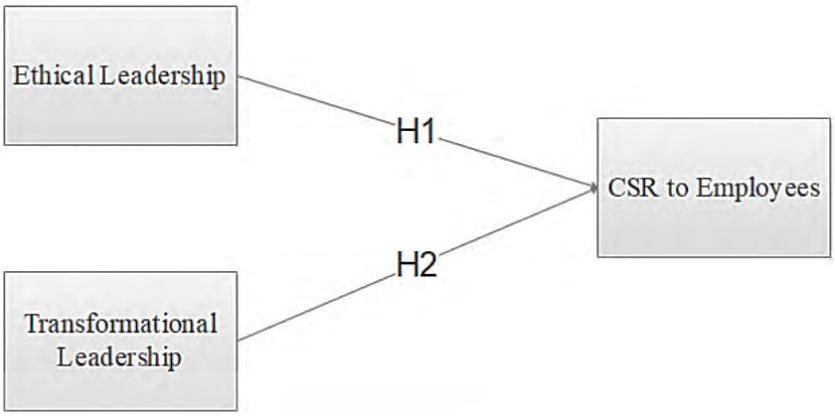


Figure 2.42 Study model cited from Budur and Demir (2019)

Chaabane (2019) conducted a study "The influence of organizational culture on the integration of CSR activities: Quantitative research within the Dutch oil and energy branch" The current study found that a linear relationship was expected between transformational leadership and CSR integration. The conceptual model is shown in Figure 2.43.

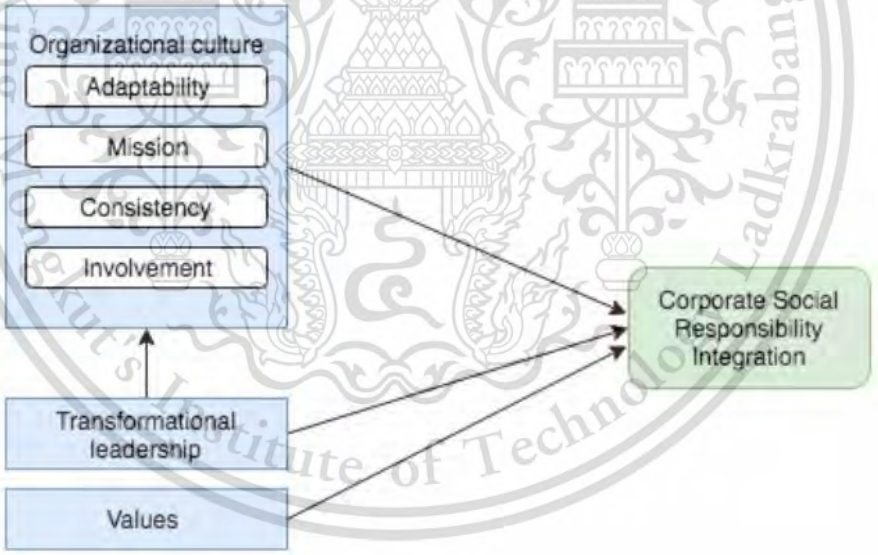


Figure 2.43 Conceptual model cited from Chaabane (2019)

Hongdao, Bibi, Khan, Ardito, and Nurunnabi (2019) conducted a study "Does What Goes around Really Comes Around? The Mediating Effect of CSR on the Relationship between Transformational Leadership and Employee's Job Performance in Law Firms." The study hypothesized that TL is significantly related to CSR; in addition, CSR mediates the relationship between TL and JP. The proposed model is shown in Figure 2.44.

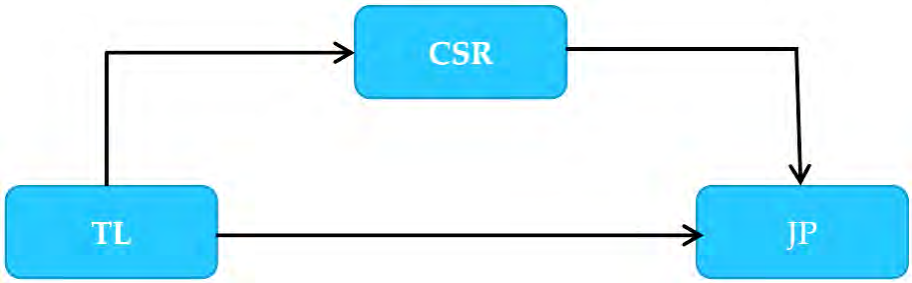


Figure 2.44 Proposed model cited from Hongdao, Bibi, Khan, Ardito, and Nurunnabi (2019)

Manzoor et al. (2019) conducted a study "The Impact of Transformational Leadership on Job Performance and CSR as Mediator in SMEs." The study finds that CSR significantly mediated the effect of transformational leadership on job performance. Based on these findings, it can be explicated that transformational leadership and CSR are important elements of an organization. The proposed model is shown in Figure 2.45.

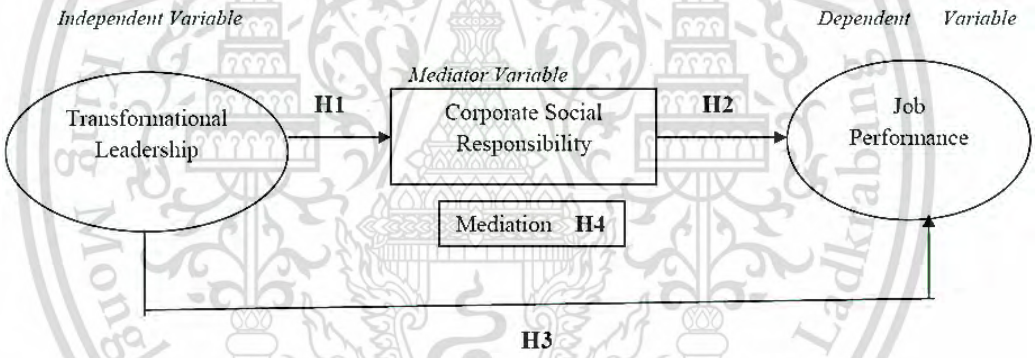


Figure 2.45 Proposed model cited from Manzoor et al. (2019)

Tefera, Yuanqiong, and Luming (2019) conducted a study "A link between top managers' perception and corporate social responsibility: Transformational Leadership as a Moderator. The result also shows transformational leadership has a moderating effect on the direct top managers' CSR perception and firm-level CSR relationship. The conceptual model is shown in Figure 2.46.

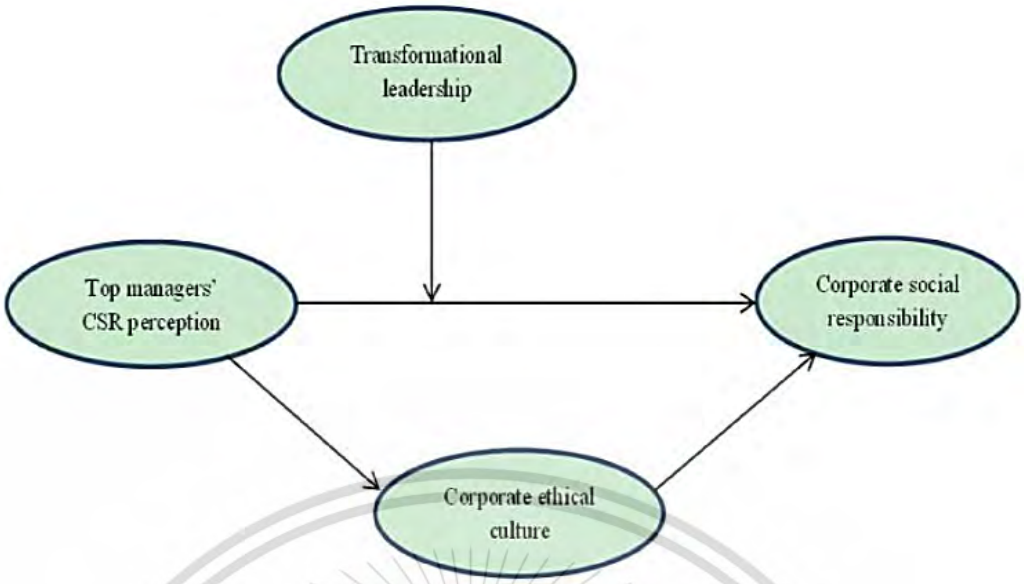


Figure 2.46 Conceptual model cited from Tefera, Yuanqiong, and Luming (2019)

Ali, Khan, and Yildiz (2020) conducted a study "Leadership Effects on CSR Employee, Media, Customer, and NGOs." This study provides a unique insight into the relationship between CSR and different types of leadership styles (EL and TL). The study finds out that both EL and TL have positive relationships with the variables M, E, C, and N. The study model is shown in Figure 2.47.

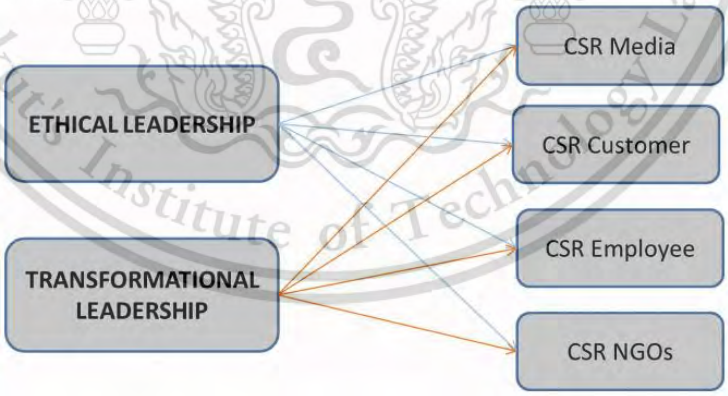


Figure 2.47 Study model cited from Ali, Khan, and Yildiz (2020)

K and Ranjit (2020) conducted a study on "Effect of transformational leadership on job performance: testing the mediating role of corporate social responsibility." TL affects CSR. CSR also showed finding of the study was the partial mediation of CSR in the TL–JP relationship. The theoretical model is shown in Figure 2.48.

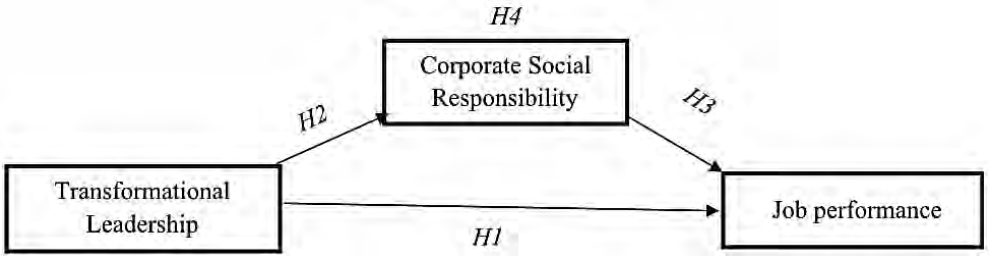


Figure 2.48 Theoretical model cited from K and Ranjit (2020)

Changar and Atan (2021) conducted a study "The Role of Transformational and Transactional Leadership Approaches on Environmental and Ethical Aspects of CSR." The study concluded that both transformational leadership approaches had positive impacts on the environmental and ethical aspects of CSR. The study proposes that the complementary implementation of transformational leadership approaches can lead to enhanced socially responsible actions in organizations. The research model is shown in Figure 2.49.

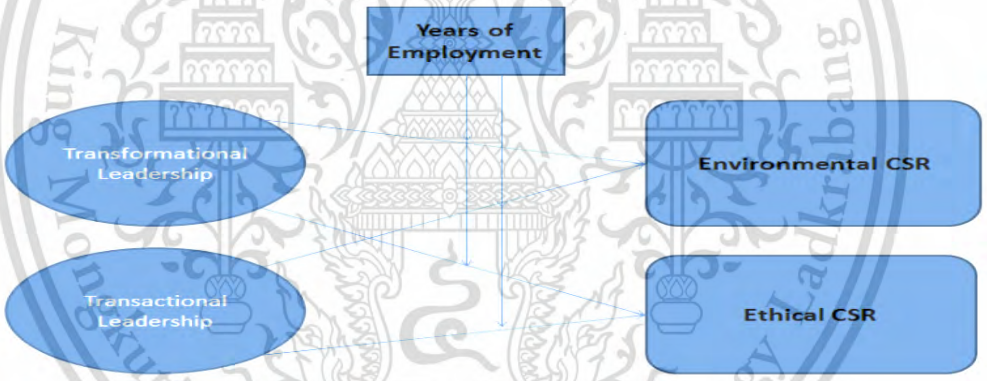


Figure 2.49 Research model cited from Changar and Atan (2021)

From the literature review, it led to the hypothesis that transformational leadership has a positive influence on corporate social responsibility, as shown in the model in Figure 2.50.

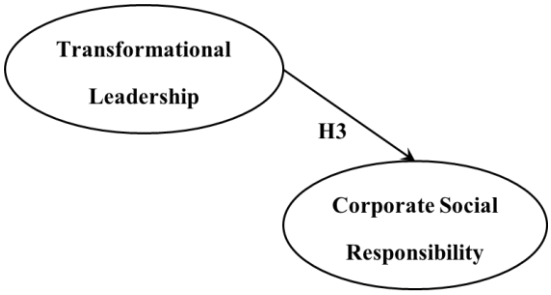


Figure 2.50 Model of hypothesis 3 (H3)

2.6.4 Relationship between Organizational Culture and Sustainability

Organizational culture comprises the shared set of beliefs, expectations, values, norms, and work routines that influence how members of an organization relate to one another and work together to achieve organizational goals. In essence, organizational culture reflects the distinctive ways in which organizational members perform their jobs and relate to others inside and outside the organization. When organizational members share an intense commitment to cultural values, beliefs, and routines and use them to achieve their goals. (Jones & George, 2019). Culture influences how people act in organizations—the ways employees relate to each other, to customers, to shareholders, and business partners. It drives behaviors and unites employees around a shared set of values (Trice & Beyer, 1993). The strong culture helped it rise to its success. The commitment to employees and long-held values of holistic practices and environmental responsibility are central to its culture. That is why an increasing number of organizations today are creating a positive and supportive working environment and, as a result, a great place for customers (Lewis, Goodman, Fandt, & Michlitsch, 2007). From the literature review, various pieces of research were identified that examined the organizational culture and sustainability as follows.

Linnenluecke and Griffiths (2010) conducted a study "Corporate sustainability and organizational culture." In this paper, we provide a closer examination of this suggested link between the cultural orientation of an organization and the pursuit of corporate sustainability principles. Specifically, we seek to assess (1) what constitutes a sustainability-oriented organizational culture, (2) whether organizations can display a unified sustainability-oriented organizational culture, and (3) whether organizations can become more sustainable through culture change.

Imran, Zahoor, and Zaheer (2012) studied "Leadership and Performance Relationship: Culture Matters". The mediating role of organizational culture in the relationship between transformational leadership and organizational performance. The Structural equation model is shown in Figure 2.51.

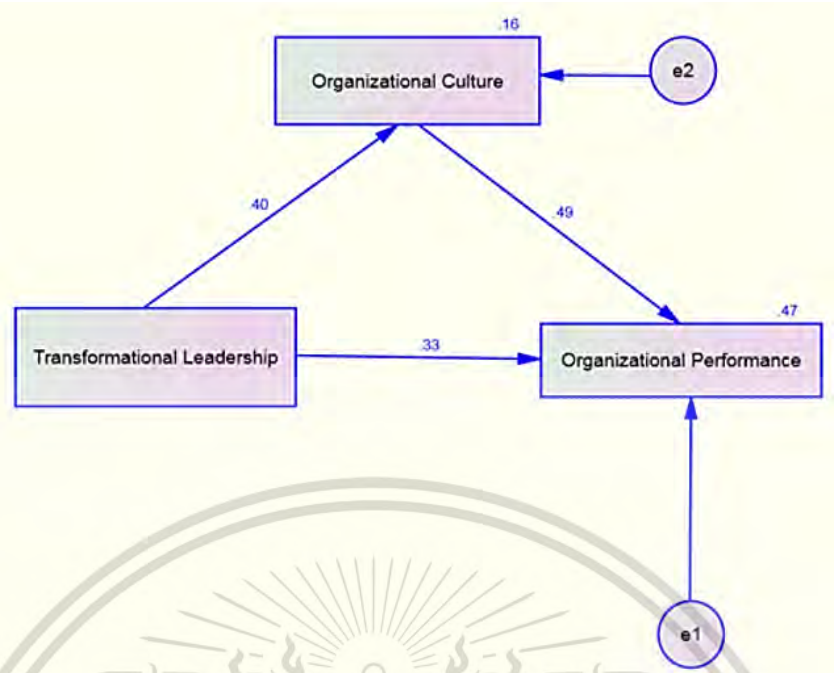


Figure 2.51 Structural equation model cited from Imran, Zahoor, and Zaheer (2012)

Ullah, Lai, and Marjoribanks (2013) studied "A Proposed Model for Business Sustainability Based on Business and Information Technology". In this paper, they present a theoretical framework for analyzing and understanding green computing in the context of building a sustainable business environment. Business culture is proposed as critical to an analysis of green computing. The proposed model is shown in Figure 2.52.

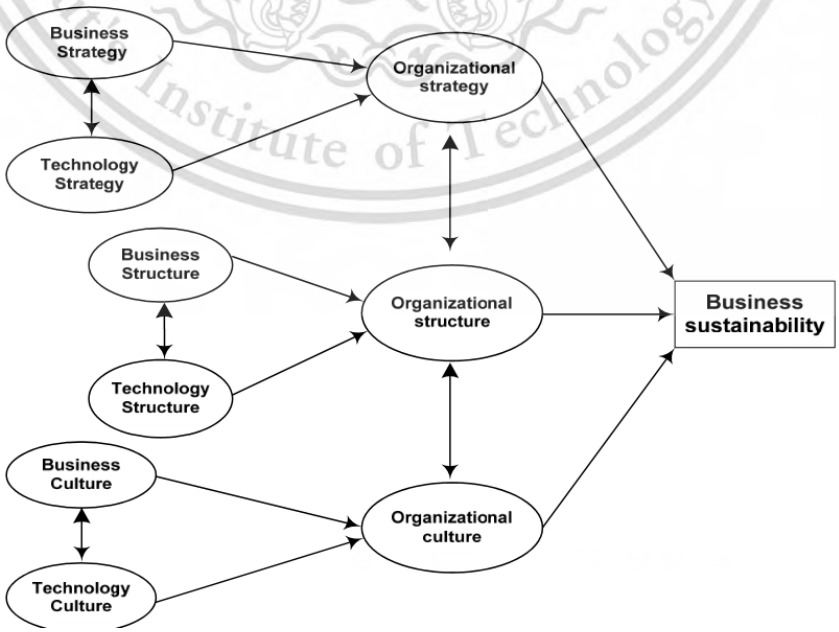


Figure 2.52 Proposed model cited from Ullah, Lai, and Marjoribanks (2013)

Bamgbade, Kamaruddeen, and Nawi (2015) conducted a study "Factors Influencing Sustainable Construction among Construction Firms in Malaysia: A Preliminary Study using PLS-SEM." This study explores the influence of organizational culture on the adoption of sustainable construction among G7 contractors operating in Peninsular Malaysia. The result shows that the measuring instruments are reliable and the data for the pilot study indicated strong evidence of rational validity. The research model is shown in Figure 2.53.

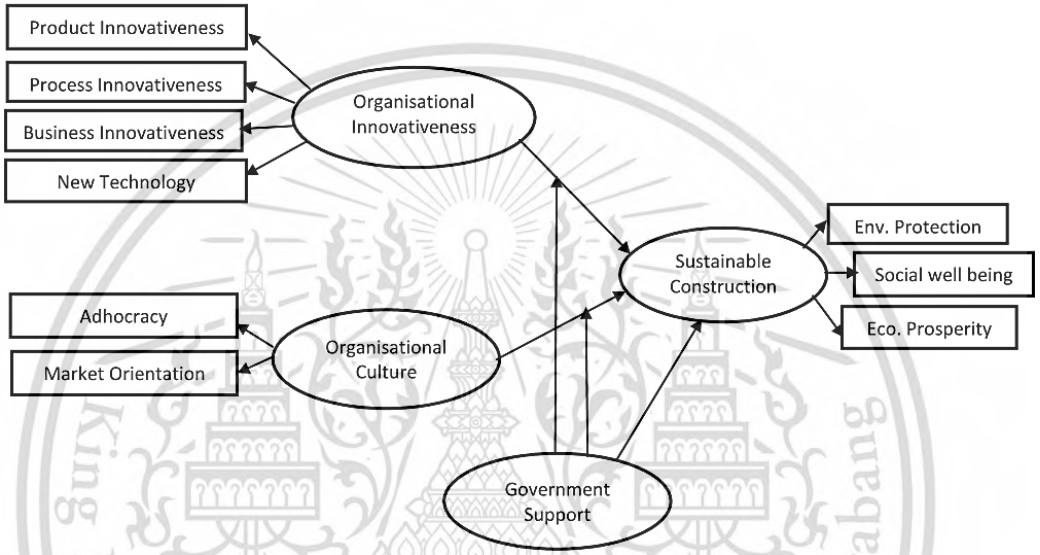


Figure 2.53 Research model cited from Bamgbade, Kamaruddeen, and Nawi (2015)

Indarti and Wijayanto (2015) conducted a study "Effect of Corporate Social Responsibility and Cultural Organization on Job Satisfaction and Business Performance." The result shows that Organizational culture has a significant role in influencing work satisfaction and business performance. The research model is shown in Figure 2.54.

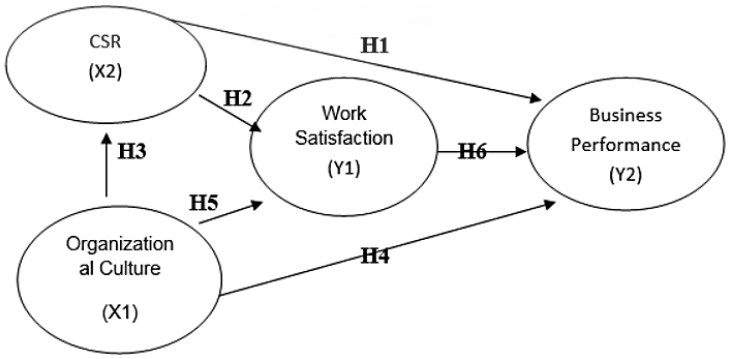


Figure 2.54 Research model cited from Indarti and Wijayanto (2015)

Dubey, Gunasekaran, Childe, Papadopoulos, Hazen, Giannakis, and Roubaud (2017) conducted a study "Examining the effect of external pressures and organizational culture on shaping performance measurement systems (PMS) for sustainability benchmarking: Some empirical findings." Organizational culture plays a different role in the differential effect of coercive pressures, normative pressures, and mimetic pressures on shaping PMS for sustainability benchmarking.

Dyck, Walker, and Caza (2019) conducted a study "Antecedents of Sustainable Organizing: A Look at the Relationship between Organizational Culture and the Triple Bottom Line." The findings provide support for the hypothesized relationships between the hierarchy culture and financially sustainable organizing, the clan culture and socially sustainable organizing and outcomes, and the market culture and ecologically sustainable outcomes. These results suggest that organizational culture is related to sustainability in predictable ways.

Iranmanesh, Zailani, Hyun, Ali, and Kim (2019) conducted a study "Impact of Lean Manufacturing Practices on Firms' Sustainable Performance: Lean Culture as a Moderator." It is also interesting to observe that lean culture positively moderated the effects of process and equipment and supplier relationships on sustainable performance. The proposed model is shown in Figure 2.55.

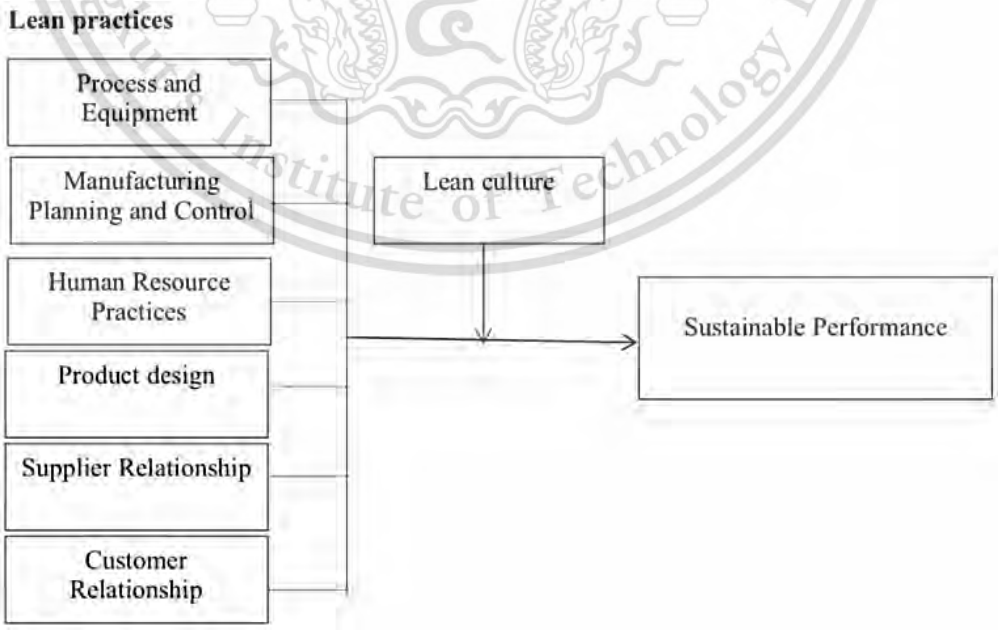


Figure 2.55 Proposed model cited from Iranmanesh, Zailani, Hyun, Ali, and Kim (2019)

Islam, Tseng, and Karia (2019) conducted a study "Assessment of Corporate Culture in Sustainability Performance Using a Hierarchical Framework and Interdependence Relations." This study investigates corporate culture attributes that are conducive to sustainability and forms these attributes as a measurement tool for assessing corporate sustainability performance. Corporate sustainability performance is highly dependent on cultural aspects. This study forms a measurement structure using cultural attributes to evaluate corporate sustainability performance.

Ketpraphakorn and Kantabutr (2019) conducted a study on "Cultural Development for Sustainable SMEs: Towards Behavioral Theory" This study arose from a "sustainable" cultural development approach of small and medium-sized enterprises (SMEs) that adopted the Thai philosophy of the sufficiency economy. Analysis reveals six emerging organizational culture development practices. The theoretical model is shown in Figure 2.56.

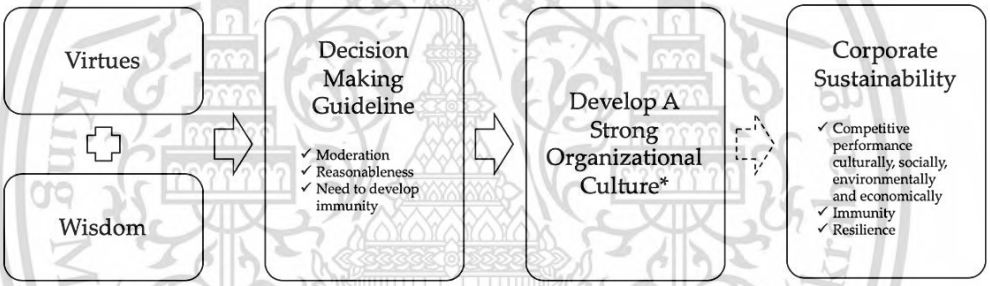


Figure 2.56 Theoretical model cited from Ketprapakorn and Kantabutra (2019)

Bakhsh, Aleem, Farooq, and Aziz (2020) conducted a study "The Mediating Effect of Organization Culture on the Relationship between Leadership Styles and Job Performance among Health Care Professionals at Tertiary Care Public Sector Hospital." The findings of the Pearson Correlation are statistically significant. The hierarchical multiple regressions revealed organizational culture explained the significant number of variances in job performance and Organization. The mediating effect model is shown in Figure 2.57.

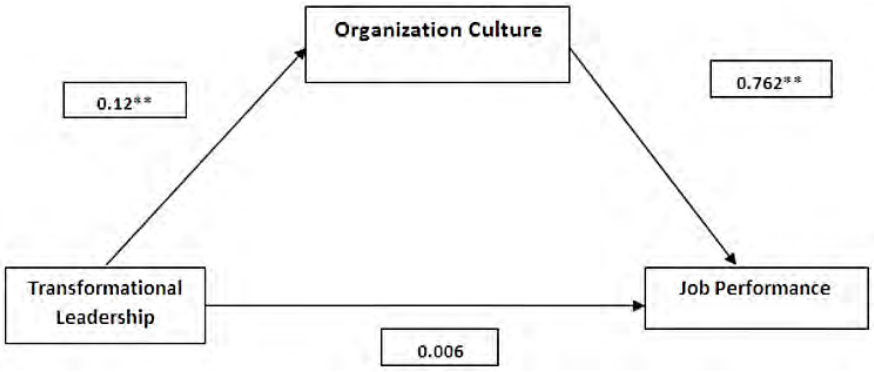


Figure 2.57 Mediating effect model cited from Bakhsh, Aleem, Farooq, and Aziz (2020)

Bhuiyan, Baird, and Munir (2020) conducted a study "The association between organizational culture, CSR practices and organizational performance in an emerging economy." The study also highlights the direct influence of organizational culture on both financial and non-financial performance. The conceptual model is shown in Figure 2.58.

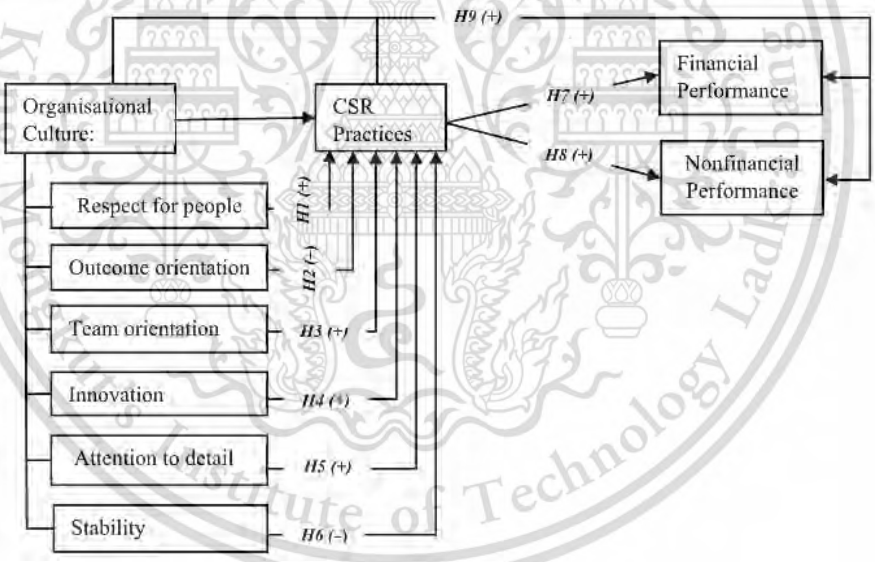


Figure 2.58 Conceptual model cited from Bhuiyan, Baird, and Munir (2020)

Metz, Ilies, and Nistor (2020) conducted a study on "The Impact of Organizational Culture on Customer Service Effectiveness from a Sustainable Perspective" The authors developed a design and an analysis model of the impact of organizational culture attributes on customer service performance. It emphasizes that the four characteristics of organizational culture are good predictors of improving customer service efficiency, which fosters an ethical business model and sustainable pursuit of economic, social, and environmental performance.

Mona, Suharto, and Subagja (2020) conducted a study "The Influence of Transformational Leadership Style and Organizational Culture on Organizational Performance with Emotional Intelligence as a Mediation Variables: A Case Study at the Jatimelati Bekasi Village Office." The results showed that simultaneously there was an influence of organizational culture on organizational performance, with emotional intelligence as an intervening variable. The simultaneous path analysis model is shown in Figure 2.59.

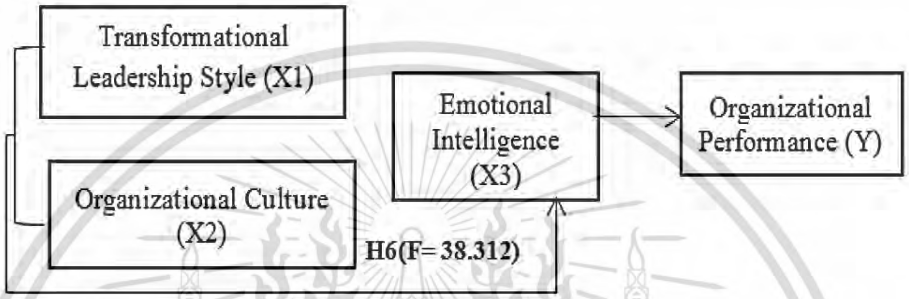


Figure 2.59 Simultaneous path analysis model cited from Mona, Suharto, and Subagja (2020)

Muliati, Iqbal, and Mayapada (2020) conducted a study on "The Effect of Organizational Culture on Firm Performance with Social Responsibility as Mediating Variable." Another finding shows that the organizational culture of SOE and ROE affects firm performance If the firm acts and reports corporate social responsibility. The results model is shown in Figure 2.60.

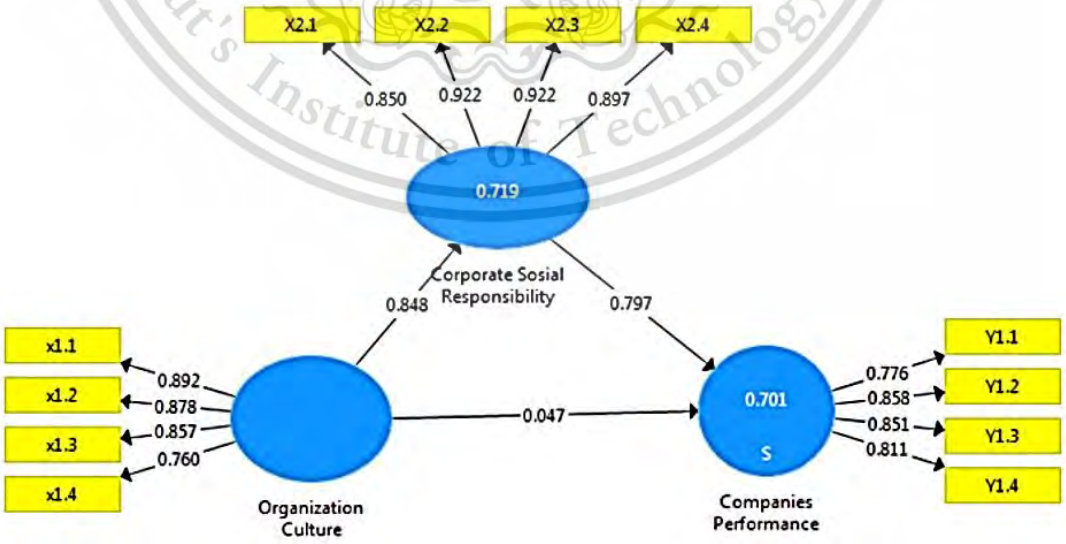


Figure 2.60 Results model cited from Muliati, Iqbal, and Mayapada (2020)

Srisathan, Ketkaew, and Naritarathon (2020) conducted a study on "The intervention of organizational sustainability in the effect of organizational culture on open innovation performance: A case of Thai and Chinese SMEs." This paper also demonstrates the significant impact of organizational culture on organizational sustainability in a cultural way that maintains the core competence of the business in terms of marketing, operations, customer orientation, capital management, and monitoring and sustainability assessment. The conceptual model is shown in Figure 2.61.

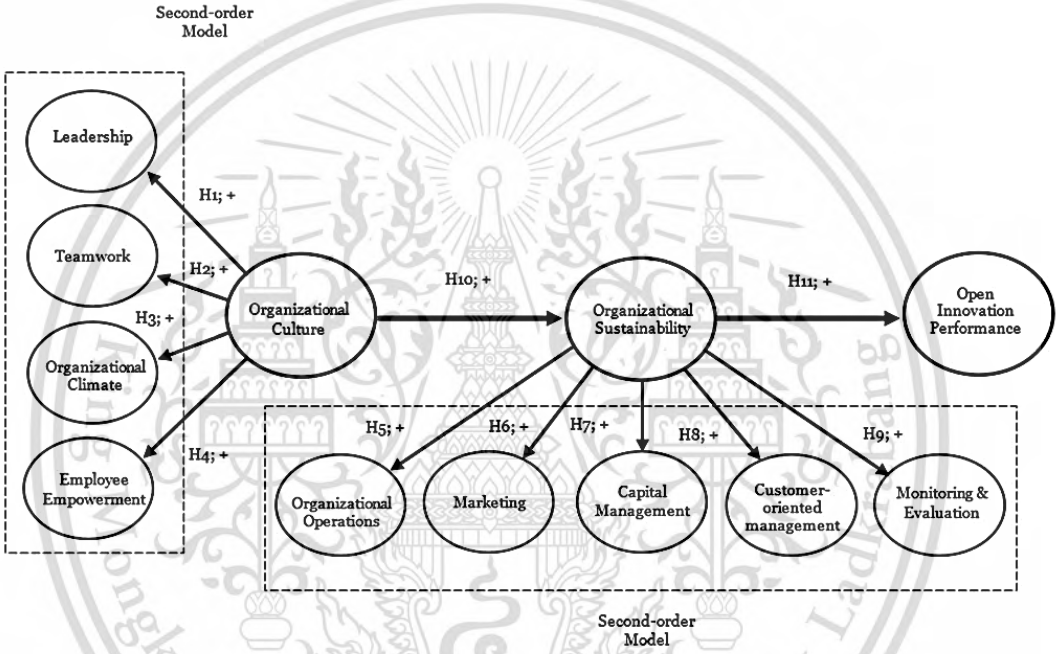


Figure 2.61 Conceptual model cited from Srisathan, Ketkaew, and Naruetharadhol (2020)

From the literature review, it led to the hypothesis that the organizational culture has a positive influence on sustainability as shown in the model in Figure 2.62.

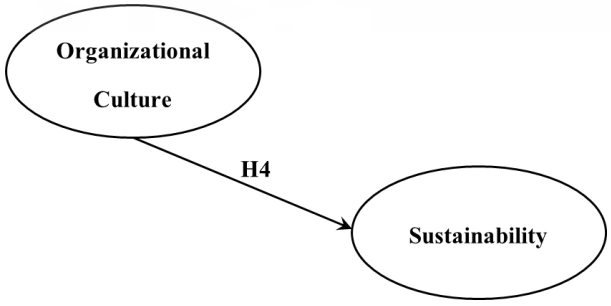


Figure 2.62 Model of hypothesis 4 (H4)

2.6.5 Relationship between Corporate Social Responsibility and Sustainability

Peng (2018) has stated that a stakeholder view of the firm represents a big picture, a key goal for CSR is global sustainability, in line with Heizer, Render, and Munson (2017) who have stated that sustainability is often associated with corporate social responsibility. CSR actions and policies take into account stakeholders' expectations and often consider the triple bottom line of economic, social, and environmental performance (Flammer, 2012; Aguinis & Glavas, 2012). The precise policies and practices underlying CSR lie at the discretion of the corporation. Some companies refer to their CSR practices in terms of sustainability, because these efforts maintain positive long-term relationships with communities, employees, customers, governments, and the natural environment (Matten & Moon, 2008). From the literature review, various pieces of research were identified that examined corporate social responsibility and sustainability as follows.

Bhagwat (2011) conducted a study "Corporate Social Responsibility and Sustainable Development." A framework is presented in which the relationship between SD and CSR is defined to ease further research in SD and CSR and to enhance the development of new methodologies and instruments for the implementation of SD/CSR strategies in companies. The relationship model is shown in Figure 2.63.

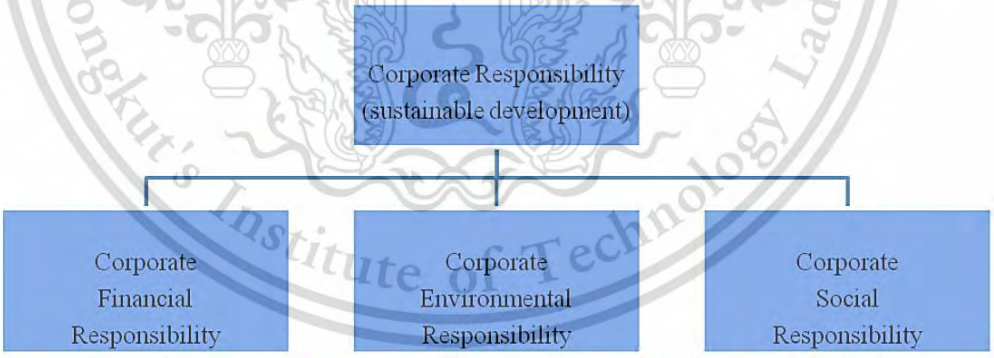


Figure 2.63 Relationship model cited from Bhagwat (2011)

Okwemba et al. (2014) studied "Effect of Corporate Social Responsibility on Organization Performance; Banking Industrykenya, Kakamega County". The research sought to find out the effect of CSR on organizational performance. Based on the results of this study, it was concluded that the philanthropic responsibility of a bank has an impact on bank performance. The positive

significant correlation coefficient shows that any increase in philanthropic responsibility will increase the performance of the bank. The conceptual model is shown in Figure 2.64.

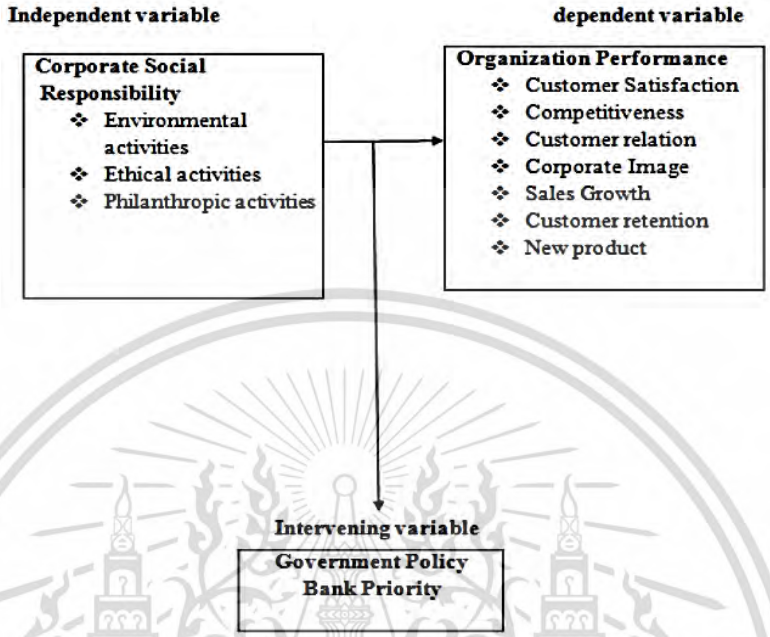


Figure 2.64 Conceptual model cited from Okwemba et al. (2014)

Indarti and Wijayanto (2015) conducted a study "Effect of Corporate Social Responsibility and Cultural Organization on Job Satisfaction and Business Performance (Studies in BUMN and BUMD in Riau Province)." The result shows that the implementation of CSR can increase the performance of BUMN (state-owned company) and BUMD (municipally-owned company). The research model is shown in Figure 2.65.

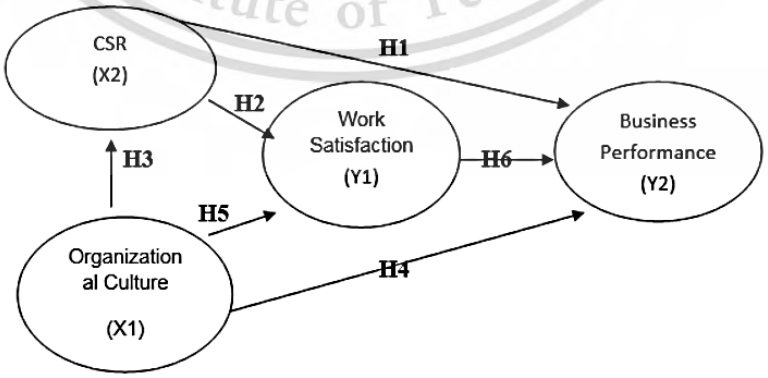


Figure 2.65 Research model cited from Indarti and Wijayanto (2015)

Alrowwad, Obeidat, Tarhini, and Aqqad (2017) studied "The Impact of Transformational Leadership on Organizational Performance via the Mediating Role of Corporate Social Responsibility: A Structural Equation Modeling Approach". The results of the data were corporate social responsibility did have a positive influence on organizational performance. The proposed model is shown in Figure 2.66.

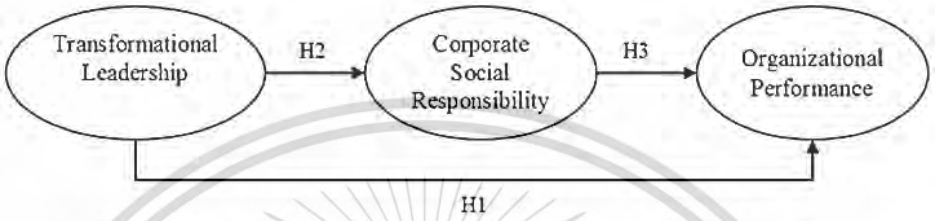


Figure 2.66 Proposed model cited from Alrowwad, Obeidat, Tarhini, and Aqqad (2017)

Bernal-Conesa, Nieto, and Briones-Peñalver (2017) conducted a study "CSR Strategy in Technology Companies: Its Influence on Performance, Competitiveness, and Sustainability." The study shows that a CSR-oriented strategy contributes significantly to the performance of the organization. Moreover, CSR influences the competitiveness of technology companies and particularly their sustainability. The predictive model is shown in Figure 2.67.

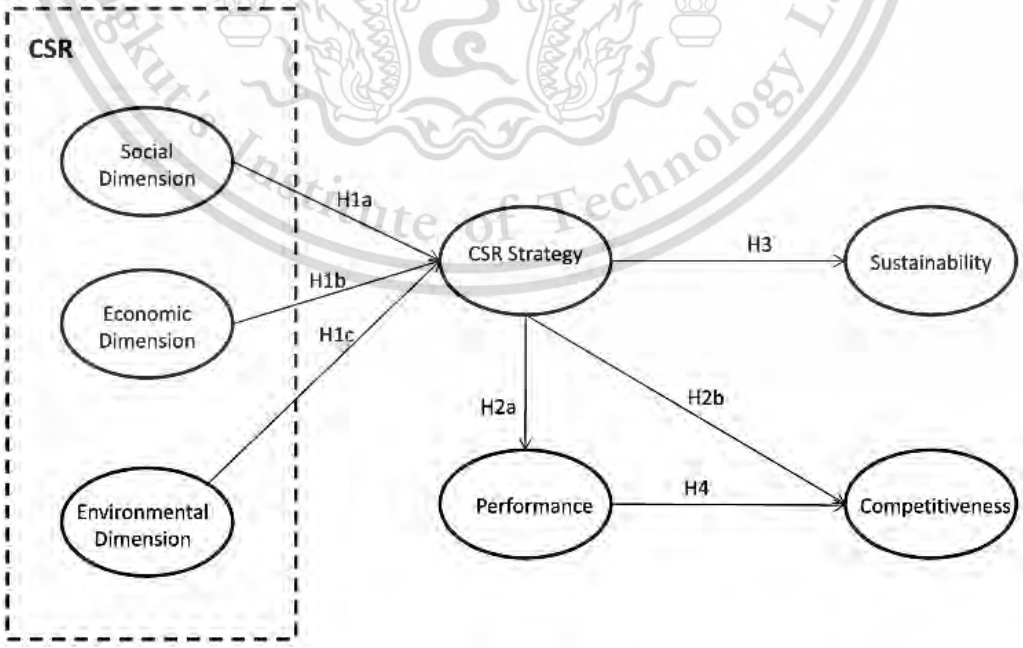


Figure 2.67 Predictive model cited from Bernal-Conesa, Nieto, and Briones-Peñalver (2017)

Jones, Willness, and Glavas (2017) conducted a study "When Corporate Social Responsibility (CSR) Meets Organizational Psychology: New Frontiers in Micro-CSR Research, and Fulfilling a Quid Pro Quo through Multilevel Insights." The authors draw on insights from the Research Topic articles to inform a multilevel model that offers multiple illustrations of how micro-level processes among individual stakeholders can explain variability in meso (firm)-level relationships between CSR practices and corporate performance. The research model is shown in Figure 2.68.

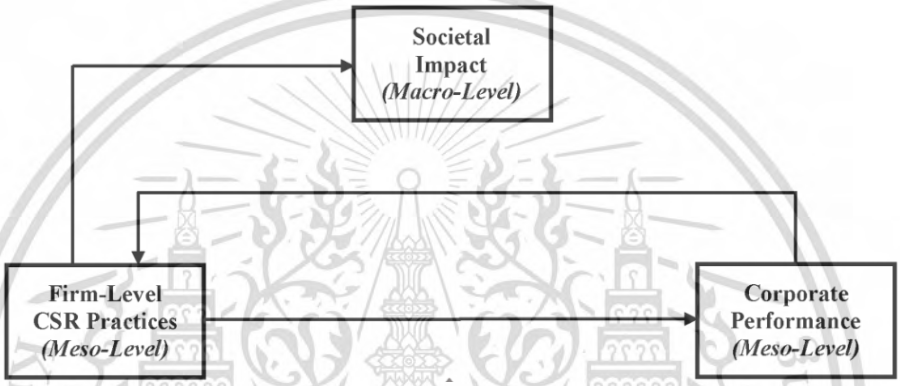


Figure 2.68 Research model cited from Jones, Willness, and Glavas (2017)

Lee and Kim (2017) conducted a study "Exploring the Organizational Culture's Moderating Role of Effects of Corporate Social Responsibility (CSR) on Firm Performance: Focused on Corporate Contributions in Korea." The results suggest that some organizational cultures moderate the relationship between CSR and financial outcomes and that organizational culture may play an important role in enhancing a positive relationship between CSR and firm performance.

Khan, Ali, and Olya (2018) studied "Transformational Leadership, Corporate Social Responsibility, Organizational Innovation, and Organizational Performance: Symmetrical and Asymmetrical Analytical Approaches". The results reveal that CSR leads to high performance.

Abbas et al. (2019) conducted a study "The Effects of Corporate Social Responsibility Practices and Environmental Factors through a Moderating Role of Social Media Marketing on Sustainable Performance of Business Firms." The results indicated that corporate social responsibility presented a positive impact on firms' sustainable performance. The conceptual model is shown in Figure 2.69.

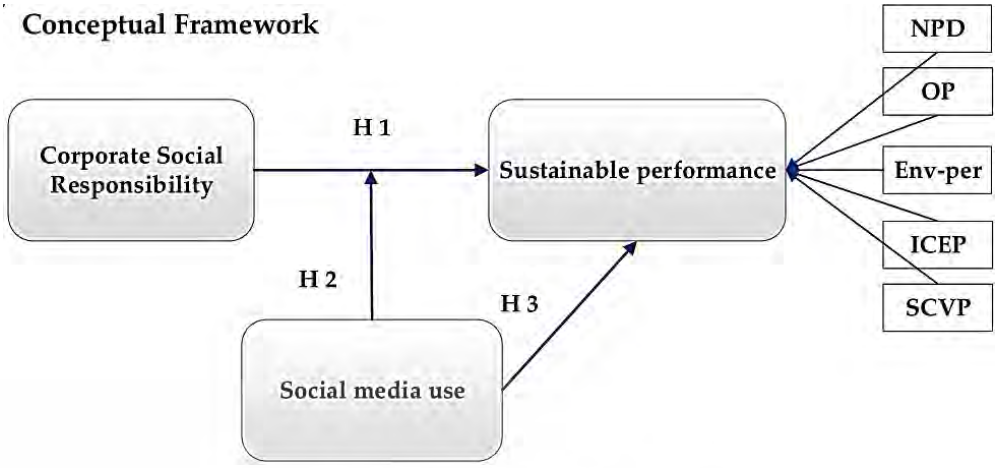


Figure 2.69 Conceptual model cited from Abbas et al. (2019)

Javeed and Lefen (2019) studied "An Analysis of CSR and Firm Performance with Moderating Effects of CEO Power and Ownership Structure: A Case Study of the Manufacturing Sector of Pakistan". The empirical analysis of this study highlights the following conclusions: CSR has a significant positive association with firm performance. The conceptual model is shown in Figure 2.70.

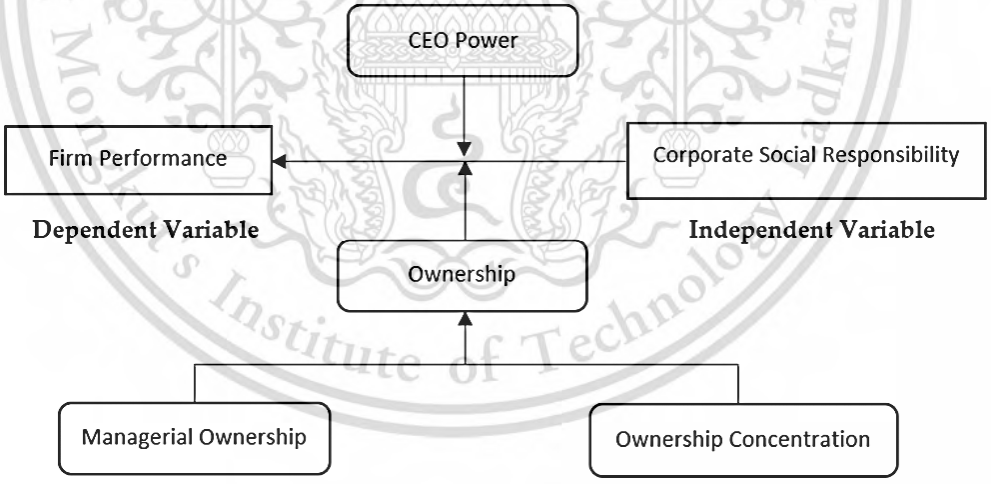


Figure 2.70 Conceptual model cited from Javeed and Lefen (2019)

Prasad, Mishra, and Bapat (2019) conducted a study "CSR and environmental sustainability: Evidence from India using energy intensity as an indicator of environmental sustainability." The regression results suggest that at present CSR is not significantly associated with energy intensity. The study has implications for public policy and corporate managers.

Zhang, Morse, and Ma (2019) studied "CSR and Sustainable Development in China: Current Status and Future Perspectives". The paper explores the extent to which CSR can contribute to solving the sustainable development challenges faced by China and discusses possible solutions if the current CSR pattern fails. The relationship model is shown in Figure 2.71.

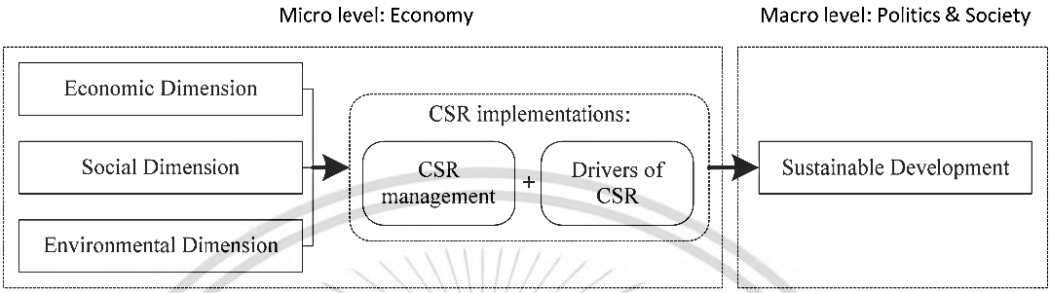


Figure 2.71 Relationship model cited from Zhang, Morse, and Ma (2019)

Bhuiyan, Baird, and Munir (2020) conducted a study "The association between organizational culture, CSR practices and organizational performance in an emerging economy." The findings highlight the diverse impacts of CSR practices on organizational performance. The conceptual model is shown in Figure 2.72.

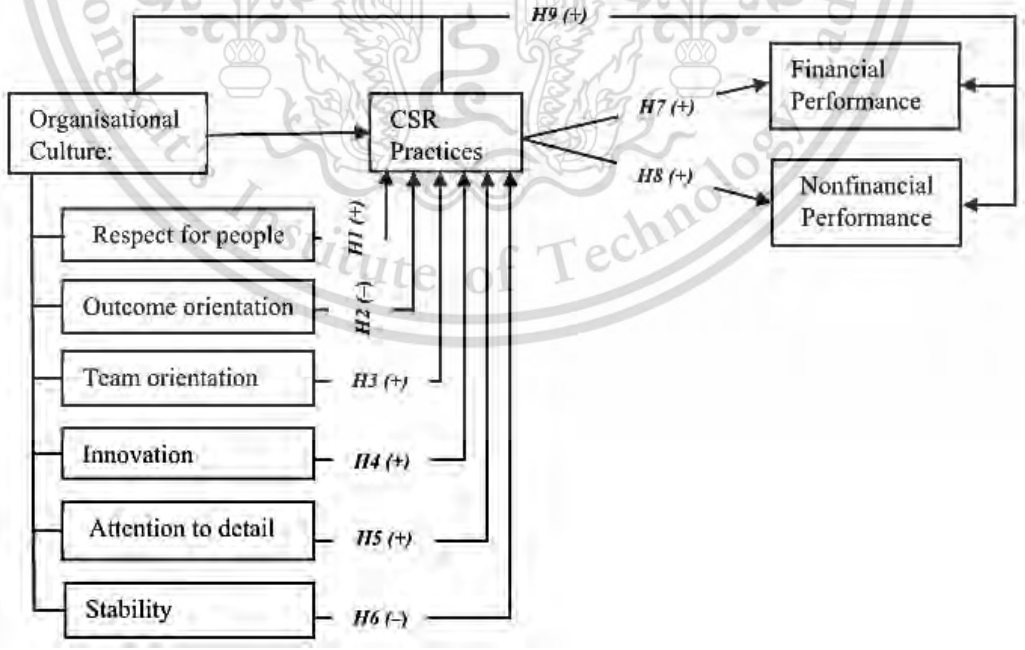


Figure 2.72 Conceptual model cited from Bhuiyan, Baird, and Munir (2020)

Muliati, Iqbal, and Mayapada (2020) conducted a study "The Effect of Organizational Culture on Firm Performance with Social Responsibility as Mediating Variable." These results mean that social responsibility plays a vital role in increasing firm performance. The results model is shown in Figure 2.73.

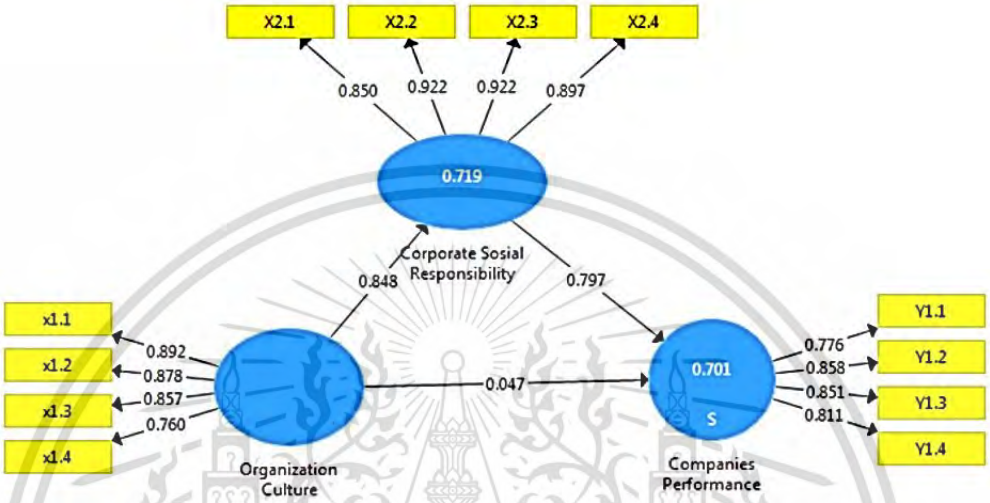


Figure 2.73 Results model cited from Muliati, Iqbal, and Mayapada (2020)

Shahzad, Qu, Javed, Zafar, and Rehman, (2020) conducted a study "Relation of environment sustainability to CSR and green innovation: A case of Pakistani manufacturing industry." As per study results, all dimensions of CSR were found positively significant towards environmentally sustainable development. The study model is shown in Figure 2.74.

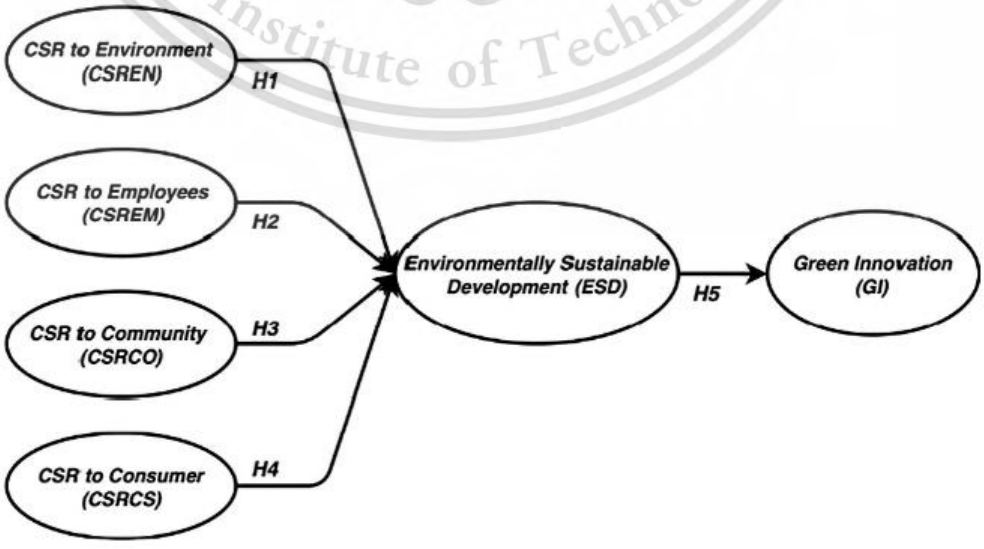


Figure 2.74 Study model cited from Shahzad, Qu, Javed, Zafar, and Rehman, (2020)

Shahzad, Qu, Rehman, Zafar, Ding, and Abbas (2020) conducted a study on "Impact of knowledge absorptive capacity on corporate sustainability with mediating role of CSR: analysis from the Asian context." Based on these results, the impact of employees' knowledge absorptive capacity (KAC) was positively correlated with CSR activities and resulted in a significant impact on corporate sustainability performance (CSP). CSR has been found to have a significant impact on mediation. The conceptual model is shown in Figure 2.75.

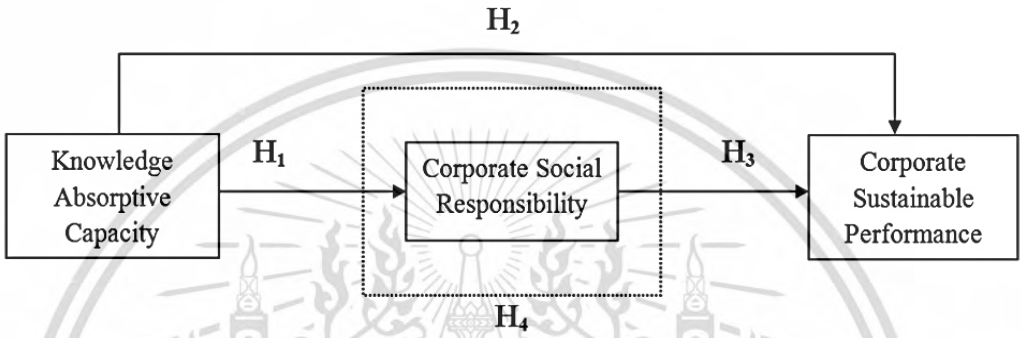


Figure 2.75 Conceptual model cited from Shahzad, Qu, Rehman, Zafar, Ding, and Abbas (2020)

Waheed, Zhang, Zafar, Zameer, Ashfaq, and Nusrat (2021) conducted a study "Impact of internal and external CSR on organizational performance with the moderating role of culture: empirical evidence from the Chinese banking sector." The findings exhibited that CSR both external and internal CSR have significant correlations with organizational competitive performance (CP) within the banking sector of China.

From the literature review, it led to the hypothesis that corporate social responsibility has a positive influence on sustainability as shown in the model in Figure 2.76.

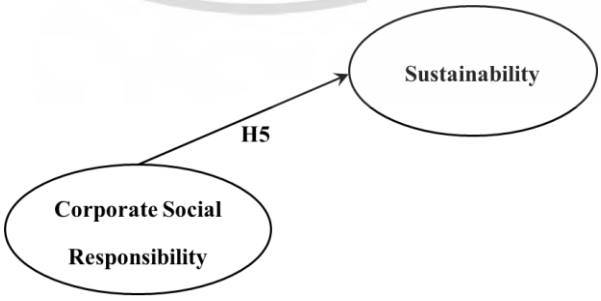


Figure 2.76 Model of hypothesis 5 (H5)

2.6.6 Relationship between Organizational Culture and Corporate Social Responsibility

The practice of business ethics is also referred to as corporate social responsibility (CSR). Much of the discussion to date of corporate social responsibility assumes that a corporation can act ethically just as an individual can. CSR initiatives and reporting are also growing globally. In 2014, the EU adopted annual corporate social responsibility reporting requirements. Under the amendment, companies exceeding an average of 500 employees on their balance sheet will be subject to mandatory reporting. This amounts to about 6,000 companies (Branny & Nwagbaraocha, 2014). Other corporate executives play a central role in promoting ethical sourcing by creating a supportive organizational culture, developing policies that outline the firm's desire to practice ethical sourcing, communicating these policies to supply chain trading partners, and then developing tactics that specifically describe how ethical sourcing will be implemented (Wisner, Tan, & Leong, 2019). From the literature review, various pieces of research were identified that examined the organizational culture and corporate social responsibility as follows.

Chang (2015) conducted a study "Proactive and reactive corporate social responsibility: antecedent and consequence." The empirical results verify that green organizational culture positively affects proactive CSR and green product innovation performance. Green organizational culture is a driving force for proactive CSR and green product innovation performance. Organizational members in Taiwanese companies are exposed to a green organizational culture that influences CSR activities.

Indarti and Wijayanto (2015) conducted a study "Effect of Corporate Social Responsibility and Cultural Organization on Job Satisfaction and Business Performance (Studies in BUMN and BUMD in Riau Province)." The result shows that a strong organizational culture has a relationship with CSR. The research model is shown in Figure 2.77.

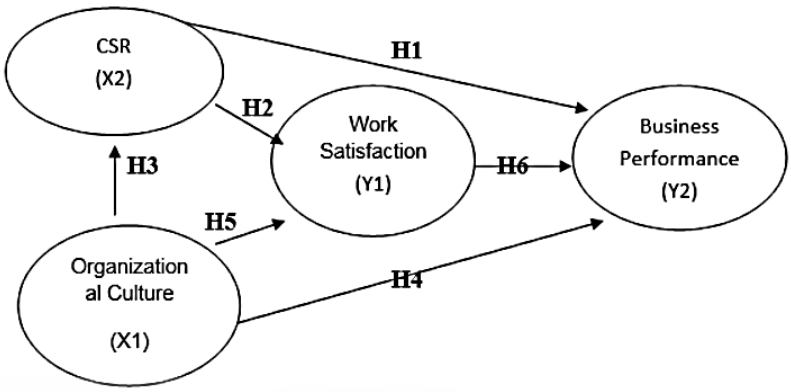


Figure 2.77 Research model cited from Indarti and Wijayanto (2015)

Lee and Kim (2017) conducted a study "Exploring the Organizational Culture's Moderating Role of Effects of Corporate Social Responsibility (CSR) on Firm Performance: Focused on Corporate Contributions in Korea." The results suggest that some organizational cultures moderate the relationship between CSR and that organizational culture may play an important role in enhancing a positive relationship between CSR.

Vveinhardt and Andriukaitiene (2017) conducted a study "Management Culture as Part of Organizational Culture in the Context of Corporate Social Responsibility Implementation." The results of the study suggest that the ideas of corporate social responsibility cannot be implemented consistently unless they are integrated into the formal part of organizational culture which plays an instrumental role.

Barile, Canestrino, Magliocca, and Caputo (2019) conducted a study "The influence of cultural dimensions on Corporate Social Responsibility: Reflections about Italian firms." To enrich the ongoing debate, this paper focuses attention on Hofstede's cultural dimensions as a way of depicting elements and variables able to influence firms' commitment to CSR strategies.

Chaabane (2019) conducted a study "The influence of organizational culture on the integration of CSR activities: Quantitative research within the Dutch oil and energy branch" The current study found that organizational culture contributes to CSR integration positively. The conceptual model is shown in Figure 2.78.

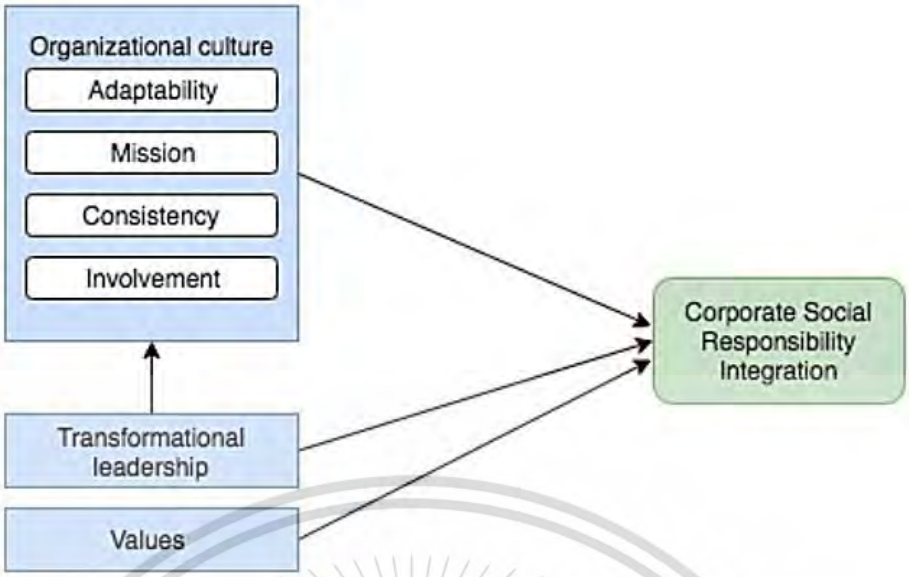


Figure 2.78 Conceptual model cited from Chaabane (2019)

Bhuiyan, Baird, and Munir (2020) conducted a study on "The association between organizational culture, CSR practices, and organizational performance in an emerging economy." The results of this research show the influence of six dimensions of organizational culture on different dimensions of CSR guidelines. The conceptual model is shown in Figure 2.79.

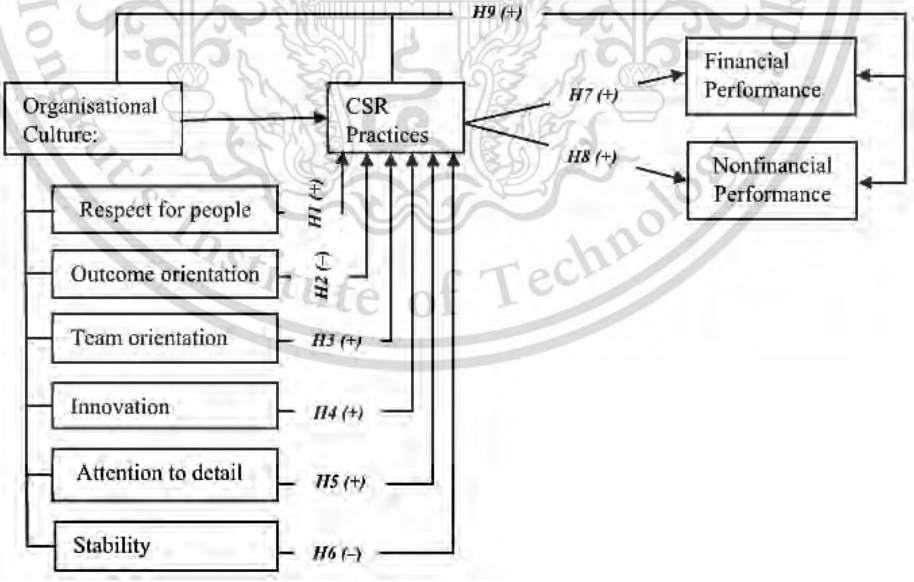


Figure 2.79 Conceptual model cited from Bhuiyan, Baird, and Munir (2020)

Liu and Lin (2020) conducted a study "Green Organizational Culture, Corporate Social Responsibility Implementation, and Food Safety." This conceptual article discusses the

relationships between green organizational culture, corporate social responsibility implementation, and food safety. As organizational culture has been largely discussed in Management and Business literature, green organizational culture and its impacts on socially and environmentally friendly organizational behaviors. The conceptual model is shown in Figure 2.80.

Figure 2.80 Conceptual model cited from Liu and Lin (2020)

Muliati, Iqbal, and Mayapada (2020) conducted a study "The Effect of Organizational Culture on Firm Performance with Social Responsibility as Mediating Variable." The result of this study shows that SOEs and ROEs' organizational culture affects firm performance if the firm does and reports corporate social responsibility. The results model is shown in Figure 2.81.

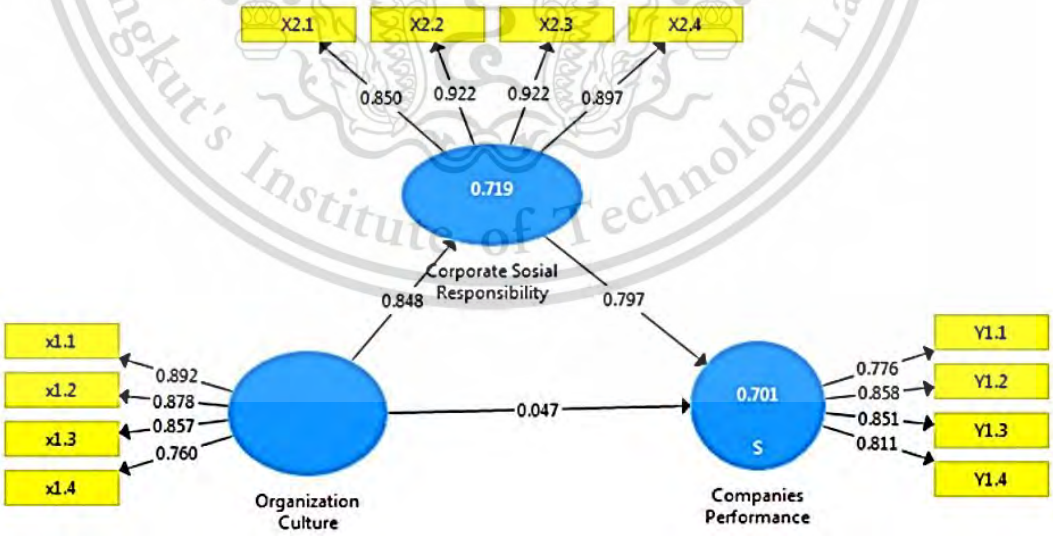


Figure 2.81 Results model cited from Muliati, Iqbal, and Mayapada (2020)

Espasandín-Bustelo, Ganaza-Vargas, and Diaz-Carrion (2021) conducted a study on "Employee happiness and corporate social responsibility: the role of organizational culture." These findings prove that clan and adhocracy cultures strongly promote internal CSR practices.

From the literature review, it led to the hypothesis that organizational culture has a positive influence on corporate social responsibility as shown in the model in Figure 2.82.

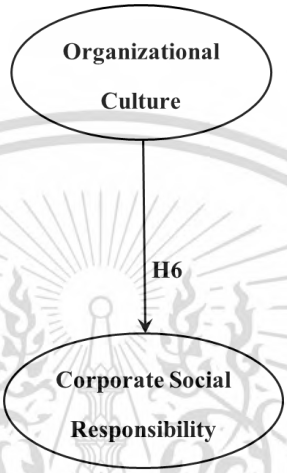


Figure 2.82 Model of hypothesis 6 (H6)

The literature review concerning the relationship between the variables can be summarized as shown in Table 2.10

Table 2.10 Summary of the relationship between the variables, hypothesis, and researchers

Relationship		Researchers
H1	Transformational Leadership & Sustainability	Imran, Zahoor, and Zaheer (2012), Alrowwad, Obeidat, Tarhini, and Aqqad (2017), Khan, Ali, and Olya (2018), Abbas and Bakr (2019), Burawat (2019), Begum, Xia, Mehmood, Iftikhar, and Li (2020), Mona, Suharto, and Subagja (2020), Munford (2020), Shah, Jintian, Sukamani, and Kusi (2020), Villca and Castillo (2020), Ullah et al. (2021)

Table 2.10 (Continue)

Relationship	Researchers
H2 Transformational Leadership & Organizational Culture	Imran, Zahoor, and Zaheer (2012), Shim, Jo, and Hoover (2015), Elshanti (2017), Pradhan, Panda, and Jena (2017), Lutfi and Siswanto (2018), Chaabane (2019), Faraz, Yanxia, Estifo, and Kaukab (2019), Rizki, Parashakti, and Saragih (2019), Andreja, Kristijana, and Sreč̌koa (2020), Bakhsh, Aleem, Farooq, and Aziz (2020), Hosseini, Hajipour, Kaffashpoor, and Darikandeh (2020), Khan, Ismail, Hussain, and Alghazali (2020), Park and Pierce (2020), Acevedo and Avecillas (2021)
H3 Transformational Leadership & Corporate Social Responsibility	Alrowwad, Obeidat, Tarhini, and Aqqad (2017), Khan, Ali, and Olya (2018), Budur and Demir (2019), Chaabane (2019), Hongdao, Bibi, Khan, Ardito, and Nurunnabi (2019), Manzoor et al. (2019), Tefera, Yuanqiong, and Luming (2019), Ali, Khan, and Yildiz (2020), K and Ranjit (2020), Changar and Atan (2021)
H4 Organizational Culture & Sustainability	Linnenluecke and Griffiths (2010), Imran, Zahoor, and Zaheer (2012), Ullah, Lai, and Marjoribanks (2013), Bamgbade, Kamaruddeen, and Nawi (2015), Indarti and Wijayanto (2015), Dubey, Gunasekaran, Childe, Papadopoulos, Hazen, Giannakis, and Roubaud (2017), Dyck, Walker, and Caza (2019), Iranmanesh, Zailani, Hyun, Ali, and Kim (2019), Islam, Tseng, and Karia (2019), Ketprapakorn and Kantabutra (2019), Bakhsh, Aleem, Farooq, and Aziz (2020), Bhuiyan, Baird, and Munir (2020), Metz, Ilies, and Nistor (2020), Mona, Suharto, and Subagja (2020), Muliati, Iqbal, and Mayapada (2020), Srisathan, Ketkaew, and Naruetharadhol (2020)

Table 2.10 (Continue)

Relationship	Researchers
H5 Corporate Social Responsibility & Sustainability	Bhagwat (2011), Okwemba et al. (2014), Indarti and Wijayanto (2015), Alrowwad, Obeidat, Tarhini, and Aqqad (2017), Bernal-Conesa, Nieto, and Briones-Peñalver (2017), Jones, Willness, and Glavas (2017), Lee and Kim (2017), Khan, Ali, and Olya (2018), Abbas et al. (2019), Javeed and Lefen (2019), Prasad, Mishra, and Bapat (2019), Zhang, Morse, and Ma (2019), Bhuiyan, Baird, and Munir (2020), Muliati, Iqbal, and Mayapada (2020), Shahzad, Qu, Javed, Zafar, and Rehman, (2020), Shahzad, Qu, Rehman, Zafar, Ding, and Abbas (2020), Waheed, Zhang, Zafar, Zameer, Ashfaq, and Nusrat (2021)
H6 Organizational Culture & Corporate Social Responsibility	Chang (2015), Indarti and Wijayanto (2015), Lee and Kim (2017), Vveinhardt and Andriukaitiene (2017), Barile, Canestrino, Magliocca, and Caputo (2019), Chaabane (2019), Bhuiyan, Baird, and Munir (2020), Liu and Lin (2020), Muliati, Iqbal, and Mayapada (2020), Espasandín-Bustelo, Ganaza-Vargas, and Diaz-Carrion (2021)

2.7 Conceptual Framework Diagram

From the research and literature review, the researcher synthesized the relevant concepts and theories and analyzed the relation between the variables related to the research objective. As a result, the conceptual framework was obtained, as shown in Figure 2.83.

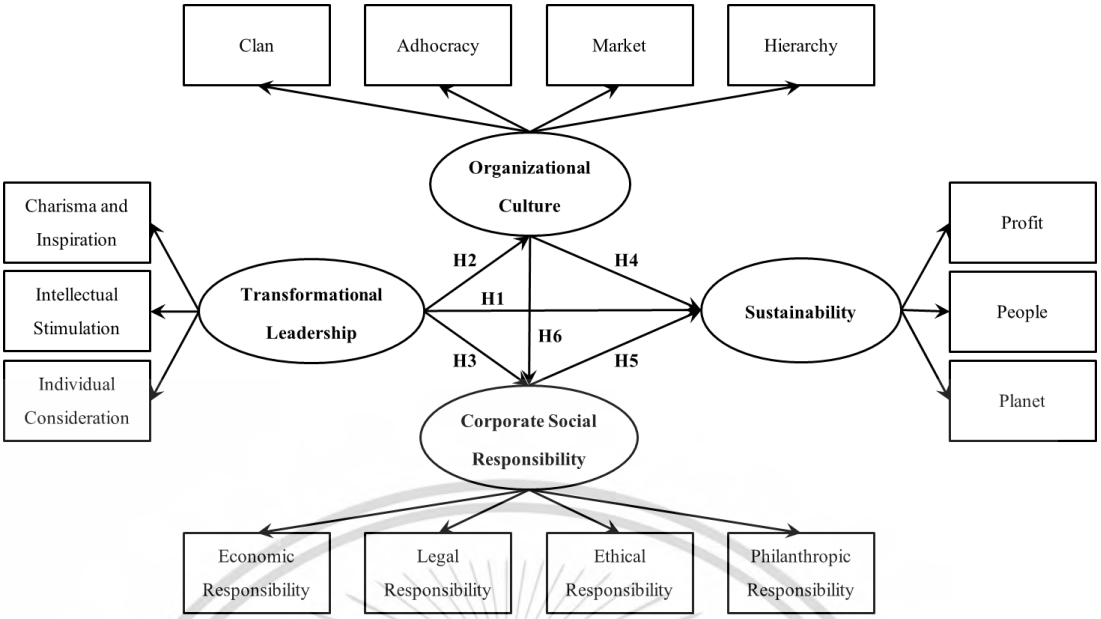


Figure 2.83 Conceptual framework in the research

CHAPTER 3

RESEARCH METHODOLOGY

The study "A Structural Equation Model of Factors Influencing Sustainability of Chemical Industry in Thailand" aimed to develop a structural equation model for the factors influencing sustainability of chemical industry in Thailand. The quantitative method is applied for this research methodology by using the AMOS as statistical software. The descriptive statistics were analyzed and analyzed with a Structural Equation Model (SEM), and the results were then discussed, summarized, and suggested further from the research.

3.1 Research Design

This research uses primary and secondary data together by collecting secondary data from published papers to analyze and construct a conceptual framework. As the conceptual frameworks are derived from secondary data that differ in time and space contexts, to be reliable and accurate in research. The questionnaire, which is quantitative research, was used as a tool to collect data and lead to quantitative research by distributing questionnaires.

To make this research meet the objectives of the research. The researcher has defined the methodology in detail: population, sample, primary informant, study variables, research tools, measurement of variables, construction and quality testing of the instruments, the study parameters, collected data, analyzed data, and statistics used for data analysis classified by quantitative research method.

In terms of the literature review for the conceptual framework, it was presented in Chapter 2. Thus, the research focused on the acquisition of the analysis results and quantitative facts to achieve the research objectives. In addition, the research procedures included the following 3 steps to enhance the quality of the research. Overall, the 3 steps can be summed up as displayed in Figure 3.1.

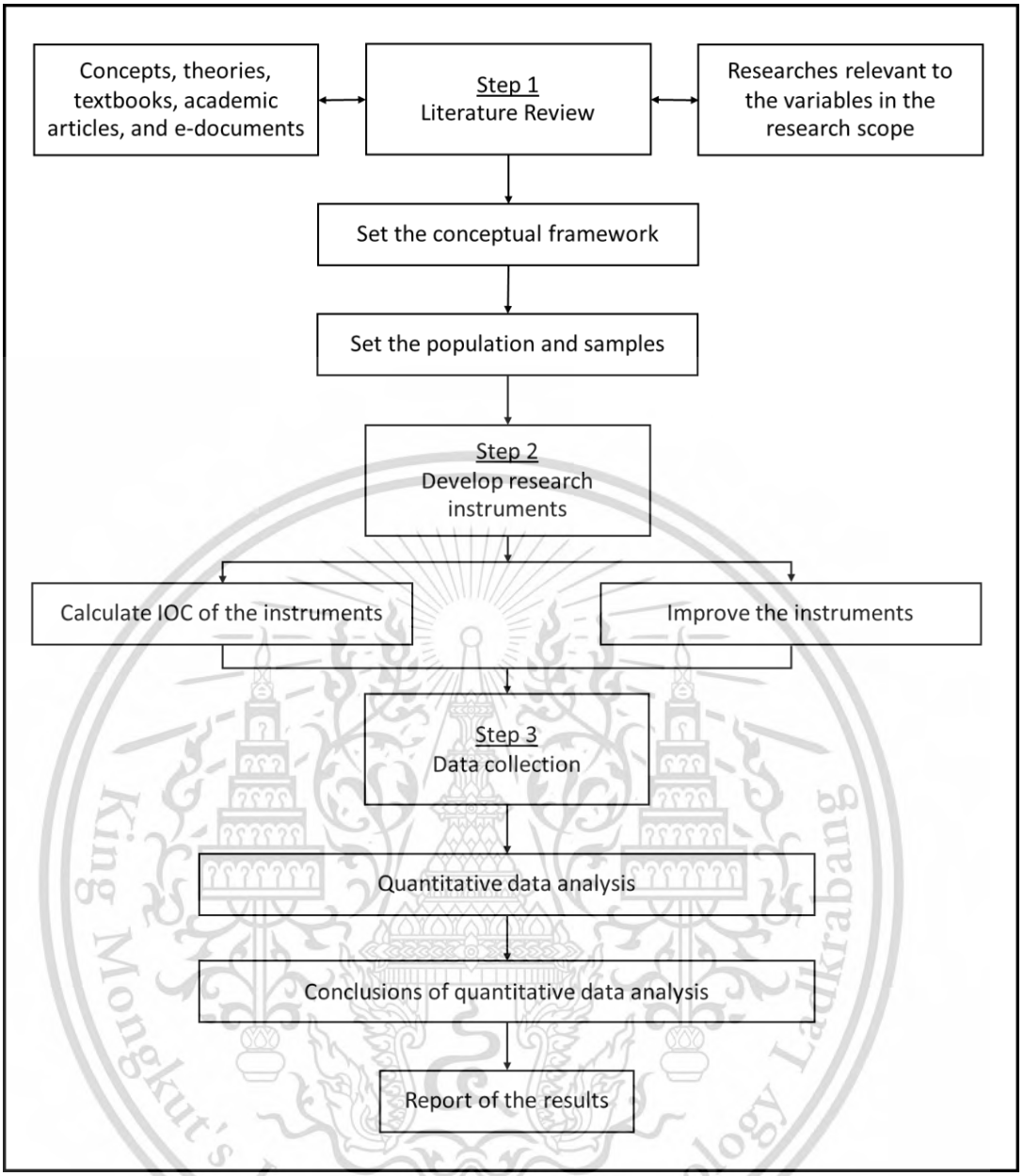


Figure 3.1 Research procedure

In Figure 3.1, the research procedure is detailed as follows.

Step 1: Studied the secondary data through a review of relevant literature, concepts, theories, textbooks, academic papers, articles, research, and online documents. Then, the variables and the relationships among the influential variables in each research published in international journals were synthesized. Besides, the researcher also studied national and international dissertations.

The researcher reviewed the variables obtained from the relevant literature and research to use the data for setting the design of the conceptual framework and questionnaire. The review led to the variables that could be further studied within the conceptual framework. Therefore, the synthesized theories, research, and knowledge brought about 4 latent variables and 14 observed variables to be used in the research. The population and samples were also set.

Step 2: Develop research instruments and develop their quality. The research instruments were improved for better with content validity testing and reliability testing.

Step 3: Conducted quantitative research using a research process, the research instrument, and statistics for data analysis. SEM was used, together with an analysis program called AMOS, to study the structural model of the variables for more precise development and revision of SEM. Finally, the results of the research were reported in compliance with international standards.

3.2 Research Variables

For the variables used in this research, the researcher studied, collected, and reviewed relevant concepts, theories, literature, textbooks, academic articles, and research, after which the variables were set as below.

1. Exogenous Latent Variable consists of the following:

    1.1 Transformational Leadership, which consists of 3 observed variables:

        1.1.1 Charisma and Inspiration

        1.1.2 Intellectual Stimulation

        1.1.3 Individual Consideration

2. Mediator/Intervening Variables consist of the following:

    2.1 Organizational Culture, which consists of 4 observed variables:

        2.1.1 Clan

        2.1.2 Adhocracy

        2.1.3 Market

        2.1.4 Hierarchy

2.2 Corporate Social Responsibility, which consists of 4 observed variables:

2.2.1 Economic responsibility

2.2.2 Legal responsibility

2.2.3 Ethical responsibility

2.2.4 Philanthropic responsibility

3. Endogenous Latent Variable consists of the following:

3.1 Sustainability, which consists of 3 observed variables:

3.1.1 Profit

3.1.2 People

3.1.3 Planet

In conclusion from the literature review, this research consists of 4 latent variables: one exogenous latent variable, two mediator/intervening variables, and one endogenous latent variable. The observed variables for the 4 latent variable indications a total of 14 observed variables were used to determine the sample size in this research.

3.3 Population and Sample

Quantitative research is the quest for the truth about social phenomena based on empirical evidence, which in this study are the factors influencing sustainability of chemical industry in Thailand. Cooper and Schindler (2014) stated that in general, quantitative research can enumerate and measure variables in numbers and use statistical methods to analyze the data. Specifically, this study focuses on the use of numbers as evidence of validity, reliability, and objective variations of the findings that can refer findings to a population.

3.3.1 Population

The population in this research study is the top management of the chemical industry in Thailand in the downstream chemical industry. From Table 2.9, the downstream chemical industry in Thailand has a total of 2,573 factories, divided into 5 industrial groups as follows (Ministry of Industry, Department of Industrial Works, 2021):

1) Chemical fertilizer industry

2) Chemical or other chemical materials industry

3) Pharmaceutical industry

4) Cosmetic industry

5) Paint industry and its associated products

3.3.2 Selection of the Samples and Sample Size

There are several methods for determining the sample size for the analysis of Structural Equation Modeling (SEM). Estimation of the studied sample size was set as the rate per number of variables. Stevens (1996) suggested that sample size or population must be considered with estimated independent parameters. The ratio of the studied variables should be 20:1 (20 samples per 1 variable). Schumacker and Lomax (2010) suggested that SEM analysis must set a larger sample size than other ways of analysis so that the estimation will be accurate and can be accurately representative of the population. The ratio criteria of 20 times per the number of variables should be used. The confirmation of the confirmation element should be 20 to 1 times the observed variable (Hair, Black, Babin, & Anderson, 2010). In this research, 14 observable variables were used to obtain accuracy. The researcher then determined the sample size to be 20 times the observed variable. Thus, 280 samples were obtained in this research.

The sampling method used in quantitative research aims to provide a representative sample of the target population. In this research, the target population is the top management of the downstream chemical industry in Thailand. The samples were obtained by multi-stage sampling. The procedure can be summarized in each step as follows:

Stage 1: Set the sample size.

Stage 2: Divided the population into 5 strata according to the Ministry of Industry, Department of Industrial Works (2021).

Stage 3: Divided the numbers of the sample size in each stratum based on the portions compared to the population in that industrial group, as seen in Table 3.1.

Stage 4: Used simple random sampling to randomize the population from each group again. Each stratum was similar to one another, whereas the units in different strata were not similar to one another (Vanichbuncha, 2011).

Table 3.1 Selection of the sample size for quantitative research

Stratum	Industrial Groups	Population	Proportion	Sample Size
1	Chemical Fertilizer Industry	790	30.70%	86
2	Chemical or Other Chemical Materials Industry	582	22.62%	63
3	Pharmaceutical Industries	482	18.73%	53
4	Cosmetic Industry	375	14.58%	41
5	Paint Industry and its associated products	344	13.37%	37
	Total	**2,573**		**280**

3.4 Research Instrument

As the research instrument, the online questionnaires are created for proving and finding the variables relevant to the model of factors influencing sustainability of chemical industry in Thailand with the research instrument as the following procedure details.

1. Collect data from the relevant theories, literature, concepts, and research to create and prepare the structure of research questionnaires.

2. Study the relevant theories, literature, concepts, and research to acknowledge the relationships among internal latent, external latent, and observed variables for developing the structure of questionnaires.

3. Prepare and develop compliance questionnaires according to the structure studied by the three experts to check the IOC confidence and the consistency between the research questions and specified objectives by the researcher and consistent with the problems of research between 0.5-1. If the value is less than 0.5, the questions should be revised to be by the objectives to be measured.

4. Carry out an update to the query according to the instructions.

5. Take the updated questionnaire with recommendations from experts and specialists. Trial with 30 samples before launching the final questionnaires. To check each question is clear and has the same content between subject and question.

6. Measure the consistency and reliability of the 30 questionnaire results from the test with Cronbach's alpha greater than 0.7.

7. Improve the questionnaires in case of a leak and revise the final one to use in the research. The structure of the questionnaires.

3.4.1 The structure of the questionnaires

As the research structure, the questionnaires are developed based on the relevant theories, literature, concepts, and research to the variable set for Transformational Leadership, Organizational Culture, and Corporate Social Responsibility influencing Sustainability, shown in APPENDIX A. The screened respondents will be given the completed version of the questionnaires which are divided into 3 parts as the following:

Part 1: Personal data of the respondents such as gender, age, highest education, management position, management experience, industrial groups, and business operation period. Nominal and ratio scales are applied.

Part 2: Questions about the latent variables in the research

1. A question about "Sustainability" is developed from previous studies. An example is demonstrated below. Ratio and Interval scales are applied and the scale is classified into 5 levels as follows.

Definition of Terms: ***Sustainability*** refers to developing an economy that meets the needs of the present without compromising the ability of future generations to meet their own needs in terms of economic, environmental, and social challenges and to undertake activities in a way that contributes to the long-term well-being of the natural environment without destroying our environmental, social and economic resources of the chemical industry.						
Question about "Sustainability"	**Researcher**	**Least ◄——► Most**				
		1	**2**	**3**	**4**	**5**
Your organization has continuously increased its market share.	Dubey, Gunasekaran, Childe, Papadopoulos, Hazen, Giannakis, and Roubaud (2017)					
Your organization is always striving to improve customer satisfaction.	Iranmanesh, Zailani, Hyun, Ali, and Kim (2019)					
Your organization has excellent relationships with suppliers and has mutual trust.	Alrowwad, Obeidat, Tarhini, and Aqqad (2017)					
Your organization has specific goals for actions to reduce its environmental impact.	Saeed (2017)					

Figure 3.2 Example questions about "Sustainability"

2. A question about “Transformational Leadership” is developed from previous studies. An example is demonstrated below. Ratio and Interval scales are applied and the scale is classified into 5 levels as follows.

Definition of Terms: ***Transformational Leadership*** refers to the ability to help leaders in the chemical industry recognize the need for transform to create a vision to guide that change and implement change effectively. There is a very clear behavior with a pattern of perception that is clear and easy to understand for the follower. Raising awareness of the mission and vision of teams and organizations and creating incentives for followers Leaders and followers help each other to advance to higher levels of morale and motivation, and leaders are willing to change patterns by taking advice from followers, improving or changing work patterns.						
Question about “Transformational Leadership”	**Researcher**	**Least ⟷ Most**				
		1	**2**	**3**	**4**	**5**
Manager seriously conveys the vision of sustainable development to employees and expresses confidence that goals will be achieved.	Alrowwad, Obeidat, Tarhini, and Aqqad (2017)					
Manager encourages support and encouragement to employees in solving problems that may arise while working.	Hongdao, Bibi, Khan, Ardito, and Nurunnabi (2019)					
Manager encourages employees to innovate, be creative and seek solutions to develop sustainability led by the employees themselves.	Villca and Castillo (2020)					
Manager focuses on brainstorming to find out how to achieve goals and how to solve problems from working with consensus on their team.	Changar and Atan (2021)					
Manager inspires employees with individual employee career advancement plans.	Manzoor et al. (2019)					

Figure 3.3 Example questions about "Transformational Leadership"

3. A question about “Organizational Culture” is developed from previous studies. An example is demonstrated below. Ratio and Interval scales are applied and the scale is classified into 5 levels as follows.

Definition of Terms: ***Organizational Culture*** refers to the system of the chemical industry in which backgrounds, norms, values, traditions, philosophies, rules, beliefs, and routines work together to influence the way individuals, groups, and teams interact for organizing actions, language, and other symbols to demonstrate mutual understanding and work together to achieve the goals of the organization.						
Question about "Organizational Culture"	**Researcher**	**Least ◄——► Most**				
		1	**2**	**3**	**4**	**5**
Your organization considers working as a team and a feeling of oneness as important.	Lee and Kim (2017)					
Your organization has a risk management plan and is open to experimenting with new ways of working.	Katamba (2010)					
Your organization has formal rules and policies that are strictly followed.	Dubey, Gunasekaran, Childe, Papadopoulos, Hazen, Giannakis, and Roubaud (2017)					

Figure 3.4 Example questions about "Organizational Culture"

4. A question about "Corporate Social Responsibility" is developed from previous studies. An example is demonstrated below. Ratio and Interval scales are applied and the scale is classified into 5 levels as follows.

Definition of Terms: ***Corporate Social Responsibility*** refers to the chemical industry's commitment to behave ethically and create interactions between the business and the existing social environment. In particular, the commitments the organization has to society by recognizing, accepting, and managing the broad impact of corporate decisions taking into account the economic, social, and environmental impacts.						
Question about "Corporate Social Responsibility"	**Researcher**	**Least ◄——► Most**				
		1	**2**	**3**	**4**	**5**
Your organization operates for the benefit of stakeholders.	Alrowwad, Obeidat, Tarhini, and Aqqad (2017)					
Your organization strictly complies with all applicable laws and regulations.	Manzoor et al. (2019)					
Your organization provides accurate and complete information to customers, business partners, and society.	Changar and Atan (2021)					
Your organization always makes charitable contributions.	Hongdao, Bibi, Khan, Ardito, and Nurunnabi (2019)					

Figure 3.5 Example questions about "Corporate Social Responsibility"

Part 3: Suggestion of respondents.

The structure of the questionnaires will be summarized in the following Table 3.2.

Table 3.2 Questionnaire structure

Variable	Total question	Question no.	Form/ Scale
Part 1: Personal data of the respondents	7	1-7	Nominal and Ratio scale
Part 2: Questions about the latent variables			Ratio and Interval scale
2.1 Sustainability			
2.1.1 Profit	4	1-4	
2.1.2 People	4	5-8	
2.1.3 Planet	4	9-12	
2.2 Transformational Leadership			
2.2.1 Charisma and Inspiration	4	13-16	
2.2.2 Intellectual Stimulation	4	17-20	
2.2.3 Individual Consideration	4	21-24	
2.3 Organizational Culture			
2.3.1 Clan	3	25-27	
2.3.2 Adhocracy	3	28-30	
2.3.3 Market	3	31-33	
2.3.4 Hierarchy	3	34-36	
2.4 Corporate Social Responsibility			
2.4.1 Economic Responsibility	3	37-39	
2.4.2 Legal Responsibility	3	40-42	
2.4.3 Ethical Responsibility	3	43-45	
2.4.4 Philanthropic Responsibility	3	46-48	
Part 3: Suggestion of respondents	-	-	-

A questionnaire set is instructed for quantitative research that is based on the different sources and is developed with the conceptual framework and literature review is accepted and validated studying as shown in table 3.3.

Table 3.3 Development of scale and research questions

Latent variable	Observed variable	Prototype of research questions	Number of questions
Sustainability	1) Profit 2) People 3) Planet	Alrowwad, Obeidat, Tarhini, and Aqqad (2017), Dubey, Gunasekaran, Childe, Papadopoulos, Hazen, Giannakis, and Roubaud (2017), Saeed (2017), Iranmanesh, Zailani, Hyun, Ali, and Kim (2019)	12
Transformational Leadership	1) Charisma and Inspiration 2) Intellectual Stimulation 3) Individual Consideration	Alrowwad, Obeidat, Tarhini, and Aqqad (2017), Hongdao, Bibi, Khan, Ardito, and Nurunnabi (2019), Manzoor et al. (2019), Villca and Castillo (2020), Changar and Atan (2021)	12
Organizational Culture	1) Clan 2) Adhocracy 3) Market 4) Hierarchy	Katamba (2010), Dubey, Gunasekaran, Childe, Papadopoulos, Hazen, Giannakis, and Roubaud (2017), Lee and Kim (2017)	12
Corporate Social Responsibility	1) Economic responsibility 2) Legal responsibility 3) Ethical responsibility 4) Philanthropic responsibility	Alrowwad, Obeidat, Tarhini, and Aqqad (2017), Hongdao, Bibi, Khan, Ardito, and Nurunnabi (2019), Manzoor et al. (2019), Changar and Atan (2021)	12

3.4.2 Scale Development

The data analysis is based on a 5-point rating scale (5-point Likert type scale), and then the questions are developed by other researchers by closing the gap between studied issues and improving new ones with relevant literature. In this research, the researcher used the 5-point rating scale of which the following scoring criteria are in Table 3.4.

Table 3.4 5-point scoring criteria

Point	Evaluation Criteria			
	Agreement	**Frequency**	**Importance**	**Quality**
5	Strongly Agree	Always	Very Important	Excellent
4	Agree	Often	Important	Good
3	Uncertain	Sometimes	Moderately Important	Fair
2	Disagree	Rarely	Slightly Important	Poor
1	Strongly Disagree	Never	Unimportant	Very Poor

The interpretation of the variables from the 5-point rating scale is based on the class interval calculation in compliance and the principle of classification (Gözde & Emel, 2016). Therefore, the distance of each interval will be used in the evaluation criteria of the variables as shown in Table 3.5.

Table 3.5 Evaluation criteria for Likert scale questions

Score Interval (Mean)	Evaluation Criteria			
	Agreement	**Frequency**	**Importance**	**Quality**
4.20-5.00	Strongly Agree	Always	Very Important	Excellent
3.40-4.19	Agree	Often	Important	Good
2.60-3.39	Uncertain	Sometimes	Moderately Important	Fair
1.80-2.59	Disagree	Rarely	Slightly Important	Poor
1.00-1.79	Strongly Disagree	Never	Unimportant	Very Poor

3.4.3 Instrument quality inspection

The investigators performed content validity and questionnaire reliability tests to optimize questionnaires to match the hypothesis to be studied. There are procedures for checking the quality of the tools as follows.

Step 1 Content validity testing by using questionnaires developed by the researcher and presenting to five experts. Quality checking of content validity to determine the consistency between the questions. Questions and Assumptions or index of item objective congruence (IOC) with the opinion scoring criteria in 3 cases as follows:

+1 means it is consistent with the question, it is consistent with the research hypothesis.

0 means uncertain, unable to determine whether the question is consistent with the research hypothesis.

–1 means the question is inconsistent with the research hypothesis.

$$\text{IOC} = \frac{\sum_i^n R_{ij}}{n}$$

Where IOC_i Represents the index of conformity with the research objective of the i

$\sum_i^n R_{ij}$ Represents the sum of the opinion scores of all n experts for point i

n Represents the number of experts

In considering the opinions of the experts from the IOC determination of all questions, Rovinelli and Hambleton (1977) interpretation criteria are used as follows:

1. Questions with an IOC value from 0.50-1.00 mean they are accurate.

2. Inquiries with an IOC below 0.50 mean whether to make adjustments based on recommendations or not.

Step 2 Reliability Testing: The researchers measured the reliability by computerized Cronbach's alpha coefficient (Cronbach, 1974), and then the updated questionnaires were applied to a population with similar characteristics to the sample for 30 series, of which the number of trials was acceptable (Engel & Schutt, 2005), to verify the completeness of the question and measure the internal consistency model using the alpha coefficient accepted at α greater than or equal to 0.7 (Hair, Black, Babin, Anderson, & Tatham, 2006). Cronbach's alpha coefficient is formulated as follows:

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

Where α Reliability coefficient

n The total number of questions

$\sum S_i^2$ The sum of the variance of each question

S_t^2 The variance of total score of all respondents

Step 3 Analysis of the relationship of the hypothesis. The researchers analyzed Pearson's product-moment correlation coefficient as a basis for the model analysis. By correlation criteria, numbers of correlation coefficients are used. If the coefficient approaches -1 or +1, this indicates a high correlation. If there is an approach to 0, there is a low or no correlation.

3.5 Data Collection

3.5.1 Primary data

1. Provide and request letters of cooperation for collecting data and approval by the authorized person from the Ph.D. Program in Industrial Business Administration, KMITL. The requested letters propose to ask for user information from 400 respondents to collect the data for this research.

2. Distribute the questionnaires to 400 respondents until completed data as the target (minimum target of 280 questionnaires).

3. Compile the completeness of the 400 questionnaires. The researcher took time to collect data from January to June 2022, a total period of approximately 6 months. The researcher was able to retrieve and select 317 completed questionnaires to proceed to the data analysis stage.

3.5.2 Secondary data

The data collection is from the relevant theories, literature, concepts, and research from various sources, e.g., books, journals, documents, internet, statistical data, and reports from both government and private sectors that are also used for synthesis and analysis to initiate the knowledge and analysis data in this research.

3.5.3 Data analysis

As the completed questionnaires, the researcher has to examine the basic data for compliance with the analysis agreement. For the statistical testing, the level of significance and acceptable error (α) is 0.05. The procedure and statistics for analysis are as follows.

1. The basics of statistical analysis of sample distribution by using descriptive statistics, i.e. percentage, mean, and the basic statistical analysis for developing the model. This research consisted of 14 observed variables for acknowledging the distribution and variation of the structural equation model. Descriptive statistics in the research included SD, mean, coefficient of variation, skewness, and kurtosis from AMOS.

2. In the relationship analysis among the variables, AMOS is the main program to use, and another is Pearson's correlation coefficient. The factors of the structural equation model as basic data. Table 3.6 shows the consideration criteria of the correlation coefficient (Taweerat, 1997).

Table 3.6 Correlation coefficient criteria

Correlation coefficient (r)	The relationship level
$r > 0.8$	Very high
$0.6 < r < 0.8$	Quite high
$0.4 < r < 0.6$	Moderate
$0.2 < r < 0.4$	Quite low
$r < 0.2$	low

3. For suitability measurement of the data, KMO is considered for testing congruence between empirical data and the conceptual framework.

4. Examined congruence of the conceptual framework by using the AMOS and also obtained the theories, concepts, and the review of relevant literature.

3.6 Statistical Data Analysis

In this research, the researcher uses Structural Equation Modeling (SEM), which is a model that combines the principles of statistical analysis of two types together, namely path analysis and factor analysis (Brown, 2006). Hair et al. (2006) explains that the structural equation model is a multivariate analysis technique that combines factor analysis and multiple regressions, allows researchers to greatly benefit from the SEM technique, and is used to examine the relationships between variables in the conceptual framework both direct and indirect. The most popular statistical program used in SEM inspection is AMOS.

The program of AMOS is used for analyzing data in this research for:

1. Studying the relationship between latent variables by testing the theoretical basis.

2. Analyzing the relationship between latent variables and Indicators or empirical variables.

By examining the quality of the measurement, the AMOS program increases the opportunity to analyze variance and covariance by applying this technique to confirm factor analysis (Confirmatory Factor Analysis: CFA) to check the harmony, accuracy, or consistency of the gauge construction. The objective of the technique is to test the hypothesis of the relationship between latent variables and manifest variables, including studying the relationship between exogenous latent variables and endogenous latent variables (Ullman, 2001).

Analysis of joint variants in this research study, the researcher uses techniques to analyze the variable of all variables by studying the overall picture according to the equation to confirm the completeness or failure to introduce indicators or empirical variables used to create theoretical variables as well as the relevant statistics to assess the consistency of the conceptual framework and the empirical data (Hair et al., 2006; Schumacker & Lomax, 2010), as shown in table 3.7.

Table 3.7 Statistics for evaluating the consistency of the conceptual framework

Statistic	Symbol	Objective	Statistics for the conceptual framework with empirical data
Chi-square	χ^2	To test the null hypothesis, the conceptual framework is consistent with the empirical data.	$p > 0.05$
Relative Chi-square	χ^2/df	To prove the conceptual framework is consistent with empirical data.	$\chi^2/df < 2.00$
Goodness of Fit Index	GFI	To measure the level of harmonious harmony between 0-1.00.	≥ 0.90
Adjusted Goodness of Fit Index	AGFI	To measure the level of harmonious harmony between 0-1.00.	≥ 0.90
Root Mean Square Error of Approximation	RMSEA	To inform the tolerances of the conceptual framework, the root form of the mean square of the estimated error between 0 -100.	< 0.05

3.7 Ethical Consideration

The data collection is for this research only. No asking personal questions and personal information was not shared with others. There are efforts to prevent participants from harming and respect their dignity in all areas. Finally, the researchers of this research project received full consent from all respondents and should be certified by Ethics in Human Research before asking questions in the survey.

CHAPTER 4

RESEARCH RESULTS

The study “A Structural Equation Model of Factors Influencing Sustainability of Chemical Industry in Thailand”. The research methodology is exploratory research. A quantitative research method was used as a descriptive research methodology and questionnaires were used as a tool to collect data. A total of 317 samples were used from chemical industry in Thailand.

Statistics for analyzing data using descriptive statistics include frequency distribution of data by percentage, arithmetic mean, and standard deviation. Inferential Statistics Statistical analysis was used, consisting of confirmatory factor analysis (CFA) and structural equation analysis (SEM), to verify the consistency of the research model with empirical data (Model Fit). Examine model fit with empirical data (Assessment of Model Fit). Indexes used to verify model fit with empirical data include the Chi-Square Index, CMIN/df., CFI, GFI, IFI, NFI, AGFI, RMSEA, and RMR by criteria for checking the consistency of data processing models from statistical computer programs. The results of data analysis and interpretation are presented in an annotated table format. The results of the research can be summarized into 6 parts as follows:

4.1 Socio-Demographic Information

4.2 Analysis of Factors Influencing Sustainability of Chemical Industry in Thailand

4.3 Confirmatory Factor Analysis of Model Factors Influencing Sustainability of Chemical Industry in Thailand

4.4 Correlation Analysis of Model Factors Influencing Sustainability of Chemical Industry in Thailand

4.5 Analysis of Structural Equations Model Factors Influencing Sustainability of Chemical Industry in Thailand

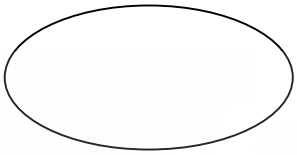
4.6 Suggestion of Respondents on Factors Influencing Sustainability of Chemical Industry in Thailand

Determination of symbols and abbreviations used in data analysis.

To have a common understanding of the presentation and interpretation of the data analysis results presented in Chapter 4, the researcher discusses the symbols and abbreviations used in the

data analysis and the analysis results of the sample status data. After that, the data analysis results will be presented in order of research objectives. Define symbols and abbreviations as follows.

Meaning Observed variables



Meaning Latent variables

Meaning Causal relationship

Meaning Relationship of variables

n	Meaning	Sample Size
$\overline{X}$	Meaning	Mean of a sample
SD	Meaning	Standard deviation
C.V.	Meaning	Coefficient of variation
r	Meaning	Pearson's product moment correlation coefficient
χ^2	Meaning	Chi - square
λ	Meaning	Factor loading
SE.	Meaning	Standard error
Sig.	Meaning	Statistical significance
df.	Meaning	Degrees of freedom
R^2	Meaning	Coefficient of determination
***	Meaning	P-values less than 0.001

**	Meaning	P-values less than 0.01
*	Meaning	P-values less than 0.05
CFI	Meaning	Comparative Fit Index
GFI	Meaning	Goodness of Fit Index: GFI
AGFI	Meaning	Adjusted Goodness of Fit Index
RMSEA	Meaning	Root Mean Square Error of Approximation
SRMR	Meaning	Standardized Root Mean Square Residual
NFI	Meaning	Normed fit index
IFI	Meaning	Incremental fit index
CFA	Meaning	Confirmatory Factor Analysis
AVE	Meaning	Average variance extracted
CR.	Meaning	Composite reliability
PRO1	Meaning	Your organization's turnover has been growing steadily every year.
PRO2	Meaning	Your organization has a continuous increase in profitability.
PRO3	Meaning	Your organization has continuously increased its market share.
PRO4	Meaning	Your organization is always striving to improve customer satisfaction.
PEO1	Meaning	Your organization produces products that are beneficial to health and safety for society.
PEO2	Meaning	Your organization strives to maintain customer loyalty with quality products and services.
PEO3	Meaning	Your organization pays high levels of employee compensation and benefits compared to competitors in the same industry.
PEO4	Meaning	Your organization has excellent relationships with suppliers and has mutual trust.

PLA1	Meaning	Your organization strives to minimize emissions and waste.
PLA2	Meaning	Your organization strives to minimize the use of resources and hazardous materials.
PLA3	Meaning	Your organization has specific goals for actions to reduce its environmental impact.
PLA4	Meaning	Your organization is certified to global environmental performance standards.
CHA1	Meaning	Manager demonstrates leadership in sustainable development by passing on key company values to employees.
CHA2	Meaning	Manager seriously conveys the vision of sustainable development to employees and expresses confidence that goals will be achieved.
CHA3	Meaning	Manager is role model for corporate sustainability development.
CHA4	Meaning	Manager encourages support and encouragement to employees in solving problems that may arise while working.
INT1	Meaning	Manager encourages employees to innovate, be creative and seek solutions to develop sustainability led by the employees themselves.
INT2	Meaning	Manager seeks a wide range of information to help support the idea of the best solution for corporate sustainability.
INT3	Meaning	Manager challenges employees to set higher goals for themselves for higher performance.
INT4	Meaning	Manager focuses on brainstorming to find out how to achieve goals and how to solve problems from working with consensus on their team.
IND1	Meaning	Manager pays close attention to the individual needs of each employee.
IND2	Meaning	Manager treats each employee as an individual rather than just a member of the organization.
IND3	Meaning	Manager cares about the abilities of each employee and strives to enhance their abilities.
IND4	Meaning	Manager inspires employees with individual employee career advancement plans.

CLA1	Meaning	Your organization has a family-like atmosphere.
CLA2	Meaning	Your organization considers working as a team and a feeling of oneness as important.
CLA3	Meaning	Your organization values loyalty and tradition in the organization
ADH1	Meaning	Your organization is committed to innovation and sustainable development.
ADH2	Meaning	Your organization emphasizes growth through developing new ideas
ADH3	Meaning	Your organization has a risk management plan and is open to experimenting with new ways of working.
MAR1	Meaning	Your organization places high importance to accomplishing goals
MAR2	Meaning	Your organization is driven by financial success.
MAR3	Meaning	Your organization emphasizes aggressive competition and outcome excellence.
HIE1	Meaning	Your organization emphasizes formalization and has a clear organizational structure.
HIE2	Meaning	Your organization has formal rules and policies that are strictly followed.
HIE3	Meaning	Your organization is certified to global operating standards.
ECO1	Meaning	Your organization operates for the benefit of stakeholders.
ECO2	Meaning	Your organization produces good quality products at reasonable prices.
ECO3	Meaning	Your organization is constantly developing products for economic and social benefits.
LEG1	Meaning	Your organization strictly complies with all applicable laws and regulations.
LEG2	Meaning	Your organization cooperates with all types of taxation and avoids the use of legal loopholes in tax evasion.
LEG3	Meaning	Your organization creates an operating environment that meets safety standards for employees.

ETH1	Meaning	Your organization has ethical standards and be faithful to them at all times.
ETH2	Meaning	Your organization takes social and environmental considerations no less than the pursuit of profit.
ETH3	Meaning	Your organization provides accurate and complete information to customers, business partners, and society.
PHI1	Meaning	Your organization reinforces voluntary activities for society.
PHI2	Meaning	Your organization always makes charitable contributions.
PHI3	Meaning	Your organization always supports and participates in social and environmental activities.
SUS1	Meaning	Profit
SUS2	Meaning	People
SUS3	Meaning	Planet
LEA1	Meaning	Charisma and Inspiration
LEA2	Meaning	Intellectual Stimulation
LEA3	Meaning	Individual Consideration
CUL1	Meaning	Clan
CUL2	Meaning	Adhocracy
CUL3	Meaning	Market
CUL4	Meaning	Hierarchy
CSR1	Meaning	Economic Responsibility
CSR2	Meaning	Legal Responsibility
CSR3	Meaning	Ethical Responsibility
CSR4	Meaning	Philanthropic Responsibility

Statistical Criteria for Data Analysis

The Chi-square (χ^2-test) value should be less than 2.00, indicating that the model is consistent with the empirical data, according to Hair et al. (2006), Bollen (1989), and Sorbon (1996).

The Comparative Fit Index (CFI), is a consideration of relative fit, where a good CFI should be 0.90 or higher, indicating that the model is a relative fit. The effect of the index was by the concept of Hair et al. (2006).

The Goodness of Fit Index (GFI) represents the amount of variance and covariance that can be explained by the model. The effect of the index is to the concepts of Hair et al. (2006) and Mueller (1996). A good value should be 0.90 or higher, indicating that the model has relative consistency.

The Adjusted Goodness of Fit Index (AGFI) represents the amount of variance and covariance explained by the model adjusted for degrees of freedom. The effect of the index is according to the concepts of Hair et al. (2006) and Mueller (1996). A good value should be 0.90 or more than 0.80, which according to the concepts of Gefen et al., (2003) assumes that the model has relative harmony.

The Root Mean Square Error of Approximation (RMSEA) is a statistical value used in hypothesis testing. A good RMSEA value should be less than 0.05 or between 0.05 - 0.08.

The Standardized Root Mean Square Residual (RMR) should be less than 0.05 to conclude that the model is consistent with the empirical data.

The Normed Fit Index (NFI) with an acceptable value of NFI greater than 0.90 indicates that the model has relative fit as a result of the index according to the concept of Hair et al. (2006).

The Incremental Fit Index (IFI) should be greater than 0.90, indicating that the model is a relative fit. The effect of the index was by the concept of Hair et al. (2006).

4.1 Socio-Demographic Information

This section presents the results of general data analysis of the respondents such as gender, age, highest education, management position, management experience, industry groups, and business operation period. The results of the analysis can be summarized as follows:

Table 4.1 Frequencies and percentages of sample demographic

Socio-demographic information	Frequency	Percentage (%)
Gender		
Male	240	75.71
Female	77	24.29
Total	**317**	**100.00**
Age		
Not more than 30 years	47	14.83
31 – 40 years	79	24.92
41 – 50 years	107	33.76
51 – 60 years	32	10.09
Older than 60 years	52	16.40
Total	**317**	**100.00**
Highest education		
Under a bachelor's degree	77	24.29
Bachelor's degree	185	58.36
Higher than a bachelor's degree	55	17.35
Total	**317**	**100.00**
Management position		
Chief Executive Officer	43	13.56
Managing Director	62	19.56
Director	15	4.73
Manager	194	61.20
Other	3	0.95
Total	**317**	**100.00**

Table 4.1 (Continue)

Socio-demographic information	Frequency	Percentage (%)
Management experience		
Not more than 5 years	77	24.29
5 – 10 years	132	41.64
11 – 15 years	47	14.83
16 – 20 years	35	11.04
More than 20 years	26	8.20
Total	**317**	**100.00**
Industrial groups		
Chemical Fertilizer Industry	92	29.02
Chemical Materials Industry	73	23.03
Pharmaceutical Industries	68	21.45
Cosmetic Industry	47	14.83
Paint Industry and its associated products	37	11.67
Total	**317**	**100.00**
Business operation period		
Not more than 5 years	28	8.83
5 – 10 years	62	19.56
11 – 20 years	141	44.48
More than 20 years	86	27.13
Total	**317**	**100.00**

The results of the analysis of general data of 317 respondents in the gender samples. Most were 240 males, representing 75.71%, and 77 females, representing 24.29%, mostly aged 41-50 years old, 107 respondents, representing 33.76%, followed by 31-40 years old, 79 respondents, representing 24.92%, and over than 60 years old, 52 respondents, representing 16.40%, not more than 30 years old, 47 respondents, representing 14.83%, the lowest 51-60 years old, 32 respondents, representing 10.09%, respectively. From the highest education, a bachelor's degree is a greater number of respondents for 185 respondents, representing 58.36%, followed by below a bachelor's degree for 77 respondents, representing 24.29%, and higher than a bachelor's degree for 55

respondents, representing 17.35%, respectively. Most of them have management positions managers 194 respondents, representing 61.20%, followed by managing directors 62 respondents, representing 19.56%, chief executive officers 43 respondents, representing 13.56%, fewer are directors, 15 respondents, representing 4.73%, and the other lowest 3 respondents, representing 0.95%, respectively. The management experience 5 - 10 years, 132 respondents, representing 41.64%, followed by not more than 5 years, 77 respondents, representing 24.29%, 11-15 years, 47 respondents, representing 14.83%, the minority is the number of 16 - 20 years, 35 respondents, representing 11.04%, and more than 20 years, 26 respondents, representing 8.20%, respectively. Most of the respondents came from the chemical fertilizer industry, 92 respondents, representing 29.02%, followed by the chemical materials industry, 73 respondents, representing 23.03%, the pharmaceutical industry, 68 respondents, representing 21.45%, the cosmetic industry, 47 respondents, representing 14.83%, and paint industry and its associated products 37 respondents, representing 11.67%, respectively. The business has the most operating period of 11-20 years, with 141 respondents, representing 44.48%, followed by more than 20 years with 86 respondents, representing 27.13%, 5-10 years, 62 respondents, representing 19.56%, and least, not more than 5 years, of 28 respondents, representing 8.83%, respectively.

4.2 Analysis of Factors Influencing Sustainability of Chemical Industry in Thailand

This part is the result of a descriptive statistical analysis of factors influencing the sustainability of the chemical industry in Thailand, consisting of sustainability, transformational leadership, organizational culture, and corporate social responsibility. The analysis results can be summarized as follows:

4.2.1 Sustainability

The results of the opinion analysis of Sustainability, consist of Profit, People, and Planet. The results of the analysis are as follows.

Table 4.2 Mean and Standard Deviation of Sustainability (n = 317)

Abbreviation	Sustainability	$\overline{X}$	SD.	Meaning	Rank
Profit					**(1)**
PRO1	Your organization's turnover has been growing steadily every year.	4.22	0.87	Strongly Agree	
PRO2	Your organization has a continuous increase in profitability.	4.20	0.84	Strongly Agree	
PRO3	Your organization has continuously increased its market share.	4.20	0.89	Strongly Agree	
PRO4	Your organization is always striving to improve customer satisfaction.	4.13	0.87	Agree	
	Mean	4.19	0.70	Agree	
People					**(3)**
PEO1	Your organization produces products that are beneficial to health and safety for society.	4.14	0.81	Agree	
PEO2	Your organization strives to maintain customer loyalty with quality products and services.	4.27	0.81	Strongly Agree	
PEO3	Your organization pays high levels of employee compensation and benefits compared to competitors in the same industry.	4.09	0.83	Agree	
PEO4	Your organization has excellent relationships with suppliers and has mutual trust.	4.06	0.77	Agree	
	Mean	4.14	0.70	Agree	

Table 4.2 (Continue)

Abbreviation	Sustainability	$\overline{X}$	SD.	Meaning	Rank
Planet					**(2)**
PLA1	Your organization strives to minimize emissions and waste.	4.18	0.89	Agree	
PLA2	Your organization strives to minimize the use of resources and hazardous materials.	4.14	0.83	Agree	
PLA3	Your organization has specific goals for actions to reduce its environmental impact.	4.13	0.85	Agree	
PLA4	Your organization is certified to global environmental performance standards.	4.19	0.91	Agree	
	Mean	4.16	0.77	Agree	
	Total Mean	4.16	0.71	Agree	

The results of the analysis of opinions on Sustainability, the overall mean was 4.16 with a standard deviation of 0.71 at an agree level. The highest was Profit, followed by Planet and People, respectively. The results of each aspect are as follows.

Profit has a mean of 4.19 with a standard deviation of 0.70 at an agree level. In each aspect, the opinions at a strongly agree level were “Your organization's turnover has been growing steadily every year” with a mean of 4.22 and an agree level of 4 aspects, namely “Your organization has a continuous increase in profitability” ($\bar{x}$ = 4.20), “Your organization has continuously increased its market share” ($\bar{x}$ = 4.20), and “Your organization is always striving to improve customer satisfaction” ($\bar{x}$ = 4.13).

People have a mean of 4.14 with a standard deviation of 0.70 at an agree level. In each aspect, the opinions at a strongly agree level were “Your organization strives to maintain customer loyalty with quality products and services” with a mean of 4.27 and an agree level of 4 aspects, namely “Your organization produces products that are beneficial to health and safety for society” ($\bar{x}$ = 4.14), “Your organization pays high levels of employee compensation and benefits compared to competitors in the same industry” ($\bar{x}$ = 4.09), and “Your organization has excellent relationships with suppliers and has mutual trust” ($\bar{x}$ = 4.06).

Planet has a mean of 4.16 with a standard deviation of 0.77 at an agree level. In each aspect, the opinions were at an agree level in all 4 aspects, namely “Your organization is certified to global environmental performance standards” with a mean of 4.19, followed by “Your organization strives to minimize emissions and waste” ($\bar{x}$ = 4.18), “ Your organization strives to minimize the use of resources and hazardous materials” ($\bar{x}$ = 4.14), and “Your organization has specific goals for actions to reduce its environmental impact” ($\bar{x}$ = 4.13).

4.2.2 Transformational Leadership

The results of the opinion analysis of Transformational Leadership, consist of Charisma and Inspiration, Intellectual Stimulation, and Individual Consideration. The results of the analysis are as follows.

Table 4.3 Mean and Standard Deviation of Transformational Leadership (n = 317)

Abbreviation	Transformational Leadership	$\overline{X}$	SD.	Meaning	Rank
Charisma and Inspiration					**(3)**
CHA1	Manager demonstrates leadership in sustainable development by passing on key company values to employees.	3.98	0.97	Agree	
CHA2	Manager seriously conveys the vision of sustainable development to employees and expresses confidence that goals will be achieved.	3.91	0.92	Agree	
CHA3	Manager is a role model for corporate sustainability development.	3.92	1.01	Agree	
CHA4	Manager encourages support and encouragement to employees in solving problems that may arise while working.	3.91	0.91	Agree	
	Mean	3.93	0.87	Agree	
Intellectual Stimulation					**(1)**
INT1	Manager encourages employees to innovate, be creative and seek solutions to develop sustainability led by the employees themselves.	3.97	0.92	Agree	
INT2	Manager seeks a wide range of information to help support the idea of the best solution for corporate sustainability.	4.02	0.94	Agree	
INT3	Manager challenges employees to set higher goals for themselves for higher performance.	4.00	0.88	Agree	

Table 4.3 (Continue)

Abbreviation	Transformational Leadership	$\overline{X}$	SD.	Meaning	Rank
INT4	Manager focuses on brainstorming to find out how to achieve goals and how to solve problems from working with consensus on their team.	4.04	0.77	Agree	
	Mean	4.01	0.72	Agree	
Individual Consideration					**(2)**
IND1	Manager pays close attention to the individual needs of each employee.	4.07	0.96	Agree	
IND2	Manager treats each employee as an individual rather than just a member of the organization.	4.01	0.86	Agree	
IND3	Manager cares about the abilities of each employee and strives to enhance their abilities.	4.07	0.89	Agree	
IND4	Manager inspires employees with individual employee career advancement plans.	4.11	0.92	Agree	
	Mean	4.06	0.79	Agree	
	Total Mean	4.00	0.72	Agree	

The results of the analysis of opinions on Transformational Leadership, the overall mean was 4.00 with a standard deviation of 0.72 at an agree level. The highest was Intellectual Stimulation, followed by Individual Consideration, and Charisma and Inspiration, respectively. The results of each aspect are as follows.

Charisma and Inspiration have a mean of 3.93 with a standard deviation of 0.87 at an agree level. In each aspect, the opinions were at an agree level in all 4 aspects, namely "Manager demonstrates leadership in sustainable development by passing on key company values to employees" with a mean of 3.98, followed by "Manager is role model for corporate sustainability development" ($\bar{x}$ = 3.92), "Manager seriously conveys the vision of sustainable development to employees and expresses confidence that goals will be achieved" ($\bar{x}$ = 3.91), and "Manager encourages support and encouragement to employees in solving problems that may arise while working" ($\bar{x}$ = 3.91).

Intellectual Stimulation has a mean of 4.01 with a standard deviation of 0.72 at an agree level. In each aspect, the opinions were at an agree level in all 4 aspects, namely "Manager focuses on brainstorming to find out how to achieve goals and how to solve problems from working with consensus on their team" with a mean of 4.04, followed by "Manager seeks a wide range of information to help support the idea of the best solution for corporate sustainability" ($\bar{x}$ = 4.02), "Manager challenges employees to set higher goals for themselves for higher performance" ($\bar{x}$ = 4.00), and "Manager encourages employees to innovate, be creative and seek solutions to develop sustainability led by the employees themselves" ($\bar{x}$ = 3.97).

Individual Consideration has a mean of 4.06 with a standard deviation of 0.79 at an agree level. In each aspect, the opinions were at an agree level in all 4 aspects, namely "Manager inspires employees with individual employee career advancement plans" with a mean of 4.11, followed by "Manager pays close attention to the individual needs of each employee" ($\bar{x}$ = 4.07), "Manager cares about the abilities of each employee and strives to enhance their abilities" ($\bar{x}$ = 4.07), and "Manager treats each employee as an individual rather than just a member of the organization" ($\bar{x}$ = 4.01).

4.2.3 Organizational Culture

The results of the opinion analysis of Organizational Culture, consist of Clan, Adhocracy, Market, and Hierarchy. The results of the analysis are as follows.

Table 4.4 Mean and Standard Deviation of Organizational Culture (n = 317)

Abbreviation	Organizational Culture	$\overline{X}$	SD.	Meaning	Rank
Clan					**(4)**
CLA1	Your organization has a family-like atmosphere.	3.59	0.98	Agree	
CLA2	Your organization considers working as a team and a feeling of oneness as important.	3.70	0.93	Agree	
CLA3	Your organization values loyalty and tradition in the organization.	3.59	0.97	Agree	
	Mean	3.63	0.88	Agree	
Adhocracy					**(1)**
ADH1	Your organization is committed to innovation and sustainable development.	4.13	0.91	Agree	
ADH2	Your organization emphasizes growth through developing new ideas.	4.12	0.91	Agree	
ADH3	Your organization has a risk management plan and is open to experimenting with new ways of working.	4.08	0.95	Agree	
	Mean	4.11	0.85	Agree	
Market					**(2)**
MAR1	Your organization places high importance on accomplishing goals.	4.08	0.88	Agree	
MAR2	Your organization is driven by financial success.	4.15	0.87	Agree	
MAR3	Your organization emphasizes aggressive competition and outcome excellence.	4.03	0.88	Agree	
	Mean	4.09	0.80	Agree	

Table 4.4 (Continue)

Abbreviation	Organizational Culture	$\overline{X}$	SD.	Meaning	Rank
Hierarchy					**(3)**
HIE1	Your organization emphasizes formalization and has a clear organizational structure.	4.08	0.85	Agree	
HIE2	Your organization has formal rules and policies that are strictly followed.	4.15	0.88	Agree	
HIE3	Your organization is certified to global operating standards.	4.05	0.89	Agree	
	Mean	4.09	0.81	Agree	
	Total Mean	3.98	0.71	Agree	

The results of the analysis of opinions on Organizational Culture, the overall mean was 3.98 with a standard deviation of 0.72 at an agree level. The highest was Adhocracy, followed by Market, Hierarchy, and Clan, respectively. The results of each aspect are as follows.

Clan has a mean of 3.63 with a standard deviation of 0.88 at an agree level. In each aspect, the opinions were at an agree level in all 3 aspects, namely "Your organization considers working as a team and a feeling of oneness as important" with a mean of 3.70, followed by "Your organization has a family-like atmosphere" ($\bar{x}$ = 3.59), and "Your organization values loyalty and tradition in the organization" ($\bar{x}$ = 3.59).

Adhocracy has a mean of 4.11 with a standard deviation of 0.85 at an agree level. In each aspect, the opinions were at an agree level in all 3 aspects, namely "Your organization is committed to innovation and sustainable development" with a mean of 4.13, followed by "Your organization emphasizes growth through developing new ideas" ($\bar{x}$ = 4.12), and "Your organization has a risk management plan and is open to experimenting with new ways of working" ($\bar{x}$ = 4.08).

Market has a mean of 4.09 with a standard deviation of 0.80 at an agree level. In each aspect, the opinions were at an agree level in all 3 aspects, namely "Your organization is driven by financial success" with a mean of 4.15, followed by "Your organization places high importance on accomplishing goals" ($\bar{x}$ = 4.08), and "Your organization emphasizes aggressive competition and outcome excellence" ($\bar{x}$ = 4.03).

Hierarchy has a mean of 4.09 with a standard deviation of 0.81 at an agree level. In each aspect, the opinions were at an agree level in all 3 aspects, namely "Your organization has formal rules and policies that are strictly followed" with a mean of 4.15, followed by "Your organization emphasizes formalization and has a clear organizational structure" ($\bar{x}$ = 4.08), and "Your organization is certified to global operating standards" ($\bar{x}$ = 4.05).

4.2.4 Corporate Social Responsibility

The results of the opinion analysis of Corporate Social Responsibility, consist of Economic Responsibility, Legal Responsibility, Ethical Responsibility, and Philanthropic Responsibility. The results of the analysis are as follows.

Table 4.5 Mean and Standard Deviation of Corporate Social Responsibility (n = 317)

Abbreviation	Corporate Social Responsibility	$\overline{X}$	SD.	Meaning	Rank
Economic Responsibility					**(1)**
ECO1	Your organization operates for the benefit of stakeholders.	4.15	0.93	Agree	
ECO2	Your organization produces good quality products at reasonable prices.	4.12	0.88	Agree	
ECO3	Your organization is constantly developing products for economic and social benefits.	4.15	0.90	Agree	
	Mean	4.14	0.81	Agree	
Legal Responsibility					**(2)**
LEG1	Your organization strictly complies with all applicable laws and regulations.	4.16	0.91	Agree	
LEG2	Your organization cooperates with all types of taxation and avoids the use of legal loopholes in tax evasion.	4.12	0.85	Agree	
LEG3	Your organization creates an operating environment that meets safety standards for employees.	4.09	0.86	Agree	
	Mean	4.12	0.79	Agree	

Table 4.5 (Continue)

Abbreviation	Corporate Social Responsibility	$\overline{X}$	SD.	Meaning	Rank
Ethical Responsibility					**(4)**
ETH1	Your organization has ethical standards and be faithful to them at all times.	4.06	0.91	Agree	
ETH2	Your organization takes social and environmental considerations no less than the pursuit of profit.	4.11	0.92	Agree	
ETH3	Your organization provides accurate and complete information to customers, business partners, and society.	4.03	0.93	Agree	
	Mean	4.07	0.84	Agree	
Philanthropic Responsibility					**(3)**
PHI1	Your organization reinforces voluntary activities for society.	4.10	0.89	Agree	
PHI2	Your organization always makes charitable contributions.	4.13	0.92	Agree	
PHI3	Your organization always supports and participates in social and environmental activities.	4.13	0.90	Agree	
	Mean	4.12	0.82	Agree	
	Total Mean	4.11	0.78	Agree	

The results of the analysis of opinions on Corporate Social Responsibility, the overall mean was 4.11 with a standard deviation of 0.79 at an agree level. The highest was Economic Responsibility, followed by Legal Responsibility, Philanthropic Responsibility, and Ethical Responsibility, respectively. The results of each aspect are as follows.

Economic Responsibility has a mean of 4.14 with a standard deviation of 0.81 at an agree level. In each aspect, the opinions were at an agree level in all 3 aspects, namely "Your organization operates for the benefit of stakeholders", and "Your organization is constantly developing products for economic and social benefits" with a mean of 4.15, followed by "Your organization produces good quality products at reasonable prices" ($\overline{X}$ = 4.12).

Legal Responsibility has a mean of 4.12 with a standard deviation of 0.79 at an agree level. In each aspect, the opinions were at an agree level in all 3 aspects, namely "Your organization strictly complies with all applicable laws and regulations" with a mean of 4.16, followed by "Your organization cooperates with all types of taxation and avoids the use of legal loopholes in tax evasion" ($\overline{X}$ = 4.12), and "Your organization creates an operating environment that meets safety standards for employees" ($\overline{X}$ = 4.09).

Ethical Responsibility has a mean of 4.07 with a standard deviation of 0.84 at an agree level. In each aspect, the opinions were at an agree level in all 3 aspects, namely "Your organization takes social and environmental considerations no less than the pursuit of profit" with a mean of 4.11, followed by "Your organization has ethical standards and be faithful to them at all times" ($\overline{X}$ = 4.06), and "Your organization provides accurate and complete information to customers, business partners, and society" ($\overline{X}$ = 4.03).

Philanthropic Responsibility has a mean of 4.12 with a standard deviation of 0.82 at an agree level. In each aspect, the opinions were at an agree level in all 3 aspects, namely "Your organization always makes charitable contributions" and "Your organization always supports and participates in social and environmental activities" with a mean of 4.13, followed by "Your organization reinforces voluntary activities for society" ($\overline{X}$ = 4.10).

4.3 Confirmatory Factor Analysis of Model Factors Influencing Sustainability of Chemical Industry in Thailand

This section examines the harmoniousness of the model using a Confirmatory Factor Analysis (CFA) of the model of factors influencing sustainability of chemical industry in Thailand. The variables were used to analyze the components of latent variables, including Sustainability, Transformational Leadership, Organizational Culture, and Corporate Social Responsibility which were used to perform a confirmatory factor analysis and using the arrow linking technique between the discrepancies between the two variables by considering the Modification Indices (MI). The results of the analysis for each variable are summarized as follows.

4.3.1 Sustainability

The results of the confirmatory factor analysis of the model of factors influencing sustainability of chemical industry in Thailand for Sustainability, there were 3 variables, namely Profit (PRO), People (PEO), and Planet (PLA), including 12 observable variables. It was found that the consistency with the empirical data was good. Chi-Square was 18.220, df was 11.0, Sig. was 0.077 > 0.05, and CMIN/df was 1.656 < 2.0. The consistency and statistical with Comparative Fit Index (CFI) 0.998 > 0.90, Goodness of Fit Index (GFI) 0.991 > 0.90, Adjusted Goodness of Fit Index (AGFI) 0.934 > 0.80, Root Mean Square Error of Approximation (RMSEA) was 0.046 < 0.05, Standardized Root Mean Square Residual (SRMR) was 0.012 < 0.05, Normed fit index (NFI) was 0.996 > 0.90, and Incremental fit index (IFI) was 0.998 > 0.90. These indices were said to have met a predetermined threshold indicating that the model in this measurement was accurate (Validity) as shown in Figure 4.1 and Table 4.6.

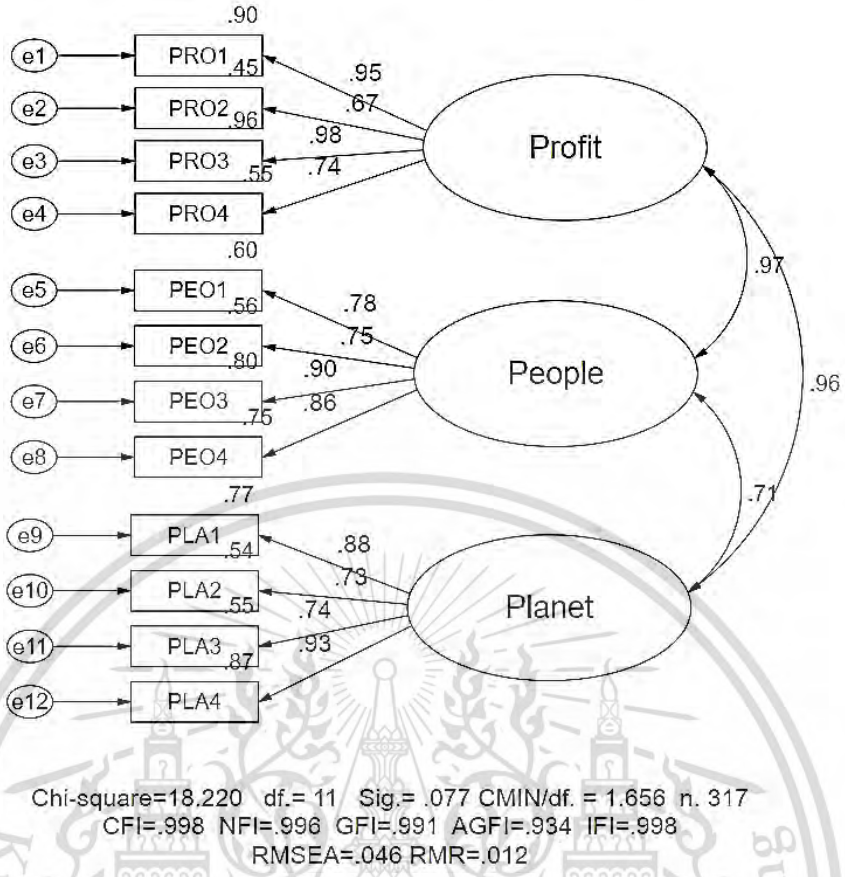


Figure 4.1 Confirmatory Factor Analysis of Sustainability

Table 4.6 The statistical analysis for the confirmatory factor analysis of sustainability

Sustainability	λ	SE.	t-value	R^2	AVE	CR.
Profit (PRO)					0.717	0.908
PRO1 (Parameter Constant)	0.95	-	-	90.0%		
PRO2	0.67	0.04	16.695**	45.0%		
PRO3	0.98	0.03	36.638**	96.0%		
PRO4	0.74	0.05	17.095**	55.0%		
People (PEO)					0.677	0.893
PEO1 (Parameter Constant)	0.78	-	-	60.0%		
PEO2	0.75	0.06	15.449**	56.0%		
PEO3	0.90	0.07	17.658**	80.0%		
PEO4	0.86	0.06	16.941**	75.0%		

Table 4.6 (Continue)

Sustainability	λ	SE.	t-value	R^2	AVE	CR.
Planet (PLA)					0.682	0.895
PLA1 (Parameter Constant)	0.88	-	-	77.0%		
PLA2	0.74	0.05	16.088**	54.0%		
PLA3	0.74	0.05	17.304**	55.0%		
PLA4	0.93	0.05	23.446**	87.0%		

** Statistically significant at 0.01

The results of the confirmatory factor analysis of the model of factors influencing sustainability of chemical industry in Thailand for Sustainability consisted of Profit (PRO), People (PEO), and Planet (PLA) with a Factor Loading (λ) between $0.67 - 0.98$ greater than 0.40, a Standard Error (SE) between 0.03 – 0.06, a Multiple Correlation Coefficient (R^2) between 45.0% - 96.0%, Average Variance Extracted (AVE) between $0.677 - 0.717$ greater than 0.50. It was said that the measurement model had good convergence and that the variables had good unity and the Composite Reliability (CR) between $0.895 - 0.908$ was greater than 0.60. It was shown that the observed and latent variables in all sustainability confirmation factor models had high discriminative fidelity, indicating the latent variable unity that satisfies the criterion. It can import the structural equation model of factors influencing sustainability of chemical industry in Thailand with a statistical significance of 0.01.

Table 4.7 The correlation coefficient analysis of the observed variables for the confirmatory factor analysis of sustainability

Sustainability	Profit (PRO)				People (PEO)				Planet (PLA)			
	PRO1	PRO2	PRO3	PRO4	PEO1	PEO2	PEO3	PEO4	PLA1	PLA2	PLA3	PLA4
PRO1	1.000											
PRO2	0.697	1.000										
PRO3	0.728	0.644	1.000									
PRO4	0.640	0.753	0.718	1.000								
PEO1	0.670	0.622	0.737	0.748	1.000							
PEO2	0.754	0.512	0.730	0.517	0.589	1.000						
PEO3	0.541	0.634	0.613	0.752	0.688	0.632	1.000					
PEO4	0.511	0.501	0.537	0.559	0.670	0.606	0.786	1.000				
PLA1	0.729	0.623	0.726	0.631	0.640	0.728	0.543	0.508	1.000			
PLA2	0.668	0.733	0.681	0.700	0.670	0.534	0.682	0.498	0.663	1.000		
PLA3	0.667	0.634	0.688	0.697	0.755	0.537	0.576	0.571	0.703	0.764	1.000	
PLA4	0.786	0.600	0.777	0.585	0.608	0.688	0.509	0.474	0.798	0.669	0.687	1.000

In the correlation coefficient analysis of the observed variables for the confirmatory factor analysis of sustainability, there were 3 variables, namely Profit (PRO), People (PEO), and Planet (PLA), including 12 observable variables. The analysis result had a correlation coefficient of the observed variables between 0.474 – 0.798, which was positive and did not exceed 0.80. It could be said that all the observed variables were independent of each other without any correlation between the variables. It can import the structural equation model of factors influencing sustainability of chemical industry in Thailand.

4.3.2 Transformational Leadership

The results of the confirmatory factor analysis of the model of factors influencing sustainability of chemical industry in Thailand for Transformational Leadership, there were 3 variables, namely Charisma and Inspiration (CHA), Intellectual Stimulation (INT), and Individual Consideration (IND), including 12 observable variables. It was found that the consistency with the empirical data was good. Chi-Square was 16.476, df was 13.0, Sig. was 0.224 > 0.05, and CMIN/df was $1.267 < 2.0$. The consistency and statistical with Comparative Fit Index (CFI) $0.999 > 0.90$, Goodness of Fit Index (GFI) $0.992 > 0.90$, Adjusted Goodness of Fit Index (AGFI) $0.949 > 0.80$, Root Mean Square Error of Approximation (RMSEA) was $0.029 < 0.05$, Standardized Root Mean Square Residual (SRMR) was $0.012 < 0.05$, Normed fit index (NFI) was $0.995 > 0.90$, and Incremental fit index (IFI) was $0.999 > 0.90$. These indices were said to have met a predetermined threshold indicating that the model in this measurement was accurate (Validity) as shown in Figure 4.2 and Table 4.8.

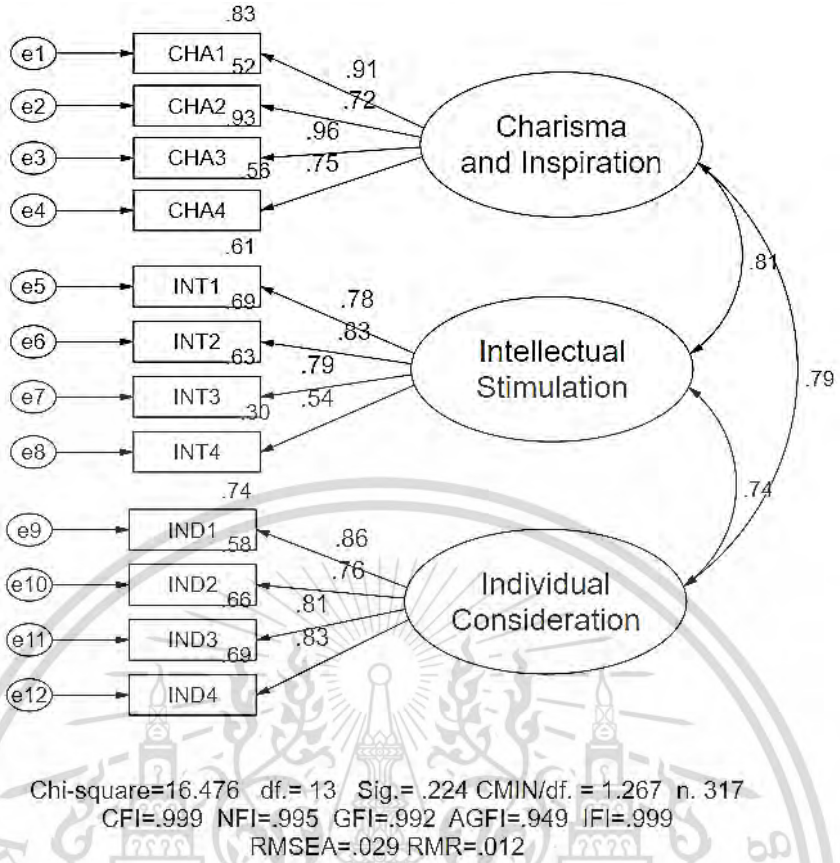


Figure 4.2 Confirmatory Factor Analysis of Transformational Leadership

Table 4.8 The statistical analysis for the confirmatory factor analysis of transformational leadership

Transformational Leadership	**λ**	**SE.**	**t-value**	**R^2**	**AVE**	**CR.**
Charisma and Inspiration (CHA)					0.709	0.906
CHA1 (Parameter Constant)	0.91	-	-	83.0%		
CHA2	0.72	0.04	18.002**	52.0%		
CHA3	0.96	0.05	23.776**	93.0%		
CHA4	0.75	0.03	22.782**	56.0%		
Intellectual Stimulation (INT)					0.555	0.803
INT1 (Parameter Constant)	0.78	-	-	61.0%		
INT2	0.83	0.07	15.779**	69.0%		
INT3	0.79	0.07	13.759**	63.0%		
INT4	0.54	0.07	9.084**	30.0%		

Table 4.8 (Continue)

Transformational Leadership	λ	SE.	t-value	R^2	AVE	CR.
Individual Consideration (IND)					0.668	0.889
IND1 (Parameter Constant)	0.86	-	-	74.0%		
IND2	0.76	0.05	15.322**	58.0%		
IND3	0.82	0.06	15.431**	66.0%		
IND4	0.83	0.06	16.187**	70.0%		

** Statistically significant at 0.01

The results of the confirmatory factor analysis of the model of factors influencing sustainability of chemical industry in Thailand for Transformational Leadership consisted of Charisma and Inspiration (CHA), Intellectual Stimulation (INT), and Individual Consideration (IND) with a Factor Loading (λ) between $0.54 - 0.96$ greater than 0.40, a Standard Error (SE) between $0.04 - 0.07$, a Multiple Correlation Coefficient (R^2) between 30.0% - 93.0%, Average Variance Extracted (AVE) between $0.555 - 0.709$ greater than 0.50. It was said that the measurement model had good convergence and that the variables had good unity and the Composite Reliability (CR) between 0.803 – 0.906 was greater than 0.60. It was shown that the observed and latent variables in all transformational leadership confirmation factor models had high discriminative fidelity, indicating the latent variable unity that satisfies the criterion. It can import the structural equation model of factors influencing sustainability of chemical industry in Thailand with a statistical significance of 0.01.

Table 4.9 The correlation coefficient analysis of the observed variables for the confirmatory factor analysis of transformational leadership

Transformational Leadership	Charisma and Inspiration (CHA)				Intellectual Stimulation (INT)				Individual Consideration (IND)			
	CHA1	CHA2	CHA3	CHA4	INT1	INT2	INT3	INT4	IND1	IND2	IND3	IND4
CHA1	1.000											
CHA2	0.704	1.000										
CHA3	0.779	0.687	1.000									
CHA4	0.794	0.724	0.722	1.000								
INT1	0.600	0.565	0.578	0.591	1.000							
INT2	0.655	0.478	0.677	0.476	0.635	1.000						
INT3	0.464	0.550	0.471	0.584	0.640	0.623	1.000					
INT4	0.333	0.266	0.311	0.327	0.447	0.427	0.541	1.000				
IND1	0.692	0.500	0.646	0.517	0.643	0.647	0.497	0.414	1.000			
IND2	0.524	0.608	0.570	0.663	0.591	0.563	0.646	0.342	0.657	1.000		
IND3	0.583	0.549	0.593	0.587	0.731	0.552	0.623	0.463	0.696	0.740	1.000	
IND4	0.701	0.481	0.724	0.505	0.480	0.615	0.386	0.372	0.716	0.620	0.609	1.000

In the correlation coefficient analysis of the observed variables for the confirmatory factor analysis of transformational leadership, there were 3 variables, namely Charisma and Inspiration (CHA), Intellectual Stimulation (INT), and Individual Consideration (IND), including 12 observable variables. The analysis result had a correlation coefficient of the observed variables between $0.266 - 0.794$, which was positive and did not exceed 0.80. It could be said that all the observed variables were independent of each other without any correlation between the variables. It can import the structural equation model of factors influencing sustainability of chemical industry in Thailand.

4.3.3 Organizational Culture

The results of the confirmatory factor analysis of the model of factors influencing sustainability of chemical industry in Thailand for Organizational Culture, there were 4 variables, namely Clan (CLA), Adhocracy (ADH), Market (MAR), and Hierarchy (HIE), including 12 observable variables. It was found that the consistency with the empirical data was good. Chi-Square was 29.483, df was 26.0, Sig. was $0.290 > 0.05$, and CMIN/df was $1.134 < 2.0$. The consistency and statistical with Comparative Fit Index (CFI) $0.999 > 0.90$, Goodness of Fit Index (GFI) $0.985 > 0.90$, Adjusted Goodness of Fit Index (AGFI) $0.956 > 0.80$, Root Mean Square Error of Approximation (RMSEA) was $0.021 < 0.05$, Standardized Root Mean Square Residual (SRMR) was $0.014 < 0.05$, Normed fit index (NFI) was $0.995 > 0.90$, and Incremental fit index (IFI) was $0.999 > 0.90$. These indices were said to have met a predetermined threshold indicating that the model in this measurement was accurate (Validity) as shown in Figure 4.3 and Table 4.10.

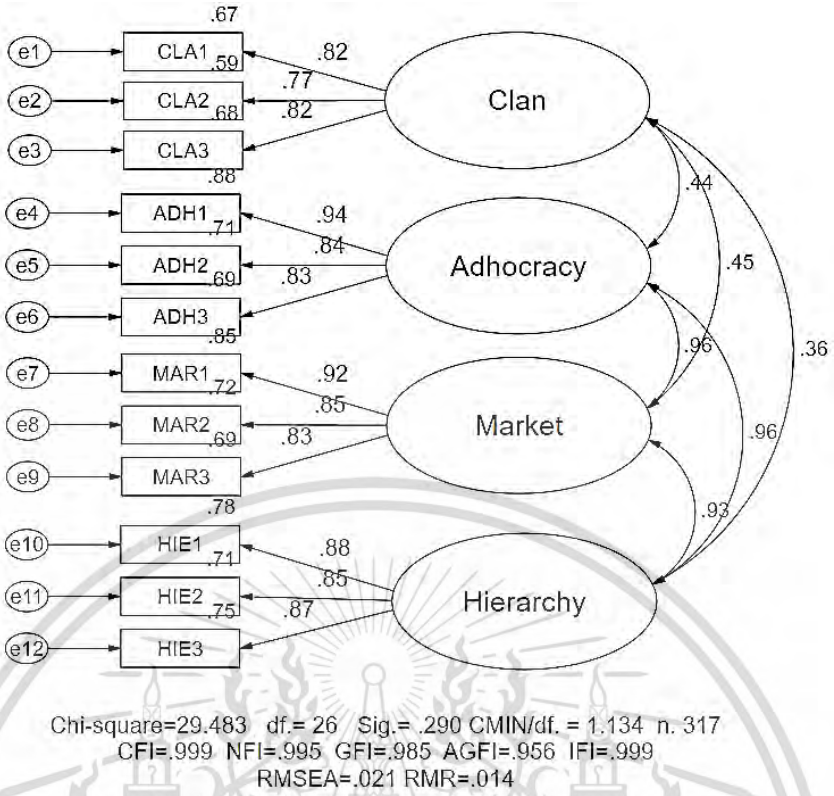


Figure 4.3 Confirmatory Factor Analysis of Organizational Culture

Table 4.10 The statistical analysis for the confirmatory factor analysis of organizational culture

Organizational Culture	λ	SE.	t-value	R^2	AVE	CR.
Clan (CLA)					0.643	0.844
CLA1 (Parameter Constant)	0.82	-	-	67.0%		
CLA2	0.77	0.11	8.022**	59.0%		
CLA3	0.82	0.01	72.771**	68.0%		
Adhocracy (ADH)					0.762	0.905
ADH1 (Parameter Constant)	0.94	-	-	88.0%		
ADH2	0.84	0.04	22.064**	71.0%		
ADH3	0.83	0.04	21.117**	69.0%		
Market (MAR)					0.755	0.902
MAR01 (Parameter Constant)	0.92	-	-	85.0%		
MAR02	0.85	0.04	21.241**	72.0%		
MAR03	0.83	0.04	20.314**	69.0%		

Table 4.10 (Continue)

Organizational Culture	λ	SE.	t-value	R^2	AVE	CR.
Hierarchy (HIE)					0.747	0.899
HIE1 (Parameter Constant)	0.88	-	-	78.0%		
HIE2	0.85	0.05	20.254**	71.0%		
HIE3	0.87	0.03	40.980**	75.0%		

** Statistically significant at 0.01

The results of the confirmatory factor analysis of the model of factors influencing sustainability of chemical industry in Thailand for Organizational Culture consisted of Clan (CLA), Adhocracy (ADH), Market (MAR), and Hierarchy (HIE) with a Factor Loading (λ) between 0.77 – 0.94 greater than 0.40, a Standard Error (SE) between 0.01 – 0.11, a Multiple Correlation Coefficient (R^2) between 59.0% - 88.0%, Average Variance Extracted (AVE) between 0.643 – 0.762 greater than 0.50. It was said that the measurement model had good convergence and that the variables had good unity and the Composite Reliability (CR) between 0.844 – 0.905 was greater than 0.60. It was shown that the observed and latent variables in all organizational culture confirmation factor models had high discriminative fidelity, indicating the latent variable unity that satisfies the criterion. It can import the structural equation model of factors influencing sustainability of chemical industry in Thailand with a statistical significance of 0.01.

Table 4.11 The correlation coefficient analysis of the observed variables for the confirmatory factor analysis of organizational culture

Organizational	Clan (CLA)			Adhocracy (ADH))			Market (MAR)			Hierarchy (HIE)		
Culture	CLA1	CLA2	CLA3	ADH1	ADH2	ADH3	MAR1	MAR2	MAR3	HIE1	HIE2	HIE3
CLA1	1.000											
CLA2	0.626	1.000										
CLA3	0.787	0.631	1.000									
ADH1	0.341	0.320	0.332	1.000								
ADH2	0.304	0.348	0.309	0.789	1.000							
ADH3	0.287	0.301	0.288	0.773	0.724	1.000						
MAR1	0.334	0.324	0.342	0.750	0.754	0.741	1.000					
MAR2	0.311	0.354	0.317	0.769	0.733	0.708	0.786	1.000				
MAR3	0.288	0.351	0.299	0.740	0.699	0.796	0.762	0.734	1.000			
HIE1	0.227	0.255	0.238	0.701	0.676	0.713	0.768	0.713	0.776	1.000		
HIE2	0.244	0.299	0.256	0.773	0.784	0.693	0.729	0.744	0.722	0.735	1.000	
HIE3	0.243	0.254	0.242	0.788	0.677	0.728	0.735	0.697	0.766	0.736	0.727	1.000

In the correlation coefficient analysis of the observed variables for the confirmatory factor analysis of organizational culture, there were 4 variables, namely Clan (CLA), Adhocracy (ADH), Market (MAR), and Hierarchy (HIE), including 12 observable variables. The analysis result had a correlation coefficient of the observed variables between 0.227 – 0.796, which was positive and did not exceed 0.80. It could be said that all the observed variables were independent of each other without any correlation between the variables. It can import the structural equation model of factors influencing sustainability of chemical industry in Thailand.

4.3.4 Corporate Social Responsibility

The results of the confirmatory factor analysis of the model of factors influencing sustainability of chemical industry in Thailand for Corporate Social Responsibility, there were 4 variables, namely Economic responsibility (ECO), Legal responsibility (LEG), Ethical responsibility (ETH), and Philanthropic responsibility (PHI), including 12 observable variables. It was found that the consistency with the empirical data was good. Chi-Square was 17.553, df was 11.0, Sig. was 0.093 > 0.05, and CMIN/df was 1.596 < 2.0. The consistency and statistical with Comparative Fit Index (CFI) 0.999 > 0.90, Goodness of Fit Index (GFI) 0.991 > 0.90, Adjusted Goodness of Fit Index (AGFI) 0.938 > 0.80, Root Mean Square Error of Approximation (RMSEA) was 0.043 < 0.05, Standardized Root Mean Square Residual (SRMR) was 0.019 < 0.05, Normed fit index (NFI) was 0.997 > 0.90, and Incremental fit index (IFI) was 0.999 > 0.90. These indices were said to have met a predetermined threshold indicating that the model in this measurement was accurate (Validity) as shown in Figure 4.4 and Table 4.12.

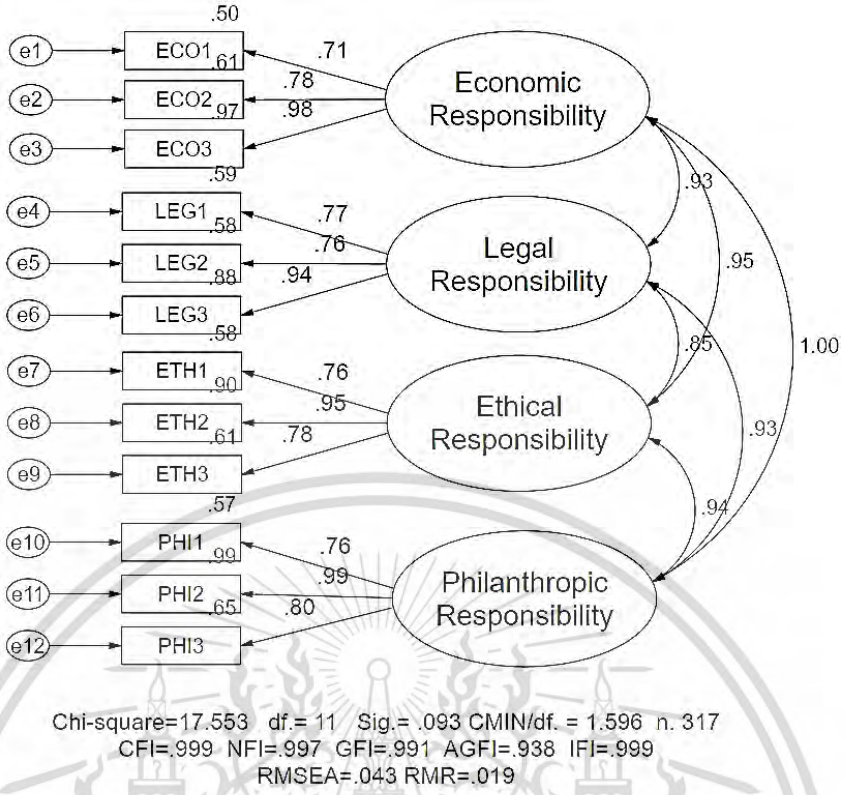


Figure 4.4 Confirmatory Factor Analysis of Corporate Social Responsibility

Table 4.12 The statistical analysis for the confirmatory factor analysis of corporate social responsibility

Corporate Social Responsibility	λ	SE.	t-value	R^2	AVE	CR.
Economic responsibility (ECO)					0.694	0.869
ECO1 (Parameter Constant)	0.71	-	-	50.0%		
ECO2	0.78	0.08	13.968**	61.0%		
ECO3	0.98	0.08	17.514**	97.0%		
Legal responsibility (LEG)					0.685	0.866
LEG1 (Parameter Constant)	0.77	-	-	59.0%		
LEG2	0.76	0.06	15.861**	58.0%		
LEG3	0.94	0.07	17.326**	88.0%		
Ethical responsibility (ETH)					0.693	0.870
ETH1 (Parameter Constant)	0.76	-	-	58.0%		
ETH2	0.95	0.06	20.867**	90.0%		
ETH3	0.78	0.06	18.031**	61.0%		

Table 4.12 (Continue)

Corporate Social Responsibility	λ	SE.	t-value	R^2	AVE	CR.
Philanthropic responsibility (PHI)					0.735	0.891
PHI1 (Parameter Constant)	0.76	-	-	57.0%		
PHI2	0.99	0.07	20.329**	99.0%		
PHI3	0.80	0.07	16.080**	65.0%		

** Statistically significant at 0.01

The results of the confirmatory factor analysis of the model of factors influencing sustainability of chemical industry in Thailand for Corporate Social Responsibility consisted of Economic responsibility (ECO), Legal responsibility (LEG), Ethical responsibility (ETH), and Philanthropic responsibility (PHI) with a Factor Loading (λ) between 0.71 – 0.99 greater than 0.40, a Standard Error (SE) between 0.06– 0.08, a Multiple Correlation Coefficient (R^2) between 50.0% - 99.0%, Average Variance Extracted (AVE) between 0.685 – 0.735 greater than 0.50. It was said that the measurement model had good convergence and that the variables had good unity and the Composite Reliability (CR) between 0.866 – 0.891 was greater than 0.60. It was shown that the observed and latent variables in all corporate social responsibility confirmation factor models had high discriminative fidelity, indicating the latent variable unity that satisfies the criterion. It can import the structural equation model of factors influencing sustainability of chemical industry in Thailand with a statistical significance of 0.01.

Table 4.13 The correlation coefficient analysis of the observed variables for the confirmatory factor analysis of corporate social responsibility

Corporate Social	Economic responsibility (ECO)			Legal responsibility (LEG)			Ethical responsibility (ETH)			Philanthropic responsibility (PHI)		
Responsibility	ECO1	ECO2	ECO3	LEG1	LEG2	LEG3	ETH1	ETH2	ETH3	PHI1	PHI2	PHI3
ECO1	1.000											
ECO2	0.633	1.000										
ECO3	0.686	0.774	1.000									
LEG1	0.783	0.640	0.691	1.000								
LEG2	0.689	0.788	0.688	0.702	1.000							
LEG3	0.703	0.712	0.718	0.716	0.706	1.000						
ETH1	0.665	0.761	0.700	0.640	0.736	0.646	1.000					
ETH2	0.635	0.791	0.783	0.606	0.608	0.750	0.787	1.000				
ETH3	0.667	0.735	0.720	0.665	0.676	0.730	0.756	0.732	1.000			
PHI1	0.639	0.758	0.745	0.651	0.748	0.681	0.794	0.782	0.751	1.000		
PHI2	0.707	0.779	0.781	0.709	0.692	0.702	0.697	0.781	0.708	0.746	1.000	
PHI3	0.756	0.676	0.791	0.705	0.786	0.777	0.657	0.709	0.697	0.667	0.799	1.000

In the correlation coefficient analysis of the observed variables for the confirmatory factor analysis of corporate social responsibility, there were 4 variables, namely Economic responsibility (ECO), Legal responsibility (LEG), Ethical responsibility (ETH), and Philanthropic responsibility (PHI), including 12 observable variables. The analysis result had a correlation coefficient of the observed variables between 0.606 – 0.799, which was positive and did not exceed 0.80. It could be said that all the observed variables were independent of each other without any correlation between the variables. It can import the structural equation model of factors influencing sustainability of chemical industry in Thailand.

4.3.5 Model of factors influencing sustainability of chemical industry in Thailand

The results of the confirmatory factor analysis of the model of factors influencing sustainability of chemical industry in Thailand, there were 4 variables, namely Sustainability (SUS), Transformational Leadership (LEA), Organizational Culture (CUL), and Corporate Social Responsibility (CSR), including 14 observable variables. It was found that the consistency with the empirical data was good. Chi-Square was 34.742, df was 32.0, Sig. was 0.339 > 0.05, and CMIN/df was $1.086 < 2.0$. The consistency and statistics with Comparative Fit Index (CFI) $1.000 > 0.90$, Goodness of Fit Index (GFI) 0.985 > 0.90, Adjusted Goodness of Fit Index (AGFI) 0.951 > 0.80, Root Mean Square Error of Approximation (RMSEA) was $0.016 < 0.05$, Standardized Root Mean Square Residual (SRMR) was $0.011 < 0.05$, Normed fit index (NFI) was $0.995 > 0.90$, and Incremental fit index (IFI) was 1.000 > 0.90. These indices were said to have met a predetermined threshold indicating that the model in this measurement was accurate (Validity) as shown in Figure 4.5 and Table 4.14.

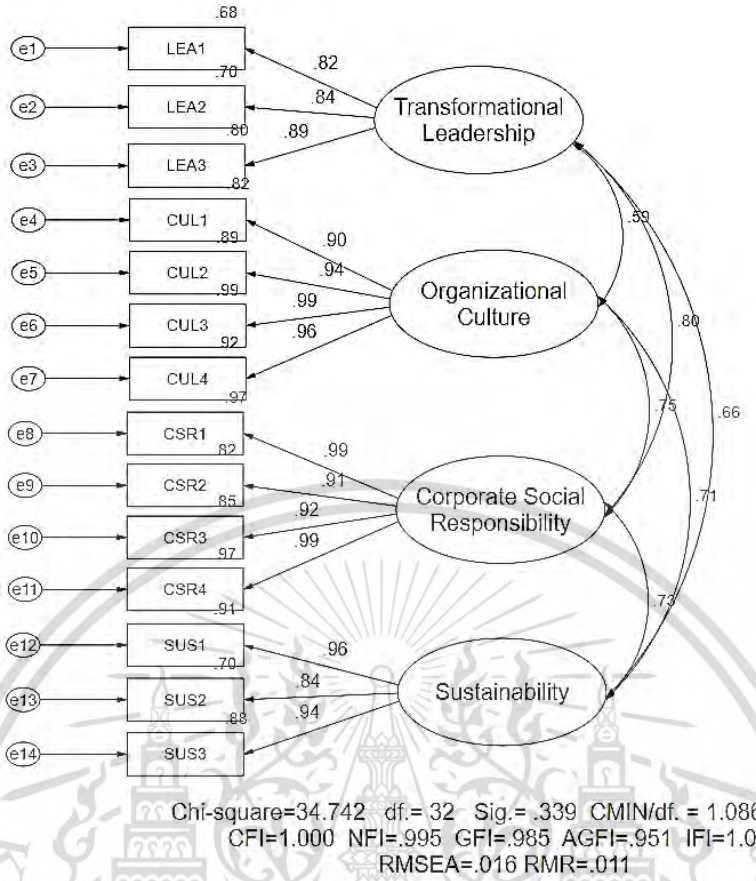


Figure 4.5 Confirmatory Factor Analysis of Model of Factors Influencing Sustainability of Chemical Industry in Thailand

Table 4.14 The statistical analysis for the confirmatory factor analysis of Model of Factors Influencing Sustainability of Chemical Industry in Thailand

Overall CFA	λ	SE.	t-value	R^2	AVE	CR.
Transformational Leadership (LEA)					0.726	0.888
LEA1 (Parameter Constant)	0.82	-	-	97.0%		
LEA2	0.84	0.05	18.043**	68.0%		
LEA3	0.89	0.05	19.174**	92.0%		
Organizational Culture (CUL)					0.903	0.974
CUL1 (Parameter Constant)	0.90	0.03	37.509**	88.0%		
CUL2	0.94	-	-	99.0%		
CUL3	0.99	0.03	37.509**	70.0%		
CUL4	0.96	0.03	32.161**	89.0%		

Table 4.14 (Continue)

Overall CFA	λ	SE.	t-value	R^2	AVE	CR.
Corporate Social Responsibility (CSR)					0.903	0.974
CSR1 (Parameter Constant)	0.99	-	-	97.0%		
CSR2	0.91	0.02	36.840**	85.0%		
CSR3	0.92	0.03	39.126**	82.0%		
CSR4	0.99	0.01	73.704**	82.0%		
Sustainability (SUS)					0.831	0.936
SUS1 (Parameter Constant)	0.96	-	-	70.0%		
SUS2	0.84	0.03	24.996**	91.0%		
SUS3	0.94	0.03	33.109**	80.0%		

** Statistically significant at 0.01

The results of the confirmatory factor analysis of the model of factors influencing sustainability of chemical industry in Thailand consisted of Sustainability (SUS), Transformational Leadership (LEA), Organizational Culture (CUL), and Corporate Social Responsibility (CSR) with a Factor Loading (λ) between 0.83 – 0.99 greater than 0.40, a Standard Error (SE) between 0.01–0.05, a Multiple Correlation Coefficient (R^2) between 68.0% - 99.0%, Average Variance Extracted (AVE) between 0.831 – 0.903 greater than 0.50. It was said that the measurement model had good convergence and that the variables had good unity and the Composite Reliability (CR) between 0.888 – 0.974 was greater than 0.60. It was shown that the observed and latent variables in all confirmation factor models had high discriminative fidelity, indicating the latent variable unity that satisfies the criterion. It can import the structural equation model of factors influencing sustainability of chemical industry in Thailand with a statistical significance of 0.01.

4.4 Correlation Analysis of Model Factors Influencing Sustainability of Chemical Industry in Thailand

This section examines the correlation problem between variables of the model of factors influencing sustainability of chemical industry in Thailand and examines the normal distribution of variables to test whether there is a multicollinearity problem. The statistical processing of data from a computer program can be summarized as follows:

4.4.1 Examining Variable Correlation Problems

This section is an analysis to examine the correlation problem of the Model of Factors Influencing Sustainability of Chemical Industry in Thailand. The variable contains Sustainability, Transformational Leadership, Organizational Culture, and Corporate Social Responsibility aspects including a total of 4 latent variables and 14 observable variables. The correlation coefficient between 0.218 – 0.797 was positive and the correlation coefficient of not more than 0.80 showed that the independent variables were independently independent of each other. There is a certainty, there is a unity of latent variables according to the criteria. It can import the structural equation model of factors influencing sustainability of chemical industry in Thailand. The results are shown in Table 4.15.

Table 4.15 Examining the correlation problem of the Model of Factors Influencing Sustainability of Chemical Industry in Thailand.

Variable	Sustainability			Transformational Leadership			Organizational Culture				Corporate Social Responsibility			
	SUS1	SUS2	SUS3	LEA1	LEA2	LEA3	CUL1	CUL2	CUL3	CUL4	CSR1	CSR2	CSR3	CSR4
SUS1	1.000													
SUS2	0.701	1.000												
SUS3	0.796	0.777	1.000											
LEA1	0.600	0.431	0.572	1.000										
LEA2	0.540	0.671	0.537	0.677	1.000									
LEA3	0.710	0.570	0.770	0.749	0.761	1.000								
CUL1	0.311	0.218	0.303	0.475	0.492	0.484	1.000							
CUL2	0.662	0.535	0.652	0.473	0.438	0.501	0.375	1.000						
CUL3	0.699	0.566	0.675	0.506	0.479	0.556	0.387	0.737	1.000					
CUL4	0.692	0.555	0.662	0.489	0.421	0.491	0.295	0.703	0.718	1.000				
CSR1	0.725	0.586	0.702	0.657	0.662	0.744	0.474	0.701	0.738	0.703	1.000			
CSR2	0.633	0.610	0.636	0.613	0.681	0.667	0.425	0.602	0.636	0.623	0.797	1.000		
CSR3	0.684	0.551	0.671	0.637	0.612	0.698	0.495	0.788	0.727	0.772	0.708	0.707	1.000	
CSR4	0.672	0.592	0.660	0.599	0.656	0.687	0.443	0.700	0.732	0.702	0.771	0.793	0.704	1.000

4.4.2 Examining the Normal Distribution of Model of Factors Influencing Sustainability of Chemical Industry in Thailand

This section examines the normal distribution of variables of the Model of Factors Influencing Sustainability of Chemical Industry in Thailand, consisting of 4 latent variables: Sustainability, Transformational Leadership, Organizational Culture, and Corporate Social Responsibility, a total of 14 observable variables. It has a range of 3.00 – 3.50, with a minimum of 1.00 and a maximum of 5.00, with an average of 3.63 – 4.19, which is good. The standard deviation (S.D.) ranges between 0.70 - 0.88, indicating that the data is distributed close to the mean, with the standard deviation not exceeding 30% of the mean and the variance or square of the standard deviation to measure the distribution of the data is between 0.49 – 0.77. Skewness or asymmetry of the distribution, that is, the variable is distributed in a right-skewed manner until left-skewed. It was shown that the data for all variables were scored above the mean with skewness between (-0.93) and (-0.13) and kurtosis between (-0.81) and 0.51. It is slightly higher than the normal curve. From the analysis results, it is considered that the variable has a kurtosis slightly higher than the normal curve, which the acceptable skewness and kurtosis criterion under the normal curve is not more than 3.00 and the kurtosis value does not exceed 10.00 (Suksawang, 2013), and A Coefficient of Variation (CV) between 16.86% - 24.25% less than 30.0% indicates an optimal distribution of the data (Griffiths JC, 1967). Therefore, it can be said that the variables are reliable and suitable to be analyzed in the Structural Equation Model of Factors Influencing Sustainability of Chemical Industry in Thailand. The results are shown in Table 4.16.

Table 4.16 Examining the descriptive statistical distribution of Model of Factors Influencing Sustainability of Chemical Industry in Thailand.

Variable		Range	Min	Max	$\overline{X}$	SD.	Variance	Skewness	Kurtosis	CV.
Sustainability	SUS1	3.50	1.50	5.00	4.19	0.78	0.61	-0.91	0.37	18.63%
	SUS2	3.25	1.75	5.00	4.14	0.70	0.49	-0.77	0.35	16.86%
	SUS3	3.50	1.50	5.00	4.16	0.77	0.60	-0.93	0.51	18.59%
Transformational Leadership	LEA1	3.50	1.50	5.00	3.93	0.87	0.75	-0.45	-0.67	22.08%
	LEA2	3.25	1.75	5.00	4.01	0.72	0.52	-0.63	-0.11	17.92%
	LEA3	3.50	1.50	5.00	4.06	0.79	0.62	-0.69	-0.11	19.36%
Organizational Culture	CUL1	3.00	2.00	5.00	3.63	0.88	0.77	-0.13	-0.81	24.25%
	CUL2	3.00	2.00	5.00	4.11	0.85	0.71	-0.73	-0.30	20.56%
	CUL3	3.00	2.00	5.00	4.09	0.80	0.64	-0.70	-0.15	19.63%
	CUL4	3.00	2.00	5.00	4.09	0.81	0.66	-0.64	-0.23	19.78%
Corporate Social Responsibility	CSR1	3.33	1.67	5.00	4.13	0.81	0.65	-0.86	0.07	19.55%
	CSR2	3.33	1.67	5.00	4.12	0.79	0.63	-0.80	0.02	19.21%
	CSR3	3.00	2.00	5.00	4.07	0.84	0.71	-0.62	-0.55	20.78%
	CSR4	3.33	1.67	5.00	4.12	0.82	0.67	-0.73	-0.25	19.86%

4.5 Analysis of Structural Equation Model of Factors Influencing Sustainability of Chemical Industry in Thailand

This section analyzes the Structural Equation Model (SEM) of the model of factors influencing sustainability of the chemical industry in Thailand. The variables in the analysis included sustainability, transformational leadership, organizational culture, and corporate social responsibility. The researcher examined the suitability and correctness of the structural equation model and adjusted the model to be perfect so that the statistical values were accepted by the variable link method (Modification Indices). The suitability and validity of the structural equation model were also checked by considering the variable weights and the R^2 value to verify the covariance of the indicators. The results of the analysis can be summarized as shown in Figure 4.6 and Table 4.17

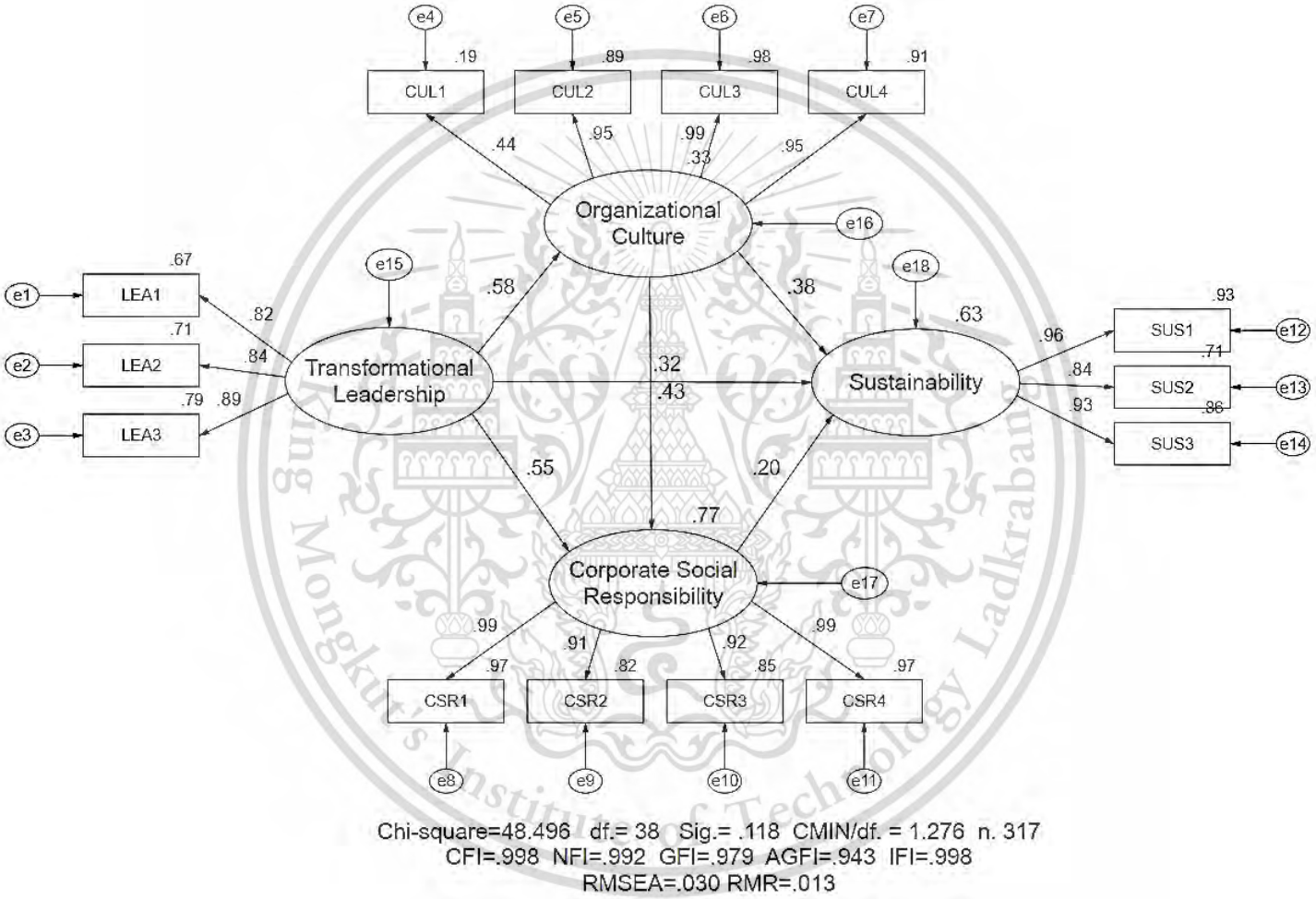


Figure 4.6 Structural Equation Model of Factors Influencing Sustainability of Chemical Industry in Thailand

Table 4.17 The statistical representation of harmonization of structural equation model of factors influencing sustainability of chemical industry in Thailand.

Index	Criteria	Result	Conclusion	Reference
Chi –Square = 48.496 df. = 38.0				
Sig.	> 0.05	0.118	Pass	Hair et al. (2006), Bollen (1989), Sorbon (1996)
CMIN/df.	< 2.0	1.276	Pass	Bollen (1989), Diamantopoulos and Siguaw (2000)
GFI	> 0.90	0.979	Pass	Hair et al. (2006), Browne and Cudeck (1993)
AGFI	> 0.90	0.943	Pass	Durande-Moreau and Usunier (1999),Harrison walker (2001)
NFI	> 0.90	0.992	Pass	Hair et al. (2006) , Diamantopoulos and Siguaw (2000)
IFI	> 0.90	0.998	Pass	Hair et al. (2006) , Mueller (1996)
CFI	> 0.90	0.998	Pass	Hair et al. (2006) , Diamantopoulos and Siguaw (2000)
RMR	< 0.05	0.013	Pass	Diamantopoulos and Siguaw (2000)
RMSEA	< 0.05	0.030	Pass	Hair et al. (2006), Schumacker and Lomax (2010)

Figure 4.6 shows a structural equation model of factors influencing sustainability of chemical industry in Thailand. After adjusting the discrepancy between the two variables using the model adjustment index statistic (Modification Index) is consistent with the empirical data is good. The model was harmonious with the empirical data with statistical significance at 0.05, Chi-Square was 48.496, df was 38.0, Sig. 0.118 > 0.05, and CMIN/df was 1.276 < 2.0, consistent with Hair et al. (2006), Bollen (1989), and Sorbon (1996). The results of the analysis of the modified model revealed that the indices were consistent and that these statistical values passed the specified criteria for all 7 indices, which can be summarized as follows:

1. The results of the analysis of the Comparative Fit Index (CFI) were 0.979 > 0.90. The results of the index were based on the concept of Hair et al. (2006), that a good CFI should have a value of 0.90 or higher. Show that the model was a comparative fit.

2. The Goodness of Fit Index (GFI) is a representation of the quantity of variance and covariance described by the model in which the analysis result is 0.979 > 0.90. The index results are based on the concept of Hair et al. (2006) and Mueller (1996), where a good GFI should be 0.90 or higher. Show that the model was a goodness of fit.

3. The Adjusted Goodness of Fit Index (AGFI) expresses the amount of variance and covariance described by the degree of freedom adjusted model. The AGFI is typically between 0 and 1 value for which the acceptable AGFI should be greater than 0.90, where the analysis result is 0.943 > 0.80. Durande-Moreau and Usunier (1999) state that a good AGFI should have a value of 0.80 or higher. Show that the model was adjusted goodness of fit.

4. Root Mean Square Error of Approximation (RMSEA) is a statistical value used to test hypotheses. A particularly good RMSEA value should be less than 0.05 or have a value between 0.05 and 0.08 means the model is harmonious with the empirical data. The analysis result was 0.030 < 0.05, a particularly excellent value. The results of the index values were based on the concept of meeting the criteria of Hair et al. (2006), Browne and Cudeck (1993). The model showed relative harmonization.

5. The Normed Fit Index (NFI) is a relative conformity index where the acceptable NFI value should be greater than 0.90, where the analysis result is 0.992 > 0.90. According to the concepts of Hair et al. (2006) and Diamantopoulos and Siguaw (2000), the model has a normed fit.

6. Incremental Fit Index (IFI) is an index that compares the test pattern with the base model in which all variables are not related to each other with a value greater than 0.90, which indicates that the theory is good at explaining the relationship of variables, where the acceptable IFI value

should be greater than 0.90. The analysis result is 0.998 > 0.90. The result of the index is based on the concept of Hair et al. (2006), showing that the model was an incremental fit.

7. Root Mean Square Residual (RMR) is a statistical value used in hypothesis testing. RMR should be less than 0.05. An excellent value should be 0 or closest to 0. The results of the analysis were 0.013 < 0.05, which is a particularly good RMR. The results of the index values conceptually fulfilled the Diamantopoulos and Siguaw (2000) criteria, indicating that the model was harmonious.

The results of the analysis of all 7 indices were consistent with the empirical data. It indicates that the Structural Equation Model of Factors Influencing Sustainability of Chemical Industry in Thailand includes Sustainability, Transformational Leadership, Organizational Culture, and Corporate Social Responsibility. It is consistent with the conditional empirical data at the statistical acceptance level. There is conformity to the configuration criteria indicating that the model in this measurement is valid (Validity) or OK Fit Confirm. Test results can be summarized as shown in Table 4.18 – 4.20.

Table 4.18 Analysis of structural equation model of factors influencing sustainability of chemical industry in Thailand.

Hypothesis				λ	SE.	t-value	Sig.	R^2
H1	Sustainability	<--	Transformational Leadership	0.32	0.07	4.636	0.000***	63.0%
H2	Organizational Culture	<--	Transformational Leadership	0.58	0.06	5.416	0.000***	33.0%
H3	Corporate Social Responsibility	<--	Transformational Leadership	0.55	0.05	12.446	0.000***	77.0%
H4	Sustainability	<--	Organizational Culture	0.38	0.17	4.426	0.000***	63.0%
H5	Sustainability	<--	Corporate Social Responsibility	0.20	0.07	2.630	0.009**	63.0%
H6	Corporate Social Responsibility	<--	Organizational Culture	0.44	0.17	5.278	0.000***	77.0%

** Statistically significant at 0.01

*** Statistically significant at 0.001

The results of the test analysis of a Structural Equation Model of Factors Influencing Sustainability of Chemical Industry in Thailand. The variable contains Sustainability, Transformational Leadership, Organizational Culture, and Corporate Social Responsibility aspects including a total of 4 latent variables and 14 observable variables. The results showed that a Factor Loading (λ) between $0.44 - 0.99$ greater than 0.40 and a Multiple Correlation Coefficient (R^2) between $19.0\% - 98.0\%$. When considering the regression coefficient of the standard score independent variable as a decision coefficient indicating the direct influence of the path, the results of the hypothesis test can be summarized as follows.

Hypothesis 1 (H1): Transformational Leadership has a positive influence on Sustainability.

The test result of H1 had a regression coefficient of 0.32, a Standard Error (SE) of 0.07, a t-value of 4.636, and a Sig. of 0.000 < 0.001. It was concluded that the test results accepted the H1, that is, Transformational Leadership had a positive influence on Sustainability. The influence was 63.0% at a statistically significant level of 0.001.

Hypothesis 2 (H2): Transformational Leadership has a positive influence on Organizational Culture.

The test result of H2 had a regression coefficient of 0.58, a Standard Error (SE) of 0.06, a t-value of 5.416, and a Sig. of 0.000 < 0.001. It was concluded that the test results accepted the H2, that is, Transformational Leadership had a positive influence on Organizational Culture. The influence was 33.0% at a statistically significant level of 0.001.

Hypothesis 3 (H3): Transformational Leadership has a positive influence on Corporate Social Responsibility.

The test result of H3 had a regression coefficient of 0.55, a Standard Error (SE) of 0.05, a t-value of 12.446, and a Sig. of 0.000 < 0.001. It was concluded that the test results accepted the H3, that is, Transformational Leadership had a positive influence on Corporate Social Responsibility. The influence was 77.0% at a statistically significant level of 0.001.

Hypothesis 4 (H4): Organizational Culture has a positive influence on Sustainability.

The test result of H4 had a regression coefficient of 0.38, a Standard Error (SE) of 0.17, a t-value of 4.426, and a Sig. of 0.000 < 0.001. It was concluded that the test results accepted the H4, that is, Organizational Culture had a positive influence on Sustainability. The influence was 63.0% at a statistically significant level of 0.001.

Hypothesis 5 (H5): Corporate Social Responsibility has a positive influence on Sustainability.

The test result of H5 had a regression coefficient of 0.20, a Standard Error (SE) of 0.07, a t-value of 2.630, and a Sig. of 0.009 < 0.01. It was concluded that the test results accepted the H5, that is, Corporate Social Responsibility had a positive influence on Sustainability. The influence was 63.0% at a statistically significant level of 0.01.

Hypothesis 6 (H6): Organizational Culture has a positive influence on Corporate Social Responsibility.

The test result of H6 had a regression coefficient of 0.44, a Standard Error (SE) of 0.17, a t-value of 5.278, and a Sig. of 0.000 < 0.001. It was concluded that the test results accepted the H6, that is, Organizational Culture had a positive influence on Corporate Social Responsibility. The influence was 77.0% at a statistically significant level of 0.001.

Table 4.19 Influence analysis of Structural Equation Model of Factors Influencing Sustainability of Chemical Industry in Thailand.

Factor	Influence	Organizational Culture	Corporate Social Responsibility	Sustainability
Transformational Leadership	Direct	0.58	0.55	0.32
	Indirect	-	0.25	0.37
	Total	0.58	0.80	0.69
Organizational Culture	Direct	-	0.43	0.38
	Indirect	-	-	0.09
	Total	-	0.43	0.46
Corporate Social Responsibility	Direct	-	-	0.20
	Indirect	-	-	-
	Total	-	-	0.20
R^2		33.0%	77.0%	63.0%

The results of the influence analysis of a Structural Equation Model of Factors Influencing Sustainability of Chemical Industry in Thailand, it was concluded that the factors influencing sustainability the most were Transformational Leadership with a total influence coefficient of 0.69,

followed by Organizational Culture with a total influence coefficient of 0.46, and Corporate Social Responsibility with a total influence coefficient of 0.20 with an influence on change of 63.00%. The factors that had the most influence on Corporate Social Responsibility were Transformational Leadership with a total influence coefficient of 0.80, followed by Organizational Culture with a total influence coefficient of 0.43, with an influence on change of 77.0%. Transformational Leadership influences Organizational Culture with a total influence coefficient of 0.58, with an influence on change of 33.0%.

Table 4.20 Summary of hypothesis testing of Structural Equation Model of Factors Influencing Sustainability of Chemical Industry in Thailand.

	Hypothesis	Test result	Influence	Coefficient	R^2
H1	Transformational Leadership has a positive influence on Sustainability	Accept	Direct	0.32	63.0%
H2	Transformational Leadership has a positive influence on Organizational Culture	Accept	Direct	0.58	33.0%
H3	Transformational Leadership has a positive influence on Corporate Social Responsibility	Accept	Direct	0.55	77.0%
H4	Organizational Culture has a positive influence on Sustainability	Accept	Direct	0.38	63.0%
H5	Corporate Social Responsibility has a positive influence on Sustainability	Accept	Direct	0.20	63.0%
H6	Organizational Culture has a positive influence on Corporate Social Responsibility	Accept	Direct	0.44	77.0%

** Statistically significant at 0.01

*** Statistically significant at 0.001

Summary of hypothesis testing of Structural Equation Model of Factors Influencing Sustainability of Chemical Industry in Thailand, it was concluded that transformational leadership has a positive influence on sustainability (H1) with a direct influence coefficient of 0.32, with an influence on change of 63.0%, transformational leadership has a positive influence on organizational culture (H2) with a direct influence coefficient of 0.58, with an influence on change of 33.0%, transformational leadership has a positive influence on corporate social responsibility (H3) with a direct influence coefficient of 0.55, with an influence on change of 77.0%,

organizational culture has a positive influence on sustainability (H4) with a direct influence coefficient of 0.38, with an influence on change of 63.0%, corporate social responsibility has a positive influence on sustainability (H5) with a direct influence coefficient of 0.20, with an influence on change of 63.0%, and organizational culture has a positive influence on corporate social responsibility (H6) with a direct influence coefficient of 0.44, with an influence on change of 77.0%.

4.6 Suggestion of Respondents on Factors Influencing Sustainability of Chemical Industry in Thailand

This section presents the suggestions of the respondents. The number of respondents who offered suggestions and did not offer suggestions is shown in Table 4.21.

Table 4.21 Number and Percentage of Suggestion of Respondents on Factors Influencing Sustainability of Chemical Industry in Thailand.

Suggestion of Respondents	Number	Percentage
Respondents offered suggestions.	18	5.68
Respondents did not offer suggestions.	299	94.32
Total	317	100.00

From Table 4.21, it was found that of the 317 respondents, 299 people did not offer suggestions, accounting for 94.32%, and 18 people offered suggestions, accounting for 5.68%. It can be summarized in each item with suggestions as follows.

1. The company must have a clear and feasible sustainability development policy and must communicate it effectively so that employees in the company are thoroughly aware of the benefits. As for employees, they must cooperate and respond seriously to the company's policies as well.

2. Employees at the management level of the company must receive training in both Hard Skill and Soft Skill courses. As for employees at the operating level, they should have the opportunity to receive training to develop themselves, leading to an increase in work efficiency at all levels.

3. CSR is a good activity that promotes the sustainability of the company. It may not be easy to create activities because of the high workload and pressure in many areas, causing CSR activities to focus not on external activities but on internal activities instead.

4. The government needs to support the industrial sector in creating sustainability, both in monetary and non-monetary terms. If the government has a serious policy, it is a good thing and the industry is willing to support this matter.

5. Please bring the results of this research to be published and used seriously so that this research can benefit the chemical industry as it has never been found that this matter has been studied seriously like this before.

CHAPTER 5

CONCLUSION AND DISCUSSION

The objective of the research on "A Structural Equation Model of Factors Influencing Sustainability of Chemical Industry in Thailand" is mainly to 1) to study a structural equation model of factors influencing sustainability of chemical industry in Thailand, 2) to study the direct, indirect, and combined influence of factors on sustainability of chemical industry in Thailand, and 3) to examine the consistency of the form, the structure equation of factors influencing sustainability of chemical industry in Thailand was developed with empirical data.

This research consisted of four latent variables and 14 observed variables. This research's sampling size used a total of 317 participants, by separating data collection into 5 industrial groups in chemical industry including the chemical fertilizer industry with 94 participants, chemical or other chemical materials industry with 71 participants, pharmaceutical industries with 60 participants, cosmetic industry with 48 participants, and paint industry and its associated products with 44 participants. Descriptive statistics through the Statistical Package for Social Science (SPSS) program was used to analyze and explain social-demographic data. The testing of models and hypotheses presented by a confirmation factor analysis (CFA) and the structural equation model (SEM) through the Analysis of Moment Structures (AMOS) program was used to test the model. Therefore, this study can develop the model of sustainability of chemical industry in Thailand, which can summarize research findings, discuss results, present practice including recommendations, and limitations of the study as follows.

5.1 Conclusion

This study is summarized with the model of factors influencing sustainability of chemical industry in Thailand, as follows.

5.1.1 Socio-Demographic Information

The general data analysis of the respondents, this survey has most respondents male (75.71%), from the age group of 41-50 years old (33.765%), and with bachelor's degrees (58.36%). Most of them have management positions was managers (61.20%) and management experience of 5 - 10 years (41.64%), and most of them came from the chemical fertilizer industry (29.02%) the business has the most operating period of 11-20 years (44.48%).

5.1.2 Sustainability

Regarding the opinions on Sustainability, the overall mean was 4.16 with a standard deviation of 0.71 at a high level. The highest was Profit, followed by Planet and People, respectively. Profit has a mean of 4.19 with a standard deviation of 0.70 at a high level, Planet has a mean of 4.16 with a standard deviation of 0.77 at a high level, and People have a mean of 4.14 with a standard deviation of 0.70 at a high level.

The observed and latent variables in all sustainability confirmation factor models had high discriminative fidelity, indicating the latent variable unity that satisfies the criterion. All the observed variables were independent of each other without any correlation between the variables. It can import the structural equation model of factors influencing sustainability of chemical industry in Thailand.

5.1.3 Transformational Leadership

Regarding the opinions on Transformational Leadership, the overall mean was 4.00 with a standard deviation of 0.72 at a high level. The highest was Intellectual Stimulation, followed by Individual Consideration, and Charisma and Inspiration, respectively. Intellectual Stimulation has a mean of 4.01 with a standard deviation of 0.72 at a high level, Individual Consideration has a mean of 4.06 with a standard deviation of 0.79 at a high level, and Charisma and Inspiration have a mean of 3.93 with a standard deviation of 0.87 at a high level.

The observed and latent variables in all transformational leadership confirmation factor models had high discriminative fidelity, indicating the latent variable unity that satisfies the criterion. All the observed variables were independent of each other without any correlation

between the variables. It can import the structural equation model of factors influencing sustainability of chemical industry in Thailand.

5.1.4 Organizational Culture

Regarding the opinions on Organizational Culture, the overall mean was 3.98 with a standard deviation of 0.72 at a high level. The highest was Adhocracy, followed by Market, Hierarchy, and Clan, respectively. Adhocracy has a mean of 4.11 with a standard deviation of 0.85 at a high level, Market has a mean of 4.09 with a standard deviation of 0.80 at a high level, Hierarchy has a mean of 4.09 with a standard deviation of 0.81 at a high level, and Clan has a mean of 3.63 with a standard deviation of 0.88 at a high level.

The observed and latent variables in all organizational culture confirmation factor models had high discriminative fidelity, indicating the latent variable unity that satisfies the criterion. All the observed variables were independent of each other without any correlation between the variables. It can import the structural equation model of factors influencing sustainability of chemical industry in Thailand.

5.1.5 Corporate Social Responsibility

Regarding the opinions on Corporate Social Responsibility, the overall mean was 4.11 with a standard deviation of 0.79 at the highest level. The highest was Economic Responsibility, followed by Legal Responsibility, Philanthropic Responsibility, and Ethical Responsibility, respectively. Economic Responsibility has a mean of 4.14 with a standard deviation of 0.81 at a high level, Legal Responsibility has a mean of 4.12 with a standard deviation of 0.79 at a high level. Philanthropic Responsibility has a mean of 4.12 with a standard deviation of 0.82 at a high level, and Ethical Responsibility has a mean of 4.07 with a standard deviation of 0.84 at a high level.

The observed and latent variables in all corporate social responsibility confirmation factor models had high discriminative fidelity, indicating the latent variable unity that satisfies the criterion. All the observed variables were independent of each other without any correlation between the variables. It can import the structural equation model of factors influencing sustainability of chemical industry in Thailand.

5.1.6 Model of factors influencing sustainability of chemical industry in Thailand

In the confirmatory factor analysis of the model of factors influencing sustainability of chemical industry in Thailand, there were 4 variables, namely Sustainability (SUS), Transformational Leadership (LEA), Organizational Culture (CUL), and Corporate Social Responsibility (CSR), including 14 observable variables. It was found that the consistency with the empirical data was good. Chi-Square was 34.742, df was 32.0, Sig. was 0.339 > 0.05, and CMIN/df was 1.086 < 2.0. The consistency and statistics with Comparative Fit Index (CFI) 1.000 > 0.90, Goodness of Fit Index (GFI) 0.985 > 0.90, Adjusted Goodness of Fit Index (AGFI) 0.951 > 0.80, Root Mean Square Error of Approximation (RMSEA) was 0.016 < 0.05, Standardized Root Mean Square Residual (SRMR) was 0.011 < 0.05, Normed fit index (NFI) was 0.995 > 0.90, and Incremental fit index (IFI) was 1.000 > 0.90. Factor Loading (λ) between 0.83 – 0.99 greater than 0.40, a Standard Error (SE) between 0.01– 0.05, a Multiple Correlation Coefficient (R2) between 68.0% - 99.0%, Average Variance Extracted (AVE) between 0.831 – 0.903 greater than 0.50. Composite Reliability (CR) between 0.888 – 0.974 was greater than 0.60. It was shown that the observed and latent variables in all confirmation factor models had high discriminative fidelity, indicating the latent variable unity that satisfies the criterion. It can import the structural equation model of factors influencing sustainability of chemical industry in Thailand statistically significant at 0.01.

5.1.7 Correlation Analysis of Model Factors Influencing Sustainability of Chemical Industry in Thailand

The correlation of the Model of Factors Influencing Sustainability of Chemical Industry in Thailand. The variable contains Sustainability, Transformational Leadership, Organizational Culture, and Corporate Social Responsibility aspects including a total of 4 latent variables and 14 observable variables. The correlation coefficient between 0.218 – 0.797 was positive and the correlation coefficient of not more than 0.80 showed that the independent variables were independently independent of each other. There is a certainty, there is a unity of latent variables according to the criteria. It can import the structural equation model of factors influencing sustainability of chemical industry in Thailand.

The normal distribution of variables of the Model of Factors Influencing Sustainability of Chemical Industry in Thailand consists of 4 latent variables: Sustainability, Transformational Leadership, Organizational Culture, and Corporate Social Responsibility, a total of 14 observable variables. It has a range of 3.00 – 3.50, with a minimum of 1.00 and a maximum of 5.00, with an average of 3.63 – 4.19, which is good. The standard deviation (S.D.) ranges between 0.70 - 0.88, indicating that the data is distributed close to the mean, with the standard deviation not exceeding 30% of the mean and the variance or square of the standard deviation to measure the distribution of the data is between 0.49 – 0.77. From the analysis results, it is considered that the variable has a kurtosis slightly higher than the normal curve, which the acceptable skewness and kurtosis criterion under the normal curve is not more than 3.00 and the kurtosis value does not exceed 10.00 (Suksawang, 2013), and A Coefficient of Variation (CV) between 16.86% - 24.25% less than 30.0% indicates an optimal distribution of the data (Griffiths JC, 1967). Therefore, it can be said that the variables are reliable and suitable to be analyzed in the Structural Equation Model of Factors Influencing Sustainability of Chemical Industry in Thailand.

5.1.8 Analysis of Structural Equation Model of Factors Influencing Sustainability of Chemical Industry in Thailand

A structural equation model of factors influencing sustainability of chemical industry in Thailand. After adjusting the discrepancy between the two variables using the model adjustment index statistic (Modification Index) is consistent with the empirical data is good. The model was harmonious with the empirical data with statistical significance at 0.05, Chi-Square was 48.496, df was 38.0, Sig. 0.118 > 0.05, and CMIN/df was 1.276 < 2.0, consistent with Hair et al. (2006), Bollen (1989), and Sorbon (1996). The results of the analysis of the modified model revealed that the indices were consistent and that these statistical values passed the specified criteria for all 7 indices, which can be summarized as follows: Comparative Fit Index (CFI) was 0.979 > 0.90, The Goodness of Fit Index (GFI) was 0.979 > 0.90, the Adjusted Goodness of Fit Index (AGFI) was 0.943 > 0.80, the Root Mean Square Error of Approximation (RMSEA) was 0.030 < 0.05, the Normed Fit Index (NFI) was 0.992 > 0.90, Incremental Fit Index (IFI) was 0.998 > 0.90, and Root Mean Square Residual (RMR) was 0.013. The results of the analysis of all 7 indices were consistent with the empirical data. It indicates that the Structural Equation Model of Factors Influencing Sustainability

of Chemical Industry in Thailand includes Sustainability, Transformational Leadership, Organizational Culture, and Corporate Social Responsibility. It is consistent with the conditional empirical data at the statistical acceptance level. There is conformity to the configuration criteria indicating that the model in this measurement is valid (Validity) or OK Fit Confirm.

It was concluded that the factors influencing sustainability the most were Transformational Leadership with a total influence coefficient of 0.69, followed by Organizational Culture with a total influence coefficient of 0.46, and Corporate Social Responsibility with a total influence coefficient of 0.20 with a 63.00% influence on change. The factors that had the most influence on Corporate Social Responsibility were Transformational Leadership with a total influence coefficient of 0.80, followed by Organizational Culture with a total influence coefficient of 0.43, with an influence on change of 77.0%. Transformational Leadership influences Organizational Culture with a total influence coefficient of 0.58, with a 33.0% influence on change.

5.2 Discussion

The conceptual framework of sustainability of chemical Industry in Thailand in this research was proposed by references from theories, articles, and reports. It is presented in Chapter 2, the literature review. Therefore, the six hypotheses were proposed in the research framework.

Moreover, the causal relationship between the variables studied and tested the hypothesis was completed, and the results were presented in Chapter 4. In this section, a more detailed discussion of the hypotheses obtained in this study can be described as follows.

5.2.1 Transformational Leadership has a positive influence on Sustainability

The test result of H1 had a regression coefficient of 0.32, a Standard Error (SE) of 0.07, a t-value of 4.636, and a Sig. of 0.000 < 0.05. It was concluded that the test results accepted the H1, that is, Transformational Leadership had a positive influence on Sustainability. The influence was 63.0% at a statistically significant level of 0.05.

From the conceptual framework of this study, it can be seen that the researcher mainly focused on studying the influence of transformational leadership on sustainability. The findings of

this study revealed a positive relationship between transformational leadership and sustainability, consistent with Abbas and Bakr (2019) who found a positive and significant relationship between transformational leadership and sustainability. This is consistent with Hongdao, Bibi, Khan, Ardito, and Nurunnabi (2019) who stated that transformational leadership improves employee performance and is important to a company's sustainability. Shah, Jintian, Sukamani, and Kusi (2020) pointed out that transformational leadership affects sustainability in the construction industry, therefore transformational leadership is important for sustainable development. However, this study contradicts Alrowwad, Obeidat, Tarhini, and Aqqad (2017) who stated that transformational leadership does not have a positive influence on organizational performance. This may be due to the different contexts of the study: they studied employees' views of leaders, which is common for studies to reveal conflicting views among followers and leaders. This study examines opinions from the perspective of senior executives toward leaders in their organizations.

Ullah et al. (2021) confirmed the significant direct positive impact of transformational leadership on the social sustainability of organizations. This is evident from the discovery that followers must rely on leaders when situations are personal and beyond understanding and interpretation. This is consistent with the findings of this study, which found that the characteristics of outstanding transformational leaders in the chemical industry in Thailand in leading organizations towards sustainability are paying close attention to the needs of employees, treating employees as family, paying attention to employees' abilities and striving to enhance them, and inspiring employees with individual career advancement plans. This is similar to Lutfi and Siswanto (2018) who said that the role of leaders in increasing employee motivation is very important. This is similar to a Munford (2020) study that said leaders who stimulate their followers' critical thinking and problem-solving skills are more likely to be financially sustainable. But unlike Burawat (2019) who stated that managers are more likely to give advice and exchange ideas with followers than to inspire and make decisions on their own. However, the result is transformational leadership that facilitates organizational performance. Transformational leaders can provide a clear, actionable, and trustworthy vision to their followers (Imran, Zahoor, & Zaheer, 2012). Additionally, managers must create an organizational architecture or work environment that encourages sustainable performance, which reflects the organization's commitment to sustainability and lays the foundation for

sustainable management (Villca & Castillo, 2020). The better the quality of leadership, the better the results of organizational performance for employees to achieve organizational goals (Mona, Suharto, & Subagja, 2020).

5.2.2 Transformational Leadership has a positive influence on Organizational Culture

The test result of H2 had a regression coefficient of 0.58, a Standard Error (SE) of 0.06, a t-value of 5.416, and a Sig. of 0.000 < 0.05. It was concluded that the test results accepted the H2, that is, Transformational Leadership had a positive influence on Organizational Culture. The influence was 33.0% at a statistically significant level of 0.05.

The findings of this study reveal a positive relationship between transformational leadership and organizational culture. This is in line with Elshanti's (2017) study that showed a positive relationship between transformational leadership style and organizational culture; Andreja, Kristijana, and SreČkoa (2020) found that transformational leadership style positively influences all three factors of knowledge infrastructure: organizational culture, organizational structure, and information technology, and Park and Pierce (2020) found that The transformational leadership of local office directors has a positive and direct effect on creating positive working conditions, organizational culture, and organizational climate. Schein (2004) noted that leaders have an important influence on maintaining and changing organizational culture. This observation may mean that transformational leadership is an important determinant of organizational culture (Faraz, Yanxia, Estifo, & Kaukab, 2019). Transformational leadership practices lay the foundation for organizational culture (Abbas & Bakr, 2019). Conclusion Transformational leadership can truly improve organizational culture (Lutfi & Siswanto, 2018).

Leadership style has a positive and important impact on organizational culture. Management scientists believe that leadership is a key factor in the success of organizations and society and can affect organizational culture. The positive and direct relationship between the two variables indicates that changes in leadership styles are accompanied by corresponding changes in organizational culture in the same direction (Hosseini, Hajipour, Kaffashpoor, & Darikandeh, 2020).

This study also found that the distinctive characteristics of transformational leadership in the chemical industry in Thailand that influence organizational culture include paying close attention to the needs of employees, treating employees as family, paying attention to employees' abilities and striving to enhance them, and inspiring employees with individual career advancement plans. These help create a positive organizational culture focused on achieving goals and delivering excellent results. This is in line with Rizki, Parashakti, and Saragih (2019) who stated that transformational leadership influences organizational culture. This means that the leadership role inspires subordinates to perform well and creates a positive organizational culture in achieving goals. Good leadership may be achieved by coaching and mentoring subordinates to take timely action, take the first step, pioneer work, consider others' opinions, guide, lead, and mobilize others through influence. Consistent with Srisathan, Ketkaew, and Naritarathon (2020), transformational leadership is one factor that has a strong influence on organizational culture. Respondents in this study believe that leaders are important to organizations. This is because leadership influences employees' perceptions of the importance of work. Cultivate positive enthusiasm and promote trust and cooperation between employees and management. Leaders help companies create an influential culture and positive organizational climate through transformational leadership. However, Chaabane (2019) noted that although the impact of transformational leadership on organizational culture is very positive, this may not be the case from a cultural perspective that focuses on achieving goals and delivering excellent results. This is because too much transformational leadership can put pressure on employees, and the mission should be aligned with long-term employee interests.

Organizational culture also plays a mediating role between transformational leadership and other organizational operations. For example, a study by Shim, Jo, and Hoover (2015) found that organizational culture mediates the link between transformational leadership and commitment, and Pradhan, Panda, and Jena (2017) found that organizational culture partially mediates between transformational leadership and psychological empowerment.

As another example, Elshanti's (2017) study found that organizational culture acts as a mediator between transformational leadership styles and organizational learning. He concluded that the more a leader practices a transformational leadership style when managing an organization, the

more appropriate the organizational culture will be. The more appropriate the organizational culture, the more likely it is to achieve learning in the organization. Transformational leadership therefore develops a vision, specifies organizational goals, and creates a learning culture consistent with organizational learning.

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Finally, a study by Khan, Ismail, Hussain, and Alghazali (2020) found organizational culture mediates transformational leadership style with innovative work behavior. They conclude that when organizational culture mediates this relationship, the organization is strengthened by supporting an innovative culture. Organizational culture characteristics influence innovative work behavior.

5.2.3 Transformational Leadership has a positive influence on Corporate Social Responsibility

The test result of H3 had a regression coefficient of 0.55, a Standard Error (SE) of 0.05, a t-value of 12.446, and a Sig. of 0.000 < 0.05. It was concluded that the test results accepted the H3, that is, Transformational Leadership had a positive influence on Corporate Social Responsibility. The influence was 77.0% at a statistically significant level of 0.05.

The findings of this study reveal a positive relationship between transformational leadership and CSR. This is consistent with studies by Ali, Khan, and Yildiz (2020) and Khan, Ali, and Olya (2018) who found that transformational leadership influences CSR practices. Changar and Atan (2021) concluded that a transformational leadership approach has a positive impact on the environmental and ethical aspects of CSR. The study suggests that the adoption of transformational leadership approaches can lead to better socially responsible actions in organizations. K and Ranjit (2020) stated that managers who lead change show a more positive attitude towards stakeholders.

Characteristics of transformational leadership such as intellectual stimulation, motivation, and having a compelling vision are more likely to carry out CSR activities. Hongdao, Bibi, Khan, Ardito, and Nurunnabi (2019) asserted that effective transformational leadership practices motivate and inspire employees to meet individual and team expectations, leading to better performance. This article's argument brings together research evidence related to how law firms can ensure that their employees are sufficiently motivated and committed to achieving organizational goals through the practices of transformational leadership and CSR.

This study continues to confirm a distinctive feature of transformational leaders in the chemical industry in Thailand that influences social responsibility: paying close attention to the needs of employees, treating employees as family, paying attention to employees' abilities and striving to enhance them, and inspiring employees with individual career advancement plans. This drives the Thailand chemical industry's commitment to CSR in developing good quality products at reasonable prices for continued economic and social benefits. This is in line with Changar and Atan (2021) who stated that there is an important link between adopting a transformational leadership approach to strengthen the impact of environmental and ethical CSR on organizational goals. One way to consider results is that individualized consideration of transformational leadership approaches allows leaders to communicate personally with every employee, resulting in employees taking actions that are more sensitive to stakeholders. In addition, the motivational nature of the approach increases the commitment of employees to achieve the organization's goals. This is slightly different from Alrowwad, Obeidat, Tarhini, and Aqqad (2017) who stated that transformational leadership has a positive influence on CSR. The reason for this association can be traced back to the characteristics of charismatic and intellectual stimulation. This is shown by change leaders. Charismatic leaders are more likely to engage in behaviors and support policies related to corporate social responsibility, thus earning the admiration of their followers. Because their vision is based on the values of altruism, justice, and humanist ideas about the greater good. Such values tend to increase the likelihood of achieving goals, especially those related to corporate social responsibility. In addition, intellectually stimulated leaders can scan and think broadly about their environment and how to serve their organizations' stakeholders.

However, it is noted by Chaabane (2019) that transformational leadership not only has a positive effect on CSR integration but this type of leadership can also have a negative effect. In addition to potential conflicts between organizational interests and employee interests, too much transformational leadership can create a work environment in which employees are given too much responsibility. This negatively affects employee performance. Moreover, the goal of integrating CSR should not be to the detriment of employees' interests. Otherwise, they will be dissatisfied with the goal of CSR integration. This may also reduce CSR integration.

CSR also plays a mediating role between transformational leadership and other organizational performance. For example, Hongdao, Bibi, Khan, Ardito, and Nurunnabi (2019) found that CSR mediated the relationship between transformational leadership and job performance. For their part, Khan, Ali, and Olya (2018) found that leadership shows a surprisingly high influence on CSR, which indirectly affects a company's innovation. This is consistent with the study of Budur and Demir (2019) who stated that although the impact of transformational leadership on CSR practices on employees is very small, it must also be noted that CSR practices towards employees will have a very positive impact on achieving the organization's goals. K and Ranjit (2020) concluded that transformational leadership affects both performance and CSR. Adopting a transformational leadership style in an organization and actively implementing CSR activities is an important and necessary part of improving employee performance. Results show that the practice of transformational leadership in organizations promotes organizational commitment to CSR activities, which, in turn, results in better job performance.

Finally, Tefera, Yuanqiong, and Luming (2019) stated that an organization's propensity to engage in CSR is mainly caused by top managers' values and CSR perceptions. In addition to top managers' direct influence on CSR, top managers can also affect an organization's CSR behavior by shaping and creating an ethical culture. The study of Tefera, Yuanqiong, and Luming (2019) reveals that top managers play an important role in the development of firm-level CSR. Upper echelons with overwhelming power in their positions can provide the necessary resources to mainstream ethical behavior throughout the organization. Top managers, as key strategic decision makers, may be motivated by the moral obligation they have to society or the strategic benefits of CSR to engage in CSR activities. Hongdao, Bibi, Khan, Ardito, and Nurunnabi (2019) suggest that

companies that engage in transformational leadership practices are more likely to engage in CSR activities.

5.2.4 Organizational Culture has a positive influence on Sustainability

The test result of H4 had a regression coefficient of 0.38, a Standard Error (SE) of 0.17, a t-value of 4.426, and a Sig. of 0.000 < 0.05. It was concluded that the test results accepted the H4, that is, Organizational Culture had a positive influence on Sustainability. The influence was 63.0% at a statistically significant level of 0.05.

When organizational members share a strong commitment to cultural values, beliefs, and routines, and use them to achieve their goals (Jones & George, 2019). The findings of this study reveal a positive relationship between organizational culture and sustainability. This is consistent with Metz, Ilies, and Nistor (2020) study, which emphasizes that organizational culture characteristics are good predictors of improving customer service performance, which promotes ethical business models and the pursuit of economic, social, and economic efficiency, and environmental sustainability and Bagbade, Kamaruddeen, and Nawi (2015) studied the important relationship between organizational culture and sustainable construction among Malaysian contractors. An organization's sustainability performance depends heavily on cultural aspects (Islam, Tseng, & Karia, 2019). Dubey, Gunasekaran, Childe, Papadopoulos, Hazen, Giannakis, and Roubaud (2017) found the role of organizational culture in determining a performance measurement system for benchmarking sustainability. A study by Ketprapakorn and Kantabutr (2019) found that senior management teams of SMEs recognize the need to maintain sustainable companies with a cohesive culture by perpetuating their culture and core values. Organizational members are united by this strong culture, especially when their business is facing a crisis. Srisathan, Ketkaew, and Naritarathon (2020) show the significant impact of organizational culture on organizational sustainability in the form of a culture that maintains the business's core competencies in marketing, operations, customer orientation, capital management, and sustainability monitoring and assessment.

This is also in line with similar previous studies including Indarti and Wijayanto (2015) who found that organizational culture plays an important role in influencing business and educational performance. Bhuiyan, Baird, and Munir (2020) emphasize the direct influence of

organizational culture on both financial and non-financial performance. Although culture is essential for sustainable performance (Iranmanesh, Zailani, Hyun, Ali, & Kim, 2019), some studies, including Muliati, Iqbal, and Mayapada (2020), argue that organizational culture does not have some impact on the performance of the company, the organizational culture will also affect the performance of the company if the company implements and reports its corporate social responsibility.

The study also points out that prominent characteristics of the organizational culture of the chemical industry in Thailand that influence sustainability are a commitment to creating a culture focused on proactive competition and excellent results with a focus on achieving goals to drive financial, social, and environmental impact. This is in line with Dyck, Walker, and Caza (2019) who support a relationship between hierarchical culture and financially sustainable arrangements, group culture and organizing and socially sustainable outcomes, as well as market culture and ecologically sustainable outcomes. Overall, Dyck, Walker, and Caza (2019) point out that knowing a company's culture often helps to understand its sustainability focus and outcomes, linking the four CVF cultures to three key dimensions of sustainability. The higher the organizational culture, the higher the organizational performance. The relationship between organizational culture and employee performance is very important in determining the growth of an organization because the existing organizational culture can boost the morale of the followers or existing employees so that organizational performance increases (Mona, Suharto, & Subagja, 2020). Having the right organizational culture is therefore essential to achieving sustainable performance (Islam, Tseng, & Karia, 2019).

This study also found that organizational culture plays a mediating role between transformational leadership and sustainability. This is consistent with similar previous studies including Bakhsh, Aleem, Farooq, and Aziz (2020) revealed that organizational culture mediates the relationship between transformational leadership style and performance, and Imran, Zahoor, and Zaheer (2012) found that transformational leadership has a positive and significant effect on organizational performance along with the mediating role of organizational culture in the relationship between transformational leadership and organizational performance. This study contradicts Abbas and Bakr (2019) who found that although there was a significant positive

relationship between transformational leadership and organizational culture, the relationship between transformational leadership and sustainability was not mediated by organizational culture. However, this study still confirms transformational leadership practices that lay the foundation for an organizational culture that in turn promotes sustainability. We found that leaders in chemical industry companies have a responsibility to create organizational cultures that support sustainability efforts.

5.2.5 Corporate Social Responsibility has a positive influence on Sustainability

The test result of H5 had a regression coefficient of 0.20, a Standard Error (SE) of 0.07, a t-value of 2.630, and a Sig. of 0.009 < 0.05. It was concluded that the test results accepted the H5, that is, Corporate Social Responsibility had a positive influence on Sustainability. The influence was 63.0% at a statistically significant level of 0.05.

Sustainability is one of the key success factors for organizations in this era of globalization. CSR activities help capture the market and reduce financial risks. CSR activities also help companies achieve tangible and intangible results of corporate sustainability (Shahzad, Qu, Rehman, Zafar, Ding, & Abbas, 2020). The findings of this study reveal a positive relationship between CSR and sustainability, consistent with studies by Bernal-Conesa, Nieto, and Briones-Peñalver (2017) that CSR-focused strategies play an important role in organizational performance. CSR also influences the competitiveness of technology companies and especially their sustainability. Shahzad, Qu, Rehman, Zafar, Ding, and Abbas (2020) said that CSR is necessary and has a positive effect on corporate sustainability performance. Shahzad, Qu, Javed, Zafar, and Rehman, (2020) found that all dimensions of CSR were positively important for environmental sustainable development. Abbas et al. (2019) stated that corporate social responsibility presents a positive impact on a company's sustainable performance. When business companies adopt CSR practices, they create a significant positive effect on customer satisfaction. CSR plays an important role in enhancing and creating consumer convenience which in turn increases the sales volume, profitability, and sustainable performance of the company. CSR is critical to succeeding in a challenging and competitive business environment.

This is also consistent with similar previous studies that found a significant positive influence between CSR and corporate performance (Alrowwad, Obeidat, Tarhini, & Aqqad, 2017;

Jones, Willness, & Glavas, 2017; Lee & Kim, 2017; Javeed & Lefen, 2019; Manzoor et al., 2019; Muliati, Iqbal, & Mayapada, 2020; Waheed, Zhang, Zafar, Zameer, Ashfaq, & Nusrat, 2021).

CSR is an appropriate form of responsibility given to stakeholders (Indarti & Wijayanto, 2015). The better the performance of social responsibility, the higher the performance of the company (Muliati, Iqbal, & Mayapada, 2020) is consistent with Javeed and Lefen (2019) who stated that company performance will improve when social responsibility increases. This is because social activities increase a company's confidence in its internal and external environment. Contrastingly, some studies include Prasad, Mishra, and Bapat (2019) indicating that CSR is not significantly related to environmental sustainability. This discrepancy may be due to differences in the sample of industries whose operations are not related to environmental impacts, but this study focuses on the chemical industry whose operations have a direct impact on the environment. Bhuiyan, Baird, and Munir (2020) CSR shows a negative relationship with financial performance, which is assessed about goals, profits, sales targets, and return on investment. Such conflicts may arise from differences in measures of organizational performance. This is because previous studies focused on financial measures of organizational performance alone, while this study combines both financial and non-financial (social and environmental) measures related to sustainability.

This study also points out that a distinctive feature of CSR in the chemical industry in Thailand that influences sustainability is the continuous effort to operate for the benefit of stakeholders and society by developing quality products at a reasonable price, which is consistent with and fills the gaps of previous studies including Bernal-Conesa, Nieto, and Briones-Peñalver (2017) noted that environmental dimensions are the most important in creating a CSR strategy, not social dimensions. On the other hand, we see strong empirical evidence of the influence of CSR strategies on the economic performance of technology companies. Okwemba et al. (2014) concluded that any increase in charitable responsibility increases bank performance based on customer retention. Environmental responsibilities are not significant in this study because environmental responsibilities go largely unnoticed by customers.

This study also found that CSR plays a mediating role between transformational leadership and sustainability. This is consistent with a study by Hongdao, Bibi, Khan, Ardito, and Nurunnabi (2019) who found that transformational leaders are more likely to conduct sustainable business

practices and support CSR activities in employee attitudes. This is also consistent with similar previous studies including Khan, Ali, and Olya (2018) that a combination of CSR and transformational leadership leads to high performance. Management's transformational leadership affects performance through CSR practices. Shahzad, Qu, Rehman, Zafar, Ding, and Abbas (2020) have a significant impact on corporate sustainability performance by CSR has a significant impact on mediation.

5.2.6 Organizational Culture has a positive influence on Corporate Social Responsibility

The test result of H6 had a regression coefficient of 0.44, a Standard Error (SE) of 0.17, a t-value of 5.278, and a Sig. of 0.000 < 0.05. It was concluded that the test results accepted the H6, that is, Organizational Culture had a positive influence on Corporate Social Responsibility. The influence was 77.0% at a statistically significant level of 0.05.

The findings of this study reveal a positive relationship between organizational culture and CSR. This is consistent with Chaabane's (2019) study, which stated that organizational culture has a strong positive effect on CSR integration. Like Indarti and Wijayanto (2015) who stated that strong corporate culture is related to CSR, corporate culture plays a role in generating CSR. Vveinhardt and Andriukaitiene (2017) point out that the concept of corporate social responsibility cannot be consistently implemented unless it is integrated into the formal part of the organizational culture, where it plays an instrumental role. Bhuiyan, Baird, and Munir (2020) reveal that cultural dimensions have different effects on specific dimensions of CSR practices. For example, green corporate culture drives proactive CSR and environmentally friendly product innovation performance (Chang, 2015).

Culture plays a very important role in the trend of CSR practices (Barile, Canestrino, Magliocca, & Caputo, 2019). Because organizational culture affects corporate social responsibility through participation, consistency, adaptability, and mission. Therefore, companies with high cultural values will require employees to engage in social responsibility and high consistency in adopting habits or values that will influence the implementation of social responsibility (Muliati, Iqbal, & Mayapada, 2020).

The study also points to distinctive features of the organizational culture of the chemical industry in Thailand that influence CSR, including creating a culture committed to innovation and sustainable development, focused on growth through developing new ideas, and open to new experimentation. This shows responsibility towards customers, partners, society, and the environment. This is in line with Chaabane (2019) who said that positive relationships show an understanding of customer needs and that the learning environment and employee participation and commitment can lead employee behavior toward CSR integration. Having a vision and mission statement that provides employees with direction, a long-term strategy, and a clear goal towards sustainability is an important part of CSR integration because of its impact on efficiency and effectiveness. This is consistent with Liu and Lin (2020) who stated that CSR based on a green corporate culture helps companies gain support from employees as well as the broader market from consumers who pay attention to food safety. Consumers are more confident in food safety when companies have a green corporate culture that can lead to CSR activities that involve employee commitment and action towards food safety. Managers can play a proactive role in promoting internal CSR by designing organizational culture based on group characteristics (Espasandín-Bustelo, Ganaza-Vargas, & Diaz-Carrion, 2021).

Ultimately, a cultural organization can create responsible behavior that influences business operations. Because organizational culture is a habit that guides work, it is reflected in everyday life, which is expressed in responsible behavior (Indarti & Wijayanto, 2015).

This study also found that CSR also plays a mediating role between organizational culture and organizational performance. This is consistent with the study of Bhuiyan, Baird, and Munir (2020) who found that the importance of this CSR performance dimension is further emphasized as it mediates the link between organizational culture and performance dimensions. This is reaffirmed by Muliati, Iqbal, and Mayapada (2020) who found that organizational culture has no direct impact on firm performance, but organizational culture affects firm performance through corporate social responsibility. It shows that the implementation of social responsibility based on a good corporate culture will support the operational success of the company. A study by Indarti and Wijayanto (2015) concluded that if a company wants to have superior business performance, it must integrate CSR into its culture, creating pride and satisfaction among its employees. In contrast, Lee and Kim

(2017) point out that certain organizational cultures moderate the relationship between CSR and financial results, and organizational culture may play an important role in strengthening the positive relationship between CSR and corporate performance.

5.3 Implications and Recommendations

This research has developed a sustainability model for the chemical industry in Thailand based on sustainability concepts and theories. The results of this research will contribute to the sustainability model of the chemical industry in Thailand for further academic and professional development, the industry sectors can use research findings and recommendations to formulate an organizational strategy for further sustainability development, the stakeholders in the chemical industry can use the research findings and recommendations to monitor and recommend further sustainability development for the organization, and the government can use research findings and recommendations as a guideline for reviewing sustainability development for the industrial sector in Thailand. The researcher focuses on studying how factors such as transformational leadership, organizational culture, and corporate social responsibility influence sustainability. This study reveals that all determinants had a strong positive influence on the proposed assumptions. This can indicate that sustainability generated by the results of this study significantly contributed by expanding the current theoretical and empirical knowledge. This will be discussed in the following details.

5.3.1 Theoretical Implication

From the conceptual framework of this study, it can be seen that the researcher mainly focused on studying the influence of transformational leadership on sustainability. This study bridged the gap and developed a structural equation model to test hypotheses for the direct and indirect relationship between transformational leadership and sustainability. Moreover, this is the first attempt to lead the transformation and sustainable development of the chemical industry in Thailand using SEM.

The findings regarding the development of the integrative model provide theoretical implications that prove the interplay between transformational leadership, organizational culture, and CSR on sustainability. This model places an overall emphasis on an integrated model of sustainability. This has implications for strategic management theory and organizational behavior that necessitate a more comprehensive discussion of the role of transformational leadership, organizational culture, and CSR in promoting organizational sustainability. The researcher discussed the theoretical implications as follows.

Firstly, this study outlines the necessary implications for chemical industry companies, stakeholders, and government regulatory agencies. Moreover, this study fills the gaps in all related literature. This study will promote sustainability for companies in the chemical industry and other industries both in Thailand and around the world to benefit from this study as well. For academics and researchers, the results of this study will help provide a clearer picture of the factors influencing sustainability.

Second, this study helps leaders identify specific leadership behaviors related to sustainability. The results indicate that the transformational leadership style of the chemical industry in Thailand is important for sustainability. This study noted that the most effective leaders influencing the sustainability of the chemical industry in Thailand are those who value and care for their followers. Dvir et al. (2002) stated that leaders treat each follower differently but equally by giving everyone individual attention as a result, followers feel special, supported, inspired, developed themselves, and they work better.

Thirdly, the results suggest that organizational cultural styles are important for sustainability. The chemical industry in Thailand has an organizational culture that focuses on achieving goals, emphasizes aggressive competition, and results in excellence that drives success. This is critical to achieving organizational sustainability as Cameron and Quinn (2011) stated a culture that focuses on competition and results such as profit to ensure discipline in achieving these goals has a strong emphasis on achieving measurable goals and targets. In addition, organizational culture is a medium for participation in organizational sustainability (Srisathan, Ketkaew, & Naritarathon, 2020).

Fourthly, the results suggest that corporate social responsibility models are important for sustainability. Specifically, this study noted that corporate social responsibility influences sustainability, namely CSR of the chemical industry in Thailand focuses on operating for the benefit of stakeholders by producing good quality products at reasonable prices for economic and societal benefits. Carroll (2004) defines this type of CSR as economic responsibility that focuses on producing goods and services that society needs at prices that make the business sustainable and satisfy its obligations to investors.

Finally, this study also shows that transformational leadership is important for both CSR integration and a strong organizational culture. Organizations can use a strong culture to differentiate themselves from competitors as this culture will positively influence the integration of CSR and increase their performance (Chaabane, 2019). That is, corporate culture and CSR are the medium that leads to sustainability. In short, this study helps in understanding the role of transformational leadership in the chemical industry in Thailand in creating the right culture for formulating CSR initiatives for sustainability, which is one of its key theoretical contributions.

5.3.2 Practical Implication

The implications of this study may provide important advantages to the chemical industry in Thailand and beyond. Including executives, organization members, and all stakeholders of the organization. As evidenced in this study, transformational leadership promotes organizational culture and CSR, which in turn leads to sustainability. The researcher discussed the Practical Implications as follows.

Firstly, executives in the chemical industry in Thailand should encourage leaders to cultivate transformational leadership qualities at all levels of the organization, such as having a vision, being able to inspire, being intellectually stimulating, and giving importance to followers. Transformational leaders can bring about much-needed changes in individual, group, and organizational behavior (K & Ranjit, 2020). With leaders in the chemical industry in Thailand embracing transformational leadership, this results in more confident and motivated employees who truly value their performance. The results of this study proved that achieving organizational objectives in a competitive environment is achieved through having transformational leadership in the organization. Significant changes in employee behavior by transformational leaders are

achieved through behaviors such as inspirational motivation, individual consideration, and cognitive motivation (K & Ranjit, 2020).

Secondly, executives in the chemical industry in Thailand should identify a variety of moral values for social and environmental responsibility and corporate core values. Management should consistently model these values to show employees that they should act accordingly. Companies should invest in leadership development to perpetuate organizational culture through communication channels, including company poems or company songs and symbols on employee uniforms and joint activities (Ketpraphakorn & Kantabutr, 2019). Including designing CSR programs to emphasize core values among employees. Companies that adopt these practices can expect their businesses to be sustainable (Ketpraphakorn & Kantabutr, 2019).

Thirdly, executives need to redesign existing cultures to pursue sustainable performance (Islam, Tseng, & Karia, 2019). Companies in the chemical industry in Thailand build and maintain beliefs, values, and skills critical to sustainability through internal employee communication and training, which play a critical role in achieving sustainability. If an organization does not already have the beliefs, values, and skills important for sustainability, it may need to begin with mission reform to change existing beliefs, values, norms, goals, and strategies. The mission statement should address sustainability to translate this concept into the company's values, strategies, and goals.

Fourthly, CSR implementation is a continuous mechanism and precise, accurate, properly targeted programs through government-defined references referring to the 3 P's (Profit, People, and Planet) are very important to achieve efficiency that increases or ensures the sustainability of the company (Indarti & Wijayanto, 2015). A CSR program must be part of the organization's vision, mission, and strategy. CSR activities encourage companies in the chemical industry in Thailand to explore new business opportunities to increase business, growth, profitability, and sustainability. However, leadership is central to unlocking value from CSR initiatives. Similar to other organizational activities, leadership helps create a CSR culture in an organization (Khan, Ali, & Olya, 2018).

Fifthly, the study results show the importance of transformational leadership in improving organizational sustainability through corporate culture and CSR. Companies in the chemical industry in Thailand need to understand the importance and characteristics of transformational

leadership. Transformational leadership incorporates unique considerations regarding the development of employees in an organization. Transformational leaders can focus their efforts on values and focus on developing a vision and inspiring followers to pursue the vision. They change or adjust systems to meet their vision as opposed to working within the existing framework and they provide advice to their followers (Khan, Ali, & Olya, 2018).

Finally, the results of this study reinforce that governments and policymakers should take measures to promote and support sustainable business practices. Innovative technology and investments in process and product innovation are not only sufficient for achieving corporate sustainability, CSR activities are also one of the factors to rely on in today's economy. However, we cannot ignore the fact that the government plays an important role in promoting sustainability (Zhang, Morse, & Ma, 2019).

5.3.3 Recommendations

The results of this study highlight the complexity of the relationship between transformational leadership, organizational culture, and social responsibility that influence sustainability, providing the basis for more optimal sustainable organizational development. Taken together, these findings are relevant to managers and sustainability advocates. It will suggest guidelines for sustainable organizational improvement as follows. Firstly, transformational leaders must commit to forming teams to design and develop CSR initiatives and involve or include employees in implementing these activities. Therefore, companies in the chemical industry need to improve their internal corporate culture, which requires alignment with internal and external policies that affect the company's sustainability. Transformational leaders should act as an example and have a broad vision that can be passed on to employees. The organizational climate should include a social gathering where everyone in the company comes together and takes time to listen to one another. Transformational leaders consider appropriate decisions for employees and allow employees to be interdependent and independent. Companies should also pay attention to and be aware of other essential elements of organizational culture.

Secondly, organizational culture is essential to achieve sustainability while leadership is essential to embed such organizational culture to influence all stakeholders to achieve shared objectives. Shared values in an organization's culture increase sustainability awareness, which

affects sustainability behavior in the workplace. Therefore, companies in the chemical industry should include transformational leadership programs and training courses in their annual plans with a focus on being more attentive and understanding to their employees. Companies should consider investing in transformational leadership training to support leadership behaviors that promote an organizational culture that supports sustainability and overcomes resistance caused by change and challenges. These companies should also focus on hiring managers who are qualified to lead change to promote sustainability.

Thirdly, companies need to consider social responsibility by helping the community rather than just looking for profits. Examples include protecting the environment and helping to solve social problems. Companies may demonstrate these beneficial activities by ethical standards and policies. CSR programs should involve employees and take action on sustainability and responsibility in planning, implementation, and evaluation. These things result in employees feeling proud.

Finally, the role of the state is crucial because it should not only design a regulatory framework for environmental and social development but also create sustainable public policies to incentivize private companies to be co-creators of value continuously. The government should develop more stringent regulations and continuously monitor the activities of companies, as well as support companies that operate fairly disclose all CSR activities to the public, and play a role in influencing companies to carry out CSR activities.

5.4 Limitation of the Study and Future Research Recommendations

This study focuses on transformational leadership which has been shown to have a positive relationship with sustainability. However, this study still has some limitations that need to be discussed. The researcher has summarized the discussion points and future research recommendations as follows. Firstly, because the study used cross-sectional data and quantitative research methods, its conclusions not only allow for causal predictions but also raise concerns about general bias. Therefore, future research should adopt qualitative methods and longitudinal studies as this will avoid ambiguity in causal relationships. Complementing quantitative approaches with

qualitative methods will help to better understand the mechanisms by which transformational leaders influence sustainability.

Secondly, access to samples is difficult. Often company executives forward questionnaires to other managers such as human resources managers, production managers, or other senior managers. This may skew the results because those managers may have insufficient knowledge of corporate strategy. Although it is possible that some effects in the test sample are not significant, they are significant in the population (Type II error). This means that it is possible that the conclusions drawn in this study may not hold for the entire population. Therefore, it is important to use qualitative research to fill this gap in future studies.

Thirdly, although the researchers claim that this study can be used to compare industries and countries, it describes the sustainability of the downstream chemical industry in Thailand which in some respects may not be consistent with the upstream and midstream chemical industries or other industry players, including that, it may not be consistent with companies in other countries. Future studies should expand the sample to other industries, areas, and countries to increase the generalizability of the findings.

Lastly, the researchers found that the impact of external factors may be related to sustainability, transformational leadership, organizational culture, and CSR, such as the COVID-19 pandemic, political problems, and economic problems. These unusual circumstances may also affect the participants' answers. Future investigations should carefully consider the impact of linking other factors that may influence sustainability beyond transformational leadership, organizational culture, and social responsibility. Other factors include transactional leadership, organizational structure, and employee engagement, among others.

REFERENCES

Abbas, J., et al. (2019). The effects of corporate social responsibility practices and environmental factors through a moderating role of social media marketing on sustainable performance of business firms. *Sustainability, 11*, 3434-3466.

Abbas, S. & Bakr, N. (2019). Transformational leadership, organizational culture and sustainability at the property development companies in Malaysia. *International Journal of Recent Technology and Engineering (IJRTE), 8*(3S2), 640-644.

Acevedo, J.L.P. and Avecillas, D.X.A. (2021). The mediating effect of organizational culture on leadership and performance in SME. *Proceedings of The 3rd International Conference on Applied Research in Management, Business and Economics.* Berlin, Germany.

Achillas, C., Bochtis, D.D., Aidonis, D., & Folinas, D. (2019). *Green supply chain management* (1st ed.). New York: Routledge.

Aguinis, H. & Glavas, A. (2012). What we know and don't know about corporate social responsibility: A review and research agenda. *Journal of Management,* 932–68.

Aleksić, A., Braje, I.N., & Jelavić, S.R. (2019). Creating sustainable work environments by developing cultures that diminish deviance. *Sustainability, 11*, 7031-7043.

Ali, S.HK., Khan, N.S., & Yildiz, Y. (2020). Leadership effects on CSR employee, media, customer, and NGOs. *Management and Economics Research Journal, 6*(1), 1-9.

Alrowwad, A., Obeidat, B.Y., Tarhini, A., & Aqqad, N. (2017). The impact of transformational leadership on organizational performance via the mediating role of corporate social responsibility: A structural equation modeling approach. *International Business Research, 10*(1), 199-221.

Andreja, N., Kristijana, B., & Srečkoa, N. (2020). How leaders can initiate knowledge management in organizations: Role of leadership style in building knowledge infrastructure. *Journal: Human Systems Management, 39*(1), 37-50.

Bakhsh, M.M., Aleem, U., Farooq, K. & Aziz, A. (2020). The mediating effect of organization culture on the relationship between leadership styles and job performance among health care professionals at tertiary care public sector hospital. *International Journal of Innovation, Creativity and Change, 14*(5), 832-869.

Bamgbade, J.A, Kamaruddeen, A.M., & Nawi, M.N.M. (2015). Factors influencing sustainable construction among construction firms in malaysia: a preliminary study using PLS-SEM. *Revista Técnica de la Facultad de Ingeniería Universidad del Zulia, 38*(3), 132-142. Retrieved December 1, 2020, from https://www.researchgate.net/publication/284183118

Barile, S., Canestrino, R., Magliocca, P., & Caputo, F. (2019). The influence of cultural dimensions on corporate social responsibility: Reflections about Italian firms. *Proceedings of The 14th International Scientific & Business Conference Social Responsibility and Current Challenges 2019: Social Responsibility: Development, Applications and Impact Measurement (Družbena Odgovornost: Razvoj, Uporaba in Merjenje Vpliva),* Maribor, Slovenia, European Union.

Bass, B.M. (1985). *Leadership and performance beyond expectations*. New York: Free Press.

Bass, B.M. & Avolio, B. J. (1993). Transformational leadership and organizational culture. *Public Administration Quarterly, 17*, 112-121.

Bateman, T.S., Snell, S.A., & Konopaske, R. (2019). *Management: Leading & collaborating in a competitive world* (13th ed). New York: McGraw-Hill Education.

Begum, S., Xia, E., Mehmood, K., Iftikhar, Y., & Li, Y. (2020). The impact of CEOs' transformational leadership on sustainable organizational innovation in SMEs: A three-wave mediating role of organizational learning and psychological empowerment. *Sustainability, 12*, 1-16.

Bernal-Conesa, J.A., Nieto, C.de.N., & Briones-Peñalver, A.J. (2017). CSR strategy in technology companies: Its influence on performance, competitiveness and sustainability. *Corporate Social Responsibility and Environmental Management, 24*, 96–107.

Bhagwat, P. (2011). Corporate social responsibility and sustainable development. *Proceeding of the Conference on Inclusive & Sustainable Growth Role of Industry, Government and Society Conference.* Organized by Institute of Management Technology.

Bhuiyan, F., Baird, K., & Munir, R. (2020). The association between organizational culture, CSR practices and organizational performance in an emerging economy. *Meditari Accountancy Research, 28*(6), 977-1011.

Boddy, D. (2017). *Management: An introduction* (7th ed). Harlow: Pearson Education Limited.

Boerner, S., Eisenbeiss, S.A., & Griesser, D. (2007). Follower behavior and organizational performance: The impact of transformational leadership. *Journal of Leadership & Organizational Studies, 13*(3), 15–26.

Bollen, K. A. (1989). *Structural equations with latent variables.* New York: John Wiley & Sons.

Branny, K. & Nwagbaraocha, J. (2014). How are you treating your employees, your neighbors and mother earth? New EU directive clarifies the scope of CSR reporting. *EHS Today,* p. 1.

Browne, M.W. & Cudeck, R. (1993). *Alternative ways of assessing model fit, in testing structural equation models, ed.* K. A. Bollen and Long. S., Newbury Park CA: Sage.

Brown, T. (2006). *Confirmatory factor analysis for applied research.* New York: Guilford Press.

Budur, T. & Demir, A. (2019). Leadership effects on employee perception about CSR in Kurdistan Region of Iraq. *International Journal of Social Sciences & Educational, 5*(4), 184-192.

Burawat, P. (2019). The relationships among transformational leadership, sustainable leadership, lean manufacturing and sustainability performance in Thai SMEs manufacturing industry. *International Journal of Quality & Reliability Management, 36*(6), 1014-1036.

Burns, J.M. (1978). *Leadership*. New York: Harper & Row.

Cameron, K.S. & Quinn, R.E. (2011). *Diagnosing and changing organizational culture: Based on the competing values framework* (3rd ed.). New Jersey: John Wiley & Sons, Inc.

Carroll, A.B. (1991). The Pyramid of corporate social responsibility: Toward the moral management of organizational stakeholders. *Business Horizons,* 39–48.

Carroll, A.B. (2004). Managing ethically and global stakeholders: A present and future challenge. *Academy of Management Executive, 18*(2), 114–120.

Chaabane, Y. (2019). *The influence of organizational culture on the integration of CSR activities: Quantitative research within the Dutch oil and energy branch* (Master's thesis). Radboud Universiteit, Nijmegen.

Chang, C.H. (2015). Proactive and reactive corporate social responsibility: antecedent and consequence. *Management Decision, 53*(2), 451-468.

Changar, M. & Atan, T. (2021). The role of transformational and transactional leadership approaches on environmental and ethical aspects of CSR. *Sustainability, 13*, 1411-1433.

Clegg, S.R., Kornberger, M., & Pitsis, T.S. (2016). *Managing & organizations: An introduction to theory and practice* (4th ed.). London: SAGE Publications Ltd.

Cooper & Schindler. (2014). *Business research methods.* USA: McGraw-Hill Companies.

Cronbach, L.J. (1974). *Essential of psychological testing.* New York: Harper & Row.

Deal, T.E. & Kennedy, A.A. (1982). *Corporate cultures: The rites and rituals of corporate life.* Reading, Mass.: Addison-Wesley Publishing Co.

Dhakal, H.R. (2017). *An alternative to paradoxical leadership model: Fulfilling the triple bottom line* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (ProQuest Number: 10623991)

Diamantopoulos, A., & Siguaw, A.D. (2000). *Introducing LISREL: A guide for the uninitiated.* London: Sage Publications.

Dubey, R., Gunasekaran, A., Childe, S.J., Papadopoulos, T., Hazen, B., Giannakis, M., & Roubaud, D. (2017). Examining the effect of external pressures and organizational culture on shaping performance measurement systems (PMS) for sustainability benchmarking: Some empirical findings. *International Journal of Production Economics, 193*, 63–76.

Dvir, T., Eden, D., Avolio, B.J., & Shamir, B. (2002). Impact of transformational leadership on follower development and performance in a field experiment. *The Academy of Management Journal, 45*(4), 735-744.

Dyck, B., Walker, K., & Caza, A. (2019). Antecedents of sustainable organizing: A look at the relationship between organizational culture and the triple bottom line. *Journal of Cleaner Production, 5*, 1-44.

Ebert, R.J., Griffin, R.W., Dracopoulos, G., & Starke, F.A. (2020). *Business essentials* (9th ed). Ontario: Pearson Canada Inc.

Elkington, J., (1994). Towards the sustainable corporation: Win-win-win business strategies for sustainable development. *California management review, 36*(2), 90-100.

Elshanti, M. (2017). Transformational leadership style and organizational learning: The mediate effect of organizational culture. *International Business and Management, 15*(2), 1-14.

Engel, R.J. & Schutt, R.K. (2005). *The practice of research in social work.* New York: SAGE.

Espasandín-Bustelo, F., Ganaza-Vargas, J., & Diaz-Carrion, R. (2021). Employee happiness and corporate social responsibility: the role of organizational culture. *Employee Relations, 43*(3), 609-629.

Faraz, N.A., Yanxia, C., Estifo, Z.G., & Kaukab, A. (2019). The Impact of transformational leadership, organizational learning and organizational culture on employee innovative work behavior. *Proceedings of the 14th International Conference on Innovation & Management* (pp. 1328-1332). Research Gate.

Ferrell, O. C., Fraedrich, J., & Ferrell, L. (2017). *Business ethics: Ethical decision making & cases* (11th ed.). Massachusetts: Cengage Learning.

Ferrell, O.C., Hirt, G.A., & Ferrell, L. (2019). *M: Business* (6th ed.). New York: McGraw-Hill Education.

Flammer, C. (2012). Corporate social responsibility and shareholder reaction: The environmental awareness of investors. *Academy of Management Journal, 56*, 758–81.

Ghauri, P., Grønhaug, K., & Strange, R. (2020). *Research methods in business studies* (5th ed.). New York: Cambridge University Press.

Giacalone, R. (2004). A transcendent business education for the 21st century. *Academy of Management Learning & Education, 3*(4), 415-420.

Godfrey P.C. (2005). The relationship between corporate philanthropy and shareholder wealth: a risk management perspective. *The Academy of Management Review, 30*(4), 777–798.

Gözde, T.Ç., & Emel L.O. (2016). Big five and organizational commitment – The case of Turkish construction professionals. *Human Resource Management Research 2016, 6*(1), 6-14.

Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E. & Tatham, R. (2006). *Multivariate data analysis* (6th ed.). New Jersey: Pearson Prentice Hall.

Hair, J.F., Black, W.C., Babin, B.J., & Anderson, R.E. (2010). *Multivariate data analysis* (7th ed.). New Jersey: Pearson Prentice Hall.

Hartman, L.P., DesJardins, J., & MacDonald, C. (2018). Business ethics: *Decision making for personal integrity and social responsibility* (4th ed.). New York: McGraw-Hill Education.

Heizer, J., Render, B., & Munson, C. (2017). *Operations management: Sustainability and supply chain management* (12th ed.). Harlow: Pearson Education Limited.

Hofstede, G. (1991). *Cultures and organizations: Software of the mind.* London: McGraw-Hill.

Hongdao, Q., Bibi, S., Khan, A., Ardito, L., & Nurunnabi, M. (2019). Does what goes around really comes around? The mediating effect of CSR on the relationship between transformational leadership and employee's job performance in law firms. *Sustainability, 11*, 3366-3384.

Hosseini, S.H., Hajipour, E., Kaffashpoor, A., & Darikandeh, A. (2020). The mediating effect of organizational culture in the relationship of leadership style with organizational learning. *Journal of Human Behavior in the Social Environment, 30*(3), 279–288.

Hughes, R.L., Ginnett, R.C., & Curphy, G.J. (2019). *Leadership: Enhancing the lessons of experience* (9th ed.). New York: McGraw-Hill Education.

Imran, R., Zahoor, F., & Zaheer, A. (2012). Leadership and performance relationship: Culture matters. *International Journal of Innovation, Management and Technology, 3*(6), 713-717.

Indarti, S. & Wijayanto, G. (2015). Effect of corporate social responsibility and cultural organization on job satisfaction and business performance (studies in BUMN and BUMD in Riau province). *Information and Knowledge Management, 5*(7), 49-61.

Iranmanesh, M., Zailani, S., Hyun, S.S., Ali, M.H., & Kim, K. (2019). Impact of lean manufacturing practices on firms' sustainable performance: Lean culture as a moderator. *Sustainability, 11*, pp. 1112-1131.

Islam, Md.S., Tseng, M.L., & Karia, N. (2019). Assessment of corporate culture in sustainability performance using a hierarchical framework and interdependence relations. *Journal of Cleaner Production, 217*, 676-690.

Jacobs, F.R. & Chase, R.B. (2020). *Operations and supply chain management* (5th ed.). New York: McGraw-Hill Education.

Jaques, E. (1952). *The changing culture of a factory.* New York: Dryden Press.

Javeed, S.A. & Lefen, L. (2019). An analysis of corporate social responsibility and firm performance with moderating effects of CEO power and ownership structure: A case study of the manufacturing sector of Pakistan. *Sustainability, 11*, 248-272.

Jones, D.A., Willness, C.R., & Glavas, A. (2017). When corporate social responsibility (CSR) meets organizational psychology: New frontiers in micro-CSR research, and fulfilling a quid pro quo through multilevel insights. *Frontiers in Psychology, 8*, 1-14.

Jones, G.R. & George, J.M. (2019). *Essentials of contemporary management* (8th ed.). New York: McGraw-Hill Education.

K, J., Ranjit, G. (2020). Effect of transformational leadership on job performance: testing the mediating role of corporate social responsibility. *Journal of Advances in Management Research, 17*(5), 605-625.

Kark, R., Shamir, B., & Chen, G. (2003). The two faces of transformational leadership: Empowerment and dependency. *Journal of Applied Psychology, 88*(2), pp. 246–255.

Katamba, D. (2010). *Corporate social responsibility, organizational culture, ethical citizenship and reputation of financial institutions in Uganda* (Master's thesis). Kampala: Makerere University.

Ketprapakorn, N. & Kantabutra, S. (2019). Culture development for sustainable SMEs: Toward a behavioral theory. *Sustainability, 11*, 2629-2643.

Khan, H.U.R., Ali, M., & Olya, H.G.T. (2018). Transformational leadership, corporate social responsibility, organizational innovation, and organizational performance: Symmetrical and asymmetrical analytical approaches. *Corporate Social Responsibility and Environmental Management, 25*(6). 1270-1283.

Khan, M.A., Ismail, F.B., Hussain, A., & Alghazali, B. (2020). The interplay of leadership styles, innovative work behavior, organizational culture, and organizational citizenship behavior. *SAGE Open,* 1–16.

Kinicki, A. & Williams, B.K. (2020). *Management: A practical introduction* (9th ed.). New York: McGraw-Hill Education.

Knowledge of Chemical Industry. (2013). Retrieved December 6, 2020, from http://chawut.blogspot.com/2013/12/blog-post.html

Krungsri Research. (2021). *Trends of Thai business and industry in 2021-2023.* Retrieved June 9, 2021, from https://www.krungsri.com/th/research/industry/summary-outlook/industry-summary-outlook-2021-2023

Lawrence, A.T. & Weber, J. (2020). *Business and society: Stakeholders, ethics, public policy* (16th ed.). New York: McGraw-Hill Education.

Lee, M. & Kim, H. (2017). Exploring the organizational culture's moderating role of effects of corporate social responsibility (CSR) on firm performance: Focused on corporate contributions in Korea. *Sustainability, 9*, 1883-1900.

Leedy, P.D. & Ormrod, J.E. (2016). *Practical research: Planning and design* (11th ed.). New York: Pearson Education, Inc.

Lewis, P.S., Goodman, S.H., Fandt, P.M., & Michlitsch, J.F. (2007). *Management: Challenges for tomorrow's leaders* (5th ed.). Ohio: Thomson South-Western.

Linnenluecke, M.K. & Griffiths, A. (2010). Corporate sustainability and organizational culture. *Journal of World Business, 45*, 357–366.

Liu, X. & Lin, K. (2020). Green organizational culture, corporate social responsibility implementation, and food safety. *Frontiers in Psychology, 11*(6), 1-7.

Louis, M.R. (1983). *Organizations as culture-bearing milieu.* In L. Pondy, P. Frost, G. Morgan, and T. Dandridge (eds.), Organizational culture. Connecticut: JAI Press.

Lutfi, M. & Siswanto. (2018). A Transformational leadership and it's implication on employee performance through organizational culture and motivation. *Ekspektra: Jurnal Bisnis dan Manajemen, 2*(2), 192-200.

Manzoor, F., et al. (2019). The impact of transformational leadership on job performance and CSR as mediator in SMEs. *Sustainability, 11*, 436-449.

Matten, D. & Moon, J. (2008). 'Implicit' and 'Explicit' CSR: A conceptual framework for a comparative understanding of corporate social responsibility. *Academy of Management Review, 33*, pp.404-424.

Mena, Rintamaki, Fleming, et al. (2016). On the forgetting of corporate irresponsibility. *Academy of Management Review, 41*(4), 720-738.

Metz, D., Ilies, L., & Nistor, R.L. (2020). The impact of organizational culture on customer service effectiveness from a sustainability perspective. *Sustainability, 12*, 6240-6266.

Ministry of Industry, Department of Industrial Works. (2021). *Cumulative statistics of the number of factories that are allowed to operate (Open for operation) according to the Factory Act 1992, classified by major industries by type as of the end of 2020.* Retrieved June 24, 2021, from https://www.diw.go.th/hawk/default.php

Ministry of Industry, Office of Industrial Economics, Division of Industrial Economics Research. (2012). *Industry press release: An introduction to the chemical industry.* Bangkok: Author.

Ministry of Industry, Office of Industrial Economics, Division of Industrial Economics Research. (2021). *Thai industrial economic report 2020 and outlook 2021.* Bangkok: Author.

Ministry of Public Health, Department of Disease Control, Bureau of Occupational and Environmental Diseases (BOED). (2020). *Report on the situation of surveillance for chemical threats in the year 2020 for the first 6 months (1 January – 30 June 2020).* Nonthaburi: Author.

Ministry of Public Health, Department of Disease Control, Bureau of Occupational and Environmental Diseases (BOED). (2021). *Report on the situation of surveillance for chemicals in the year 2020 for the last 6 months (1 July – 31 December 2020).* Nonthaburi: Author.

Modern Manufacturing. (2017). *Eco industry: The new industry must sustainably balance the economy and society.* Retrieved November 12, 2020, from https://www.mmthailand.com/eco-industry.

Mona, V., Suharto, & Subagja, I.K., (2020). The influence of transformational leadership style and organizational culture on organizational performance with emotional intelligence as a mediation variables: A case study at the Jatimelati Bekasi village office. *International Journal of Business and Social Science Research, 1*(1), 17-27.

Mueller, R.O. (1996). *Basic principles of structural equation modeling. An introduction to LISREL and EQS.* New York: Springer-Verlag.

Muliati, M., Iqbal, M., & Mayapada, A.G. (2020). The effect of organizational culture on firm performance with social responsibility as mediating variable. *Research in World Economy, 11*(5), 279-287.

Munford, J.R. (2020). *Transformational leadership and fiscal sustainability in African American churches* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (ProQuest Number: 28086785)

Nahavandi, A. (2015). *The art and science of leadership* (7th ed.). Harlow: Pearson Education Limited.

Nalick, M., Josefy, M., Zardkoohi, A., & Bierman, L. (2016). Corporate sociopolitical involvement: A reflection of whose preferences? *The Academy of Management Perspectives, 30*(4), 384-403.

Okwemba, E.M., et al. (2014). Effect of corporate social responsibility on organization performance; Banking industry Kenya, Kaka mega County. *International Journal of Business and Management Invention, 3*(4), 37-51.

Park, T. & Pierce, B. (2020). Impacts of transformational leadership on turnover intention of child welfare workers. *Children and Youth Services Review, 108*, 1-10.

Peng, M.W. (2018). *Global business.* Massachusetts: Cengage Learning.

Peters, T.J. & Waterman, R.H. Jr. (1982). *In search of excellence: lessons from America's best run companies.* New York: Harper & Row.

Pettigrew, A. (1979). On studying organizational culture. *Administrative Science Quarterly, 24*, 570–81

Pokpong, S. (2020). *Triple bottom line.* Retrieved November 12, 2020, from https://www.kaohoon.com/content/335317

Pradhan, R.K., Panda, M., & Jena, L.K. (2017). Transformational leadership and psychological empowerment: The mediating effect of organizational culture in Indian retail industry. *Journal of Enterprise Information Management, 30*(1), 82-95.

Prasad, M., Mishra, T., & Bapat, V. (2019). Corporate social responsibility and environmental sustainability: Evidence from India using energy intensity as an indicator of environmental sustainability. *IMB Management Review, 31*, 374–384.

Rizki, M., Parashakti, R.D., & Saragih, L. (2019). The Effect of Transformational leadership and organizational culture towards employees' innovative behavior and performance. *International Journal of Economics and Business Administration, 7*(1), 227-239.

Roberts, N.C. (2018). *Transforming leadership: A process of collective action.* Retrieved June 20, 2021, from https://www.researchgate.net/publication/248150557

Rothaermel, F.T. (2018). *Strategic management* (4th ed.). New York: McGraw-Hill Education.

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.

Saeed, A. (2017). *A 'green' strategy for triple bottom line corporate sustainability: A case study of a major manufacturer in the UAE* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (ProQuest Number: 28018499)

Schein, E.H. (1985). *Organizational culture and leadership: A dynamic view.* San Francisco: Jossey-Bass.

Schein, E.H. (1996). Culture: The missing concept in organization studies. *Administrative Science Quarterly,* June 1996, 236.

Schein, E. H. 2004. *Organizational culture and leadership.* San Francisco: Jossey-Bass.

Schein, E.H. (2010). *Organizational Culture and Leadership* (3rd ed.). San Francisco: Jossey-Bass A Wiley Imprint.

Schermerhorn et al. (2017). *Management* (6th ed.). San Francisco: Jossey-Bass A Wiley Imprint.

Schneider, B. & Barbera, K.M. (2014). *The oxford handbook of organizational climate and culture.* Oxford: Oxford University Press.

Schumacker, R.E. & Lomax, R.G. (2010). *A beginner's guide to structural equation modeling* (3rd ed.). New York: Routledge.

Shah, A.K., Jintian, Y., Sukamani, D., & Kusi1, M. (2020). How green transformational leadership influences sustainability? Mediating effects of green creativity and green procurement. *RISUS – Journal on Innovation and Sustainability, 11*(4), 69-87.

Shahzad, M., Qu, Y., Javed, S.A., Zafar, A.U., & Rehman, S.U. (2020). Relation of environment sustainability to CSR and green innovation: A case of Pakistani manufacturing industry. *Journal of Cleaner Production, 253*, 1-12.

Shahzad, M., Qu, Y., Rehman, S.U., Zafar, A.U., Ding, X., & Abbas, J. (2020) Impact of knowledge absorptive capacity on corporate sustainability with mediating role of CSR: analysis from the Asian context. *Journal of Environmental Planning and Management, 63*(2), 148-174.

Shim, H.S., Jo, Y., & Hoover, L.T. (2015). Police transformational leadership and organizational commitment: Mediating role of organizational culture. *Policing: An International Journal, 38*(4), 754-774.

Shin and Zhou. (2003). Transformational leadership, conservation, and creativity: Evidence from Korea. *The Academy of Management Journal, 46*(6), pp. 703-714.

Sorbon, D. (1996). *LISREL 8: User's reference guide.* Sweden: Scientific Software International.

Srisathan, W.A., Ketkaew, C. & Naruetharadhol, P. (2020). The intervention of organizational sustainability in the effect of organizational culture on open innovation performance: A case of Thai and Chinese SMEs. *Cogent Business & Management, 7*(1), 1-28.

Stevens, J. (1996). *Applied multivariate statistics for the social sciences* (3rd ed.). New Jersey: Lawrence Erlbaum Associates.

Sukorndhaman, P. (2017). *Guidelines for the development of environmental chemical industry to drive the bio-economy strategy* (Research report). Bangkok: Thailand National Defence College.

Suzuki, P. (1996). *Avenues and opportunities for exports and the impact of the ASEAN free trade area (for chemical and pharmaceutical industry)* (Research report). Bangkok: Thailand Development Research Institute (TDRI).

Swink, M., Melnyk, S.A., & Hartley, J.L. (2020). *Managing operations across the supply chain* (4th ed.). New York: McGraw-Hill Education.

Taweerat, P. (1997). *Research methodology in behavioral sciences and social sciences* (7th ed.). Bangkok: Srinakharinwirot University.

Teerikangas and Very. (2006). The culture–performance relationship in M&A: From yes/no to how. *Journal of Management, 17*(S1), S31-S48

Tefera, M.A., Yuanqiong, H., & Luming, L. (2019). A link between top managers' perception and corporate social responsibility: Transformational leadership as a moderator. *International Journal of Research in Business and Social Science, 9*(1), 01–14.

The Brundtland Commission. (1987). *Report of the world commission on environment and development: Our common future.* UN Documents: Gathering a Body of Global Agreements has been compiled by the NGO Committee on Education of the Conference of NGOs from United Nations web sites with the invaluable help of information & communications technology.

Thompson, A.A., Peteraf, M.A., Gamble, J.E., & Strickland III, A.J. (2018). *crafting and executing strategy: The quest for competitive advantage, concepts* (21st ed.). New York: McGraw-Hill Education.

Trice, H.M. & Beyer, J.M. (1993). *The cultures of work organizations.* New Jersey: Prentice-Hall.

Ullah, A., Lai, R., & Marjoribanks, T. (2013). A proposed model for business sustainability based on business and information technology. *Journal of Software, 8*(11), 2796-2806.

Ullah, Z., et al. (2021). Achieving organizational social sustainability through electronic performance appraisal systems: The moderating influence of transformational leadership. *Sustainability, 13*, 5611.

Ullman, J.B. (2001). *Structural equation modeling.* In B.G. Tabachnick & L. S. Fidell (Eds.), Using multivariate statistics (4th ed.). Boston, MA: Pearson Education.

Van Maanen, J. (1988). *Tales of the field: On writing ethnography.* Illinois: University of Chicago Press.

Vanichbuncha, K. (2011). *Statistical analysis: Statistics for administration and research.* Bangkok: Chulalongkorn University Printing House.

Villca, R.C. & Castillo, C.J.P. (2020). Sustainable management model to strengthen competitiveness in “Supermarket” retail companies in the region of Coquimbo, Chile. *Contaduría y Administración, 65*(2), 1-34.

Vveinhardt, J. & Andriukaitiene, R. (2017). Management culture as part of organizational culture in the context of corporate social responsibility implementation. *Economics and Sociology, 10*(3), 294-320.

Waheed, A., Zhang, Q., Zafar, A.U., Zameer, H., Ashfaq, M., & Nusrat, A. (2021), Impact of internal and external CSR on organizational performance with moderating role of culture: empirical evidence from Chinese banking sector. *International Journal of Bank Marketing,* ahead-of-print.

Wang, G., Oh, I.S., Courtright, S.H., & Colbert, A.E. (2011). Transformational leadership and performance across criteria and levels: A meta-analytic review of 25 years of research. *Group and Organizational Management, 36*(2), 223–270.

Wang, H. & Qian, C. (2011). Corporate philanthropy and corporate financial performance: The roles of stakeholder response and political access. *Academy of Management Journal, 54*, 1159–81.

Westermann-Behaylo, Rehbein, and Fort. (2015). Enhancing the concept of corporate diplomacy: Encompassing political corporate social responsibility, international relations, and peace through commerce. *Academy of Management Perspectives, 29*(4), 387-404.

Wheelen, T.L., Hunger, J.D., Hoffman, A.N., & Bamford, C.E. (2018). *Strategic management and business policy: globalization, innovation, and sustainability* (15th ed.). Harlow: Pearson Education Limited.

Whittington, R., et.al. (2019). *Exploring strategy* (12th ed.). Harlow: Pearson Education Limited.

Wisner, J., Tan, K., & Leong, G.K. (2019). *Principles of supply chain management* (5th ed.). Massachusetts: Cengage Learning.

Zhang, D., Morse, S., & Ma, Q. (2019). Corporate social responsibility and sustainable development in China: Current status and future perspectives. *Sustainability, 11*, 4392-4414.

APPENDIX

APPENDIX A

QUESTIONNAIRE

A Structural Equation Model of Factors Influencing Sustainability of Chemical Industry in Thailand

This questionnaire is a part of the research of the Doctor of Philosophy Program in Industry Business Administration, Faculty of Administration and Management, King Mongkut's Institute of Technology Ladkrabang. All data obtained from this questionnaire would be complied with data from other sets of questionnaires and processed as a statistical report regardless of the specific name of the agency or the individual.

There are 3 parts in the questionnaire.

Part 1: Personal Data of the Respondent

Part 2: Questions about the latent variables in the research

Definition of the 5-point Scale:

"5" Point: Strongly agree, always, very important, or excellent to you.

"4" Point: Agree, often, important, or good to you.

"3" Point: Undecided, sometimes, moderately important, or fair to you.

"2" Point: disagree, rarely, slightly important, or poor to you.

"1" Point: Strongly disagree, never, unimportant, or very poor to you.

Part 3: Suggestion of respondents

Part 1: Personal Data of the Respondent

1. Gender

( ) Male ( ) Female

2. Age

( ) Not more than 30 years ( ) 31 – 40 years

( ) 41 – 50 years ( ) 51 – 60 years

( ) Older than 60 years

3. Highest education

( ) Under a bachelor's degree

( ) Bachelor's degree

( ) Higher than a bachelor's degree

4. Your management position_____

5. Your management experience

( ) Not more than 5 years ( ) 5 – 10 years

( ) 11 – 15 years ( ) 16 – 20 years

( ) More than 20 years

6. Industrial groups

( ) Chemical Fertilizer Industry ( ) Chemical Materials Industry

( ) Pharmaceutical Industry ( ) Cosmetic Industry

( ) Paint Industry and its associated products

7. Business operation period

( ) Not more than 5 years ( ) 5 – 10 years

( ) 11 – 20 years ( ) More than 20 years

Part 2: Questions about the latent variables in the research

Please mark ✓ in the box that most matches your opinion.

Question	Least ◄——► Most				
	1	2	3	4	5
Sustainability					
Profit					
1. Your organization's turnover has been growing steadily every year.					
2. Your organization has a continuous increase in profitability.					
3. Your organization has continuously increased its market share.					
4. Your organization is always striving to improve customer satisfaction.					
People					
5. Your organization produces products that are beneficial to health and safety for society.					
6. Your organization strives to maintain customer loyalty with quality products and services.					
7. Your organization pays high levels of employee compensation and benefits compared to competitors in the same industry.					
8. Your organization has excellent relationships with suppliers and has mutual trust.					
Planet					
9. Your organization strives to minimize emissions and waste.					
10. Your organization strives to minimize the use of resources and hazardous materials.					
11. Your organization has specific goals for actions to reduce its environmental impact.					
12. Your organization is certified to global environmental performance standards.					

Question	Least ⟷ Most				
	1	2	3	4	5
Transformational Leadership					
Charisma and Inspiration					
13. Manager demonstrates leadership in sustainable development by passing on key company values to employees.					
14. Manager seriously conveys the vision of sustainable development to employees and expresses confidence that goals will be achieved.					
15. Manager is role model for corporate sustainability development.					
16. Manager encourages support and encouragement to employees in solving problems that may arise while working.					
Intellectual Stimulation					
17. Manager encourages employees to innovate, be creative and seek solutions to develop sustainability led by the employees themselves.					
18. Manager seeks a wide range of information to help support the idea of the best solution for corporate sustainability.					
19. Manager challenges employees to set higher goals for themselves for higher performance.					
20. Manager focuses on brainstorming to find out how to achieve goals and how to solve problems from working with consensus on their team.					
Individual Consideration					
21. Manager pays close attention to the individual needs of each employee.					
22. Manager treats each employee as an individual rather than just a member of the organization.					
23. Manager cares about the abilities of each employee and strives to enhance their abilities.					
24. Manager inspires employees with individual employee career advancement plans.					

Question	Least ⟷ Most				
	1	2	3	4	5
Organizational Culture					
Clan					
25. Your organization has a family-like atmosphere.					
26. Your organization considers working as a team and a feeling of oneness as important.					
27. Your organization values loyalty and tradition in the organization					
Adhocracy					
28. Your organization is committed to innovation and sustainable development.					
29. Your organization emphasizes growth through developing new ideas					
30. Your organization has a risk management plan and is open to experimenting with new ways of working.					
Market					
31. Your organization places high importance to accomplishing goals					
32. Your organization is driven by financial success.					
33. Your organization emphasizes aggressive competition and outcome excellence.					
Hierarchy					
34. Your organization emphasizes formalization and has a clear organizational structure.					
35. Your organization has formal rules and policies that are strictly followed.					
36. Your organization is certified to global operating standards.					

Question	Least ⟷ Most				
	1	2	3	4	5
Corporate Social Responsibility					
Economic Responsibility					
37. Your organization operates for the benefit of stakeholders.					
38. Your organization produces good quality products at reasonable prices.					
39. Your organization is constantly developing products for economic and social benefits.					
Legal Responsibility					
40. Your organization strictly complies with all applicable laws and regulations.					
41. Your organization cooperates with all types of taxation and avoids the use of legal loopholes in tax evasion.					
42. Your organization creates an operating environment that meets safety standards for employees.					
Ethical Responsibility					
43. Your organization has ethical standards and be faithful to them at all times.					
44. Your organization takes social and environmental considerations no less than the pursuit of profit.					
45. Your organization provides accurate and complete information to customers, business partners, and society.					
Philanthropic Responsibility					
46. Your organization reinforces voluntary activities for society.					
47. Your organization always makes charitable contributions.					
48. Your organization always supports and participates in social and environmental activities.					

Part 3: Suggestion of respondents

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Thank you very much for your information

If there is any suggestion, please contact 098-584-4122 or suradetw888@gmail.com

แบบสอบถามเพื่อการวิจัย
เรื่อง “โมเดลสมการโครงสร้างของปัจจัยที่มีอิทธิพลต่อความยั่งยืนของอุตสาหกรรมเคมีในประเทศไทย”

แบบสอบถามนี้เป็นส่วนหนึ่งของการวิจัยประกอบดุษฎีนิพนธ์ ในหลักสูตรปรัชญาดุษฎีบัณฑิต สาขาวิชาบริหารธุรกิจอุตสาหกรรม (หลักสูตรนานาชาติ) คณะบริหารธุรกิจ สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง โดยมีวัตถุประสงค์เพื่อศึกษาเรื่อง “โมเดลสมการโครงสร้างของปัจจัยที่มีอิทธิพลต่อความยั่งยืนของอุตสาหกรรมเคมีในประเทศไทย” โดยแบบสอบถามมีจำนวน 3 ตอน ดังนี้

ตอนที่ 1 ข้อมูลส่วนตัวของผู้ตอบแบบสอบถาม

ตอนที่ 2 แบบสอบถามเกี่ยวกับตัวแปรที่ใช้ในการวิจัย

ตอนที่ 3 ข้อเสนอแนะอื่นๆ

ผู้วิจัยขอขอบพระคุณในความกรุณาของท่านมา ณ โอกาสนี้

นายสุรเดช หวังทอง

นักศึกษาปริญญาเอก หลักสูตรปรัชญาดุษฎีบัณฑิต

สาขาวิชาบริหารธุรกิจอุตสาหกรรม (นานาชาติ) คณะบริหารธุรกิจ

สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง

ตอนที่ 1 ข้อมูลส่วนตัวของผู้ตอบแบบสอบถาม

1. เพศ

( ) ชาย ( ) หญิง

2. อายุ

( ) ไม่เกิน 30 ปี ( ) 31 – 40 ปี

( ) 41 – 50 ปี ( ) 51 – 60 ปี

( ) มากกว่า 60 ปี

3. ระดับการศึกษาสูงสุด

( ) ต่ำกว่าปริญญาตรี

( ) ปริญญาตรี

( ) สูงกว่าปริญญาตรี

4. ตำแหน่งบริหารของท่าน

( ) ประธานเจ้าหน้าบริหาร ( ) กรรมการผู้จัดการ

( ) ผู้อำนวยการ ( ) ผู้จัดการ

( ) อื่นๆ (โปรดระบุ)_____

5. ประสบการณ์ในตำแหน่งบริหารของท่าน

( ) ไม่เกิน 5 ปี ( ) 5 – 10 ปี

( ) 11 – 15 ปี ( ) 16 – 20 ปี

( ) มากกว่า 20 ปี

6. ประเภทของอุตสาหกรรมที่บริษัทของท่านดำเนินการอยู่

( ) อุตสาหกรรมปุ๋ยเคมี ( ) อุตสาหกรรมเคมีภัณฑ์

( ) อุตสาหกรรมยา ( ) อุตสาหกรรมเครื่องสำอาง

( ) อุตสาหกรรมสีและผลิตภัณฑ์ที่เกี่ยวข้อง

7. ระยะเวลาการดำเนินงานของบริษัท

( ) ไม่เกิน 5 ปี ( ) 5 – 10 ปี

( ) 10 – 20 ปี ( ) มากกว่า 20 ปี

ตอนที่ 2 แบบสอบถามเกี่ยวกับตัวแปรที่ใช้ในการวิจัย

โปรดทำเครื่องหมาย ✓ ในช่องว่างตามความคิดเห็นของท่าน

คำถาม	น้อยที่สุด ⟷ มากที่สุด				
	1	2	3	4	5
ความยั่งยืนขององค์กร					
เศรษฐกิจ					
1. บริษัทของท่านมีผลประกอบการเติบโตอย่างสม่ำเสมอทุกปี					
2. บริษัทของท่านมีความสามารถในการทำกำไรเพิ่มขึ้นอย่างต่อเนื่อง					
3. บริษัทของท่านมีส่วนแบ่งการตลาดเพิ่มขึ้นอย่างต่อเนื่อง					
4. บริษัทของท่านสามารถรักษาความพึงพอใจของลูกค้าได้อย่างสม่ำเสมอ					
สังคม					
5. บริษัทของท่านผลิตสินค้าที่เป็นประโยชน์ต่อสุขภาพและปลอดภัยต่อสังคม					
6. บริษัทของท่านสามารถรักษาความภักดีของลูกค้าได้ด้วยสินค้าและบริการที่มีคุณภาพ					
7. บริษัทของท่านจ่ายค่าตอบแทนและสวัสดิการสำหรับพนักงานในระดับสูงเมื่อเทียบกับคู่แข่งในอุตสาหกรรมเดียวกัน					
8. บริษัทของท่านมีความสัมพันธ์ที่ดีกับซัพพลายเออร์และมีความไว้วางใจซึ่งกันและกัน					
สิ่งแวดล้อม					
9. บริษัทของท่านสามารถลดการปล่อยมลพิษและของเสียลงได้อย่างต่อเนื่อง					
10. บริษัทของท่านสามารถลดการใช้ทรัพยากรและวัสดุอันตรายลงได้อย่างต่อเนื่อง					
11. บริษัทของท่านสามารถลดการใช้พลังงานลงได้อย่างต่อเนื่อง					
12. บริษัทของท่านได้รับการรับรองมาตรฐานการดำเนินงานด้านสิ่งแวดล้อมในระดับโลก					

คำถาม	น้อยที่สุด ◄——► มากที่สุด				
	1	2	3	4	5
ภาวะผู้นำการเปลี่ยนแปลง					
ความสามารถและการสร้างแรงบันดาลใจ					
13. ผู้บริหารของบริษัทเป็นผู้นำการพัฒนาที่ยั่งยืนขององค์กรโดยส่งต่อค่านิยมของบริษัทให้กับพนักงาน					
14. ผู้บริหารของบริษัทถ่ายทอดวิสัยทัศน์ในการพัฒนาความยั่งยืนกับพนักงานและแสดงความมั่นใจว่าจะบรรลุเป้าหมาย					
15. ผู้บริหารของบริษัทเป็นแบบอย่างที่ดีของการพัฒนาความยั่งยืนของบริษัท					
16. ผู้บริหารของบริษัทให้การสนับสนุนและให้กำลังใจต่อพนักงานในการแก้ไขปัญหาที่เกิดขึ้นได้ในขณะปฏิบัติงาน					
การกระตุ้นทางปัญญา					
17. ผู้บริหารของบริษัทส่งเสริมให้พนักงานสร้างสรรค์สิ่งใหม่ๆ มีความคิดสร้างสรรค์ และแสวงหาแนวทางแก้ไขปัญหา					
18. ผู้บริหารของบริษัทแสวงหาข้อมูลที่หลากหลายเพื่อช่วยสนับสนุนการคิดหาวิธีการที่ดีที่สุดเพื่อความยั่งยืนของบริษัท					
19. ผู้บริหารของบริษัทเปิดโอกาสให้พนักงานตั้งเป้าหมายที่ท้าทายขึ้นด้วยตัวเอง					
20. ผู้บริหารของบริษัทสนับสนุนการระดมสมองเพื่อค้นหาวิธีดำเนินการเพื่อให้ไปถึงเป้าหมายและวิธีการแก้ปัญหาจากการดำเนินงานด้วยฉันทามติของทีมงาน					
การให้ความสำคัญในรายบุคคล					
21. ผู้บริหารของบริษัทใส่ใจความต้องการของพนักงานแต่ละคนอย่างทั่วถึง					
22. ผู้บริหารของบริษัทปฏิบัติต่อพนักงานเหมือนคนในครอบครัว					
23. ผู้บริหารของบริษัทใส่ใจในความสามารถของพนักงานแต่ละคนและมุ่งมั่นที่จะเพิ่มพูนความสามารถของพวกเขา					
24. ผู้บริหารของบริษัทสร้างแรงบันดาลใจให้พนักงานด้วยแผนความก้าวหน้าในอาชีพของพนักงานแต่ละคน					

วัฒนธรรมองค์กร					
ความสัมพันธ์ภายในองค์กร					
25. บริษัทของท่านมีบรรยากาศการอยู่ร่วมกันเสมือนเป็นครอบครัวเดียวกัน					
26. บริษัทของท่านมุ่งเน้นการทำงานเป็นทีมและความเป็นน้ำหนึ่งใจเดียวกัน					
27. บริษัทของท่านให้คุณค่ากับความจงรักภักดีและประเพณีสำคัญต่างๆ ของบริษัท					
ความสามารถในการปรับตัว					
28. บริษัทของท่านมุ่งมั่นที่จะสร้างสรรค์นวัตกรรมและการพัฒนาความยั่งยืน					
29. บริษัทของท่านเน้นการเติบโตผ่านการพัฒนาแนวคิดใหม่ๆ					
30. บริษัทของท่านมีแผนรองรับความเสี่ยงและเปิดกว้างการทดลองวิธีการทำงานใหม่ๆ					
ความมุ่งมั่นต่อภารกิจ					
31. บริษัทของท่านให้ความสำคัญกับการบรรลุเป้าหมายเป็นอย่างมาก					
32. บริษัทของท่านขับเคลื่อนด้วยความสำเร็จทางการเงิน					
33. บริษัทของท่านเน้นการแข่งขันเชิงรุกและผลลัพธ์ที่เป็นเลิศ					
ความสอดคล้องภายในองค์กร					
34. บริษัทของท่านมีโครงสร้างการบังคับบัญชาที่ชัดเจน					
35. บริษัทของท่านมีกฎระเบียบและนโยบายที่เป็นทางการและปฏิบัติตามอย่างเคร่งครัด					
36. บริษัทของท่านได้รับการรับรองมาตรฐานการดำเนินงานในระดับโลก					
ความรับผิดชอบต่อสังคม					
ด้านเศรษฐกิจ					
37. บริษัทของท่านดำเนินงานเพื่อผลประโยชน์ของผู้มีส่วนได้เสียทุกฝ่าย					
38. บริษัทของท่านผลิตสินค้าที่มีคุณภาพดีในราคาที่เหมาะสม					
39. บริษัทของท่านพัฒนาผลิตภัณฑ์อยู่เสมอ					

ด้านกฎระเบียบ					
40. บริษัทของท่านปฏิบัติตามกฎหมายและระเบียบข้อบังคับที่เกี่ยวข้องทั้งหมดอย่างเคร่งครัด					
41. บริษัทของท่านให้ความร่วมมือในการเสียภาษีอากรทุกประเภทและหลีกเลี่ยงการใช้ช่องโหว่ทางกฎหมายในการหลีกเลี่ยงภาษี					
42. บริษัทของท่านสร้างสภาพแวดล้อมการปฏิบัติงานได้ตามมาตรฐานความปลอดภัยสำหรับพนักงาน					
ด้านจริยธรรม					
43. บริษัทของท่านมีมาตรฐานทางจริยธรรมและซื่อสัตย์ต่อมาตรฐานดังกล่าวตลอดเวลา					
44. บริษัทของท่านคำนึงถึงสังคมและสิ่งแวดล้อมไม่น้อยไปกว่าการมุ่งแสวงหาผลกำไร					
45. บริษัทของท่านให้ข้อมูลที่ถูกต้องและครบถ้วนแก่ลูกค้า พันธมิตรทางธุรกิจ และสังคม					
ด้านการกุศล					
46. บริษัทของท่านส่งเสริมกิจกรรมจิตอาสาสมัครเพื่อสังคม					
47. บริษัทของท่านมอบเงินบริจาคเพื่อการกุศลอยู่เสมอ					
48. บริษัทของท่านให้การสนับสนุนและมีส่วนร่วมในกิจกรรมทางสังคมและสิ่งแวดล้อมอยู่เสมอ					

ตอนที่ 3 ข้อเสนอแนะอื่นๆ

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ขอบพระคุณอย่างสูงสำหรับข้อมูลของท่าน

หากมีข้อเสนอแนะอื่นๆ กรุณาติดต่อ 098-584-4122 or suradetw888@gmail.com

APPENDIX B

EXPERTS EXAMINE QUESTIONNAIRES FOR RESEARCH

ที่ อว ๗๐๒๕/๑ ๕๒๒๗

คณะบริหารธุรกิจ
สถาบันเทคโนโลยีพระจอมเกล้า
เจ้าคุณทหารลาดกระบัง
๑ ซอยฉลองกรุง ๑ เขตลาดกระบัง
กรุงเทพฯ ๑๐๕๒๐

๑ พฤศจิกายน ๒๕๖๔

เรื่อง ขอเชิญเป็นผู้ทรงคุณวุฒิตรวจแบบสอบถามเพื่อการวิจัย

เรียน รศ.ดร.รพีพรรณ พิริยะกุล

ด้วย นายสุรเดช หวังทอง นักศึกษาปริญญาเอก รหัสนักศึกษา ๖๒๐๑๑๐๗๕ ศึกษาอยู่ในหลักสูตรปรัชญาดุษฎีบัณฑิต สาขาวิชาบริหารธุรกิจอุตสาหกรรม (นานาชาติ) คณะบริหารธุรกิจ สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง ซึ่งอยู่ในระหว่างการทำดุษฎีนิพนธ์ เรื่อง "A STRUCTURAL EQUATION MODEL OF FACTORS INFLUENCING SUSTAINABILITY OF CHEMICAL INDUSTRY IN THAILAND" โดยต้องการรวบรวมข้อมูล เพื่อนำไปประกอบการทำดุษฎีนิพนธ์ โดยมี ผู้ช่วยศาสตราจารย์ ดร.ณัฐวุฒิ โรจน์นิรุตติกุล เป็นอาจารย์ที่ปรึกษาดุษฎีนิพนธ์ นั้น

คณะบริหารธุรกิจ สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง พิจารณาแล้วเห็นว่า ท่านเป็นผู้มีความรู้ความสามารถ ในเรื่องดังกล่าวเป็นอย่างดี จึงขอเรียนเชิญท่านเป็นผู้ทรงคุณวุฒิตรวจแบบสอบถาม ตามที่แนบมาพร้อมนี้ ว่ามีเนื้อหาถูกต้องและเหมาะสมมากน้อยเพียงใด ซึ่งผลการตรวจสอบของท่านจะช่วยให้งานวิจัยของ นายสุรเดช หวังทอง มีความสมบูรณ์ยิ่งขึ้น

ขอแสดงความนับถือ

(ผู้ช่วยศาสตราจารย์ ดร.สิงหะ ฉวีสุข)
รองคณบดีคณะบริหารธุรกิจ
๑๑ พ.ย. ๖๔ เวลา [illegible] Non-PKI Server Sign-LN
Signature Code : MjA4A-DMAOQ-BEAEE-ARQBF

หลักสูตรปรัชญาดุษฎีบัณฑิต (นานาชาติ)
โทรศัพท์ ๐ ๒๓๒๙ ๘๐๐๐ ต่อ ๖๐๐๑
โทรสาร ๐ ๒๓๒๙ ๘๔๖๑

ที่ อว ๗๐๖๕/ค ๕๒๖๘

คณะบริหารธุรกิจ
สถาบันเทคโนโลยีพระจอมเกล้า
เจ้าคุณทหารลาดกระบัง
๑ ซอยฉลองกรุง ๑ เขตลาดกระบัง
กรุงเทพฯ ๑๐๕๒๐

๓ พฤศจิกายน ๒๕๖๔

เรื่อง ขอเชิญเป็นผู้ทรงคุณวุฒิตรวจแบบสอบถามเพื่อการวิจัย

เรียน รศ.ภญ.ดร.อโณทัย งามวิชัยกิจ

ด้วย นายสุรเดช หวังทอง นักศึกษาปริญญาเอก รหัสนักศึกษา ๖๒๐๑๑๐๑๕ ศึกษาอยู่ในหลักสูตรปรัชญาดุษฎีบัณฑิต สาขาวิชาบริหารธุรกิจอุตสาหกรรม (นานาชาติ) คณะบริหารธุรกิจ สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง ซึ่งอยู่ในระหว่างการทำดุษฎีนิพนธ์ เรื่อง "A STRUCTURAL EQUATION MODEL OF FACTORS INFLUENCING SUSTAINABILITY OF CHEMICAL INDUSTRY IN THAILAND" โดยต้องการรวบรวมข้อมูล เพื่อนำไปประกอบการทำดุษฎีนิพนธ์ โดยมี ผู้ช่วยศาสตราจารย์ ดร.ณัฐวุฒิ โรจน์นิรุตติกุล เป็นอาจารย์ที่ปรึกษาดุษฎีนิพนธ์ นั้น

คณะบริหารธุรกิจ สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง พิจารณาแล้วเห็นว่าท่านเป็นผู้มีความรู้ความสามารถ ในเรื่องดังกล่าวเป็นอย่างดี จึงขอเรียนเชิญท่านเป็นผู้ทรงคุณวุฒิตรวจแบบสอบถาม ตามที่แนบมาพร้อมนี้ ว่ามีเนื้อหาถูกต้องและเหมาะสมมากน้อยเพียงใด ซึ่งผลการตรวจสอบของท่านจะช่วยให้งานวิจัยของ นายสุรเดช หวังทอง มีความสมบูรณ์ยิ่งขึ้น

ขอแสดงความนับถือ

(ผู้ช่วยศาสตราจารย์ ดร.สิงหะ ฉวีสุข)
รองคณบดีคณะบริหารธุรกิจ
๐๑ พ.ย. ๖๔ [illegible] Non-PKI Server Sign-LN
Signature Code : RjA2A-5MARA-A3AOc-AMwA2

หลักสูตรปริญญาดุษฎีบัณฑิต (นานาชาติ)
โทรศัพท์ ๐ ๒๓๒๙ ๘๐๐๐ ต่อ ๖๐๐๑
โทรสาร ๐ ๒๓๒๙ ๘๔๖๑

ที่ อว ๗๐๖๕/๔ ๕๒๒๙

คณะบริหารธุรกิจ
สถาบันเทคโนโลยีพระจอมเกล้า
เจ้าคุณทหารลาดกระบัง
๑ ซอยฉลองกรุง ๑ เขตลาดกระบัง
กรุงเทพฯ ๑๐๕๒๐

๑ พฤศจิกายน ๒๕๖๔

เรื่อง ขอเชิญเป็นผู้ทรงคุณวุฒิตรวจแบบสอบถามเพื่อการวิจัย

เรียน รศ.ดร.ชลธิศ ดาราวงษ์

ด้วย นายสุรเดช หวังทอง นักศึกษาปริญญาเอก รหัสนักศึกษา ๖๒๐๑๑๐๑๕ ศึกษาอยู่ในหลักสูตรปรัชญาดุษฎีบัณฑิต สาขาวิชาการบริหารธุรกิจอุตสาหกรรม (นานาชาติ) คณะบริหารธุรกิจ สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง ซึ่งอยู่ในระหว่างการทำดุษฎีนิพนธ์ เรื่อง "A STRUCTURAL EQUATION MODEL OF FACTORS INFLUENCING SUSTAINABILITY OF CHEMICAL INDUSTRY IN THAILAND" โดยต้องการรวบรวมข้อมูล เพื่อนำไปประกอบการทำดุษฎีนิพนธ์ โดยมี ผู้ช่วยศาสตราจารย์ ดร.ณัฐวุฒิ โรจน์นิรุตติกุล เป็นอาจารย์ที่ปรึกษาดุษฎีนิพนธ์ นั้น

คณะบริหารธุรกิจ สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง พิจารณาแล้วเห็นว่าท่านเป็นผู้มีความรู้ความสามารถ ในเรื่องดังกล่าวเป็นอย่างดี จึงขอเรียนเชิญท่านเป็นผู้ทรงคุณวุฒิตรวจแบบสอบถาม ตามที่แนบมาพร้อมนี้ ว่ามีเนื้อหาถูกต้องและเหมาะสมมากน้อยเพียงใด ซึ่งผลการตรวจสอบของท่านจะช่วยให้งานวิจัยของ นายสุรเดช หวังทอง มีความสมบูรณ์ยิ่งขึ้น

ขอแสดงความนับถือ

(ผู้ช่วยศาสตราจารย์ ดร.สิงหะ ฉวีสุข)
รองคณบดีคณะบริหารธุรกิจ
Non-PKI Server Sign-LM
Signature Code : NAA4A-OAAOA-AtADM-ARQAw

หลักสูตรปรัชญาดุษฎีบัณฑิต (นานาชาติ)
โทรศัพท์ ๐ ๒๓๒๙ ๘๐๐๐ ต่อ ๖๐๐๑
โทรสาร ๐ ๒๓๒๙ ๘๔๖๑

ที่ อว ๗๐๖๕/ค ๕๒๓๓

คณะบริหารธุรกิจ
สถาบันเทคโนโลยีพระจอมเกล้า
เจ้าคุณทหารลาดกระบัง
๑ ซอยฉลองกรุง ๑ เขตลาดกระบัง
กรุงเทพฯ ๑๐๕๒๐

๓ พฤศจิกายน ๒๕๖๔

เรื่อง ขอเชิญเป็นผู้ทรงคุณวุฒิตรวจแบบสอบถามเพื่อการวิจัย

เรียน ผศ.ดร.ชาคริต ศรีทอง

ด้วย นายสุรเดช หวังทอง นักศึกษาปริญญาเอก รหัสนักศึกษา ๖๒๐๑๑๐๖๕ ศึกษาอยู่ในหลักสูตรปริญญาดุษฎีบัณฑิต สาขาวิชาบริหารธุรกิจอุตสาหกรรม (นานาชาติ) คณะบริหารธุรกิจ สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง ซึ่งอยู่ในระหว่างการทำดุษฎีนิพนธ์ เรื่อง "A STRUCTURAL EQUATION MODEL OF FACTORS INFLUENCING SUSTAINABILITY OF CHEMICAL INDUSTRY IN THAILAND" โดยต้องการรวบรวมข้อมูล เพื่อนำไปประกอบการทำดุษฎีนิพนธ์ โดยมี ผู้ช่วยศาสตราจารย์ ดร.ณัฐวุฒิ โรจน์นิรุตติกุล เป็นอาจารย์ที่ปรึกษาดุษฎีนิพนธ์ นั้น

คณะบริหารธุรกิจ สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง พิจารณาแล้วเห็นว่าท่านเป็นผู้มีความรู้ความสามารถ ในเรื่องดังกล่าวเป็นอย่างดี จึงขอเรียนเชิญท่านเป็นผู้ทรงคุณวุฒิตรวจแบบสอบถาม ตามที่แนบมาพร้อมนี้ ว่ามีเนื้อหาถูกต้องและเหมาะสมมากน้อยเพียงใด ซึ่งผลการตรวจสอบของท่านจะช่วยให้งานวิจัยของ นายสุรเดช หวังทอง มีความสมบูรณ์ยิ่งขึ้น

ขอแสดงความนับถือ

(ผู้ช่วยศาสตราจารย์ ดร.สิงหะ ฉวีสุข)
รองคณบดีคณะบริหารธุรกิจ
๑๑ พ.ย. ๖๔ เวลา ๑๕:๕๑:๓๘ Non-PKI Server Sign-IN
Signature Code : RQAwA-DAAOQ-A2AD6-ANgAy

หลักสูตรปริญญาดุษฎีบัณฑิต (นานาชาติ)
โทรศัพท์ ๐ ๒๓๒๙ ๘๐๐๐ ต่อ ๖๐๐๑
โทรสาร ๐ ๒๓๒๙ ๘๕๖๑

ที่ อว ๗๐๒๕/๐ ๕๒๓๒

คณะบริหารธุรกิจ
สถาบันเทคโนโลยีพระจอมเกล้า
เจ้าคุณทหารลาดกระบัง
๑ ซอยฉลองกรุง ๑ เขตลาดกระบัง
กรุงเทพฯ ๑๐๕๒๐

๓ พฤศจิกายน ๒๕๖๔

เรื่อง ขอเชิญเป็นผู้ทรงคุณวุฒิตรวจแบบสอบถามเพื่อการวิจัย

เรียน ดร.วิกร ภูวพัชร์

ด้วย นายสุเมธ หวังทอง นักศึกษาปริญญาเอก รหัสนักศึกษา ๖๒๐๑๑๐๗๕ ศึกษาอยู่ในหลักสูตรปรัชญาดุษฎีบัณฑิต สาขาวิชาบริหารธุรกิจอุตสาหกรรม (นานาชาติ) คณะบริหารธุรกิจ สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง ซึ่งอยู่ในระหว่างการทำดุษฎีนิพนธ์ เรื่อง "A STRUCTURAL EQUATION MODEL OF FACTORS INFLUENCING SUSTAINABILITY OF CHEMICAL INDUSTRY IN THAILAND" โดยต้องการรวบรวมข้อมูล เพื่อนำไปประกอบการทำดุษฎีนิพนธ์ โดยมี ผู้ช่วยศาสตราจารย์ ดร.ณัฐวุฒิ โรจน์นิรุตติกุล เป็นอาจารย์ที่ปรึกษาดุษฎีนิพนธ์ นั้น

คณะบริหารธุรกิจ สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง พิจารณาแล้วเห็นว่าท่านเป็นผู้มีความรู้ความสามารถ ในเรื่องดังกล่าวเป็นอย่างดี จึงขอเรียนเชิญท่านเป็นผู้ทรงคุณวุฒิตรวจแบบสอบถาม ตามที่แนบมาพร้อมนี้ ว่ามีเนื้อหาถูกต้องและเหมาะสมมากน้อยเพียงใด ซึ่งผลการตรวจสอบของท่านจะช่วยให้งานวิจัยของ นายสุเมธ หวังทอง มีความสมบูรณ์ยิ่งขึ้น

ขอแสดงความนับถือ

(ผู้ช่วยศาสตราจารย์ ดร.สิงหะ ฉวีสุข)
รองคณบดีคณะบริหารธุรกิจ
๑๑ พ.ย. ๖๔ เวลา ๑๕:๕๔:๕๔ Non-PKI Server Sign-LM
Signature Code : NwBBA-OMAQg-BGADQ-AQQAw

หลักสูตรปรัชญาดุษฎีบัณฑิต (นานาชาติ)
โทรศัพท์ ๐ ๒๓๒๙ ๘๐๐๐ ต่อ ๖๐๐๑
โทรสาร ๐ ๒๓๒๙ ๘๔๖๑

APPENDIX C

AN ANNOUNCEMENT OF THESIS

ประกาศคณะบริหารธุรกิจ

เรื่อง ผลการพิจารณาหัวข้อและเค้าโครงดุษฎีนิพนธ์

คณะบริหารธุรกิจ สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง โดยความเห็นชอบของคณะกรรมการพิจารณาหัวข้อและเค้าโครงดุษฎีนิพนธ์ ขอประกาศรายชื่อหัวข้อ และเค้าโครงดุษฎีนิพนธ์ หลักสูตรปรัชญาดุษฎีบัณฑิต สาขาวิชาบริหารธุรกิจอุตสาหกรรม (นานาชาติ) ซึ่งได้รับอนุมัติเมื่อวันที่ ๗ กันยายน พ.ศ. ๒๕๖๔ ให้ดำเนินการดังนี้

นายสุรเดช หวังทอง รหัสประจำตัว ๖๒๖๑๑๐๙๕ ให้ทำดุษฎีนิพนธ์ เรื่อง "A STRUCTURAL EQUATION MODEL OF FACTORS INFLUENCING SUSTAINABILITY OF CHEMICAL INDUSTRY IN THAILAND"

โดยมี ผู้ช่วยศาสตราจารย์ ดร.ณัฐวุฒิ โรจน์นิรุตติกุล เป็นอาจารย์ที่ปรึกษาดุษฎีนิพนธ์

ทั้งนี้ ให้นักศึกษาค้นคว้า และเรียบเรียงดุษฎีนิพนธ์ โดยปรึกษากับอาจารย์ที่ปรึกษาดุษฎีนิพนธ์ให้แล้วเสร็จภายในเวลาที่กำหนด ในระเบียบสถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง

ประกาศ ณ วันที่ ๑ พฤศจิกายน พ.ศ. ๒๕๖๔

(ผู้ช่วยศาสตราจารย์ ดร.สุดาพร สาวม่วง)

คณบดีคณะบริหารธุรกิจ

๐๑ พ.ย. ๖๔ เวลา ๑๒:๐๔:๒๒ Non-PKI Server Sign-LN

Signature Code : QQASA-DUARA-AyADU-AQgA0

APPENDIX D

CERTIFICATE OF RESEARCH ETHICS TRAINING

Certificate of Completion

National Research Council of Thailand (NRCT) and Forum for Ethical Review Committee in Thailand (FERCIT)

Certify that

Suradetch Wangthong

Has completed the ON-LINE RESEARCH ETHICS TRAINING

Course หลักสูตรหลักจริยธรรมการวิจัยในมนุษย์ สำหรับนักศึกษา/นักวิจัย

Date approved
(14/05/2563)

Date expired
(14/05/2566)

S. Songsivilai

(Professor Dr.Sirirurg Songsivilai)
Secretary-General
National Research Council of Thailand

APPENDIX E

CERTIFICATE OF RESEARCH ETHICS

No. 043
EC-KMITL_65_043

The Research Ethics Committee of
King Mongkut's Institute of Technology Ladkrabang
1, Chalongkrung Rd., Lat Krabang, Lat Krabang, Bangkok Thailand 10520
Tel. +66 2329 8000

Certificate of Exemption

The Research Ethics Committee of King Mongkut's Institute of Technology Ladkrabang has exempted the following study which is to be carried out in compliance with the International guidelines for human research protection as Declaration of Helsinki, The Belmont Report, CIOMS Guideline, International Conference on Harmonization in Good Clinical Practice (ICH-GCP) and 45CFR 46.101(b)

Study title : A Structural Equation Model of Factors Influencing Sustainability of Chemical Industry in Thailand
Study code : EC-KMITL_65_043
Principal investigator : Mr. Suradetch Wangthong
Co-Investigator : Asst. Prof. Dr. Nuttawut Rojmuttikul
Study center : KMITL Business School
Document reviewed :

1. Submission form version 1, date 15 February, 2022
2. Full protocol/proposal version 1, date 15 February, 202
3. Participant information sheet 1, date 15 February, 2022
4. Informed consent form version 1, date 15 February, 2022
5. Data record form version 1, date
6. Curriculum Vita

Signature Pastraporn Thipayasothorn
(Assoc. Prof. Dr. Pastraporn Thipayasothorn)
Chair of the Human Ethics Committee
King Mongkut's Institute of Technology Ladkrabang, 2021

Date of Exemption : 3 March, 2022
Note No continuing review required

AUTHOR BIOGRAPHY

Name Mr. Suradetch Wangthong

Date of Birth 8 August 1980

Address 55/6 Ramkhamhaeng Road, Suanluang, Suanluang, Bangkok, Thailand

Education

- B.Eng., Chemical Engineering,
  Srinakharinwirot University, 2003
- M.B.A., Industrial Business Administration,
  King Mongkut's Institute of Technology Ladkrabang, 2014

Work Experience

- Research and Development Officer,
  Flow Line Manufacturing Company Limited, 2003-2004
- Production Engineering Supervisor at Operation Department,
  Thai Glass Industry Public Company Limited, 2004–2014
- Assistant Professor at the School of Management Science,
  Sukhothai Thammathirat Open University, 2015-Present