



# NIDA Development Journal

## วารสารพัฒนบริหารศาสตร์

Volume 60 Number 1-2 (January-December 2020)

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# **NIDA Development Journal**

## **វារសារព័ត៌មានបច្ចុប្បន្នសាស្ត្រ**

### **Aims and Scope**

The NIDA Development Journal (NDJ) publishes manuscripts that describe or synthesize research of direct relevance to development administration. Its main objective is to publish high quality, peer-reviewed papers using at least two referees that have not previously been published and that reflect the latest research in the area of policy, administration and development. The editors welcome a wide range of academic papers, including research articles, review articles, and book reviews.

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## Message from the Editor

Dear Readers,

Welcome to Volume 60, Number 1-2 (January-June 2020) of the NIDA Development Journal (NDJ). In this edition, we are thrilled to present a collection of insightful research articles covering a broad spectrum of subjects, reflecting the multidisciplinary nature of our academic exploration.

The journey begins with “Job Security on Freelancer’s Perception of Online Delivery, Chiang Mai, Thailand” by Taien Layraman and Nawakarn Sirarujanon. This research sheds light on the transformations in job positions for freelancers in the online delivery industry in Chiang Mai, exploring their perceptions of job security and quality of work life.

Next, “**Factors Related to Remote Working Affecting Knowledge Sharing: Case Study of An Industrial Printing Ink Distributor in Samut Sakhon Province**” by Paksiri Taensaengthong and Sutep Tongngam delves into the dynamics of remote work, investigating factors influencing knowledge sharing among employees, including job satisfaction, trust in colleagues, interpersonal bond, and perceived organization support.

We then turn our attention to “**Role of Public Participation in an Environmental Impact Assessment System in Thailand: A Case of Rayong Industrial Estate (Ban Khai)**” by Chutarat Chompunth. This article critically examines the public participation process in environmental impact assessment, focusing on the Rayong Industrial Estate Project, and underscores the importance of transparency and stakeholder engagement for successful environmental governance.

“**Factors Influencing The Intention to Purchase Smart Home Devices in Generation Y**” by Morgot Camta and Sutep Tongngam explores the quantitative aspects of consumer behavior, identifying the key factors influencing the intention to purchase smart home devices among Generation Y.

As we continue our exploration, we encounter “**Developing Institutional Structural Frameworks for Promoting Eco-Industrial Towns under The Context of Thailand**” by Siwatt Pongpiachan and a team of researchers. This article proposes institutional frameworks to foster eco-industrial towns, aligning industrial activities with environmental sustainability and social well-being.

The crypto world takes center stage in “**Factors that Affect Bitcoin Investment and Trading in Thailand**” by Panjapong Loysawai and Sutep Tongngam. This research investigates the factors influencing Bitcoin investment, highlighting the significance of perceived risk, trust, and social influence in shaping investor behavior.

The impact of environmental factors continues with “**The Impact of Resource Threat on Chinese Overseas Students’ Online Learning Behavioral Intentions in Thailand: The Moderating Role of Attitude**” by Bin Chen and Xuemei Sun. Drawing on Conservation of Resources Theory, this study explores how resource threats, such as social isolation and fear of the virus, influence Chinese overseas students’ willingness to adopt online learning.

Finally, we explore “**Analysis of Key Features Affecting The Effectiveness of English Language Learning among Undergraduate Students Utilizing Data Mining Techniques**” by Chidchanok Kaewpanitch and Sutep Tongngam. This paper utilizes data mining techniques to identify key features influencing the effectiveness of English language learning among undergraduate students.

We believe that the wealth of knowledge presented in this volume will not only capture your interest but also contribute to ongoing discussions and explorations within the academic community. Thank you for being part of the NDJ scholarly journey.

Warm regards,

**Patthareeya Lakpetch**

Editor

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# Job Security on Freelancer's Perception of Online Delivery, Chiang Mai, Thailand

Taien Layraman\* and Nawakarn Sirarujanon\*\*

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## Abstract

Online delivery transforms job positions for Freelancers, particularly in Chiang Mai, Thailand. Therefore, this research examines Freelancers' perception of their job security and quality of work life in an online delivery industry in Chiang Mai, Thailand. The data are collected from 400 Freelancers in Chiang Mai, Thailand. Multiple regression is used to identify job security determining Freelancers. The results show high-level job security of employees in the online delivery industry; most respondents are confident they can maintain their quality of work life and steady income growth with their current career path. The result indicates that online delivery in Chiang Mai, Thailand, can adjust their employment structure from marketing retail disruption, and they feel secure with their current jobs.

**Keywords:** Job Security, Freelancer, Online Delivery, Quality of Work Life

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## ความมั่นคงในการทำงานที่เกี่ยวข้องกับการรับรู้ ของพนักงานจัดส่งสินค้าออนไลน์อาชีพอิสระ ในจังหวัดเชียงใหม่ ประเทศไทย

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### บทคัดย่อ

การส่งสินค้าออนไลน์ในปัจจุบันส่งผลต่อการปรับเปลี่ยนลักษณะการจ้างงานของพนักงานอิสระ โดยเฉพาะอย่างยิ่งในจังหวัดเชียงใหม่ ประเทศไทย ผลงานวิจัยครั้งนี้จึงมีวัตถุประสงค์เพื่อศึกษาการรับรู้ของพนักงานอิสระในมิติของความมั่นคงในการทำงานและคุณภาพชีวิตในการทำงาน ในธุรกิจการบริการจัดส่งสินค้าออนไลน์ การวิจัยครั้งนี้รวมข้อมูลจากพนักงานอิสระจำนวนรวม 400 คน ในจังหวัดเชียงใหม่ วิเคราะห์ข้อมูลด้วยสถิติการพยากรณ์แบบถดถอย เพื่อประเมินระดับความมั่นคงในการทำงานของพนักงานอิสระ ผลการวิจัยแสดงให้เห็นว่าพนักงานอิสระมีการรับรู้ระดับความมั่นคงในงานในระดับสูง กลุ่มตัวอย่างส่วนใหญ่มุ่งเน้นไปที่ลักษณะงานนี้สามารถรักษาคุณภาพชีวิตในการทำงาน สามารถสร้างรายได้ที่มั่นคงตามสายงานในปัจจุบัน ผลจากการวิจัยเสนอแนะว่าธุรกิจบริการจัดส่งสินค้าออนไลน์ให้มั่นใจได้ถึงสถานะการปรับเปลี่ยนโครงสร้างการจ้างงานในธุรกิจค้าปลีกและพิสูจน์ได้ว่าพนักงานอิสระรับรู้ได้ว่าสายงานนี้ยังมีความมั่นคงในการทำงานอยู่ในปัจจุบัน

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## Introduction

New marketing strategies and communication technologies have transformed the online delivery industry over the past few years (Abasolo, 2021). The adopted online marketing, such as an online shop, e-payment, and online delivery, allows customers transactions their behavior to perceive delivery services from online shopping (Pragarauskaitė & Dzemyda, 2012). When customers purchase online, they expect some delivery will send goods directly to their homes or places. However, businesses want more Freelancers who prefer to work without a fixed salary. Now, the public and private sectors in Thailand recognize the importance of developing workforce skills to prepare for modern technologies in the digital economy. Moreover, there are self-employed skills development challenges: freelance work groups with growth prospects spanning the world, not just in the EU and the US; In Thailand, freelancers with intermediate and high-level skills and digital skills are still in short supply, unlike in other countries where freelancers are distributed in a variety of occupations and have higher incomes than Thailand (Payoneer, 2020). The main aspect to come up with is wages, working conditions, employment contracts, and fair management (Funda et al., 2020). This situation has caused significant distress to many Freelancers and forces them to realize their job security and quality of work life. Andrew & Marc (2020) pointed out freelancers as alternatives for workers who participate in labor and value-added over. Already contemporary perspectives describe our workers as non-competing matching differentiated workers who make jobs to become suppler and more entrepreneurial.

Under changes that can affect the organization, human beings are aware of the changes; then they adapt to be survived and grow steadily. These must depend on a good quality of life and lifestyle guarantees; the most important thing to be met is job security. Katsimi (2008) explains that a sense of security at work is what causes a higher working power and morale, encourages diligence, contributes to effective work, and also contributes to a positive attitude towards the performance of work is pride and belief in one's profession, Markel et al. (2018) who have explained that the importance of job security is something that everyone wants and is important to perform, that job security is also a motivator to be diligent, work happily and as an incentive to raise morale, contribute to loyalty. Unity creates a good understanding among personnel within the organization towards the organization's policies and objectives to empower them to work together,

for example, to help to eliminate problems and obstacles in the organization, to create confidence and faith in the organization, to achieve the results of the work, to achieve the aims, to benefit the performance of the work, to achieve effective performance, and also to increase the potential of the organization (Barley, 2015). An organization needs job security to prevent personnel from becoming insecure, unsure of their status, making them unhappy or independent, lacking morale at work, and constantly paranoid (Hora, 2019). The results of the operation will also be bad.

Freelance workers have highlighted structural inequalities within the industry and the significant challenges for individual workers in the early stages of their careers. However, workers' perceptions of the value of their practice counteract some of the industry's risks, uncertainty, and low economic rewards (Kirchner & Mittelhamm, 2010; Muhsin, 2021). For those that pursue creative careers, their work is highly intertwined with self-identity and personal motivations (Gentry et al., 2015; Guillén, M., 2017; Chong et al., 2019). Others have noted that self-employment can lead to greater job and life satisfaction (Adams, E., 2013; Conen & Schippers, 2019). High levels of well-being have been reported for performing artists, and for many, their practice is emotionally significant, viewed as life rather than just a source of income (Kadnichanskaya & Galkina, 2019) as new forms of employment have the greatest potential for distribution in those areas where a unique product produced by highly qualified specialists will be in demand, especially deliverers, entrepreneurs, self-employed, and freelancers (Lei & Lin, 2019).

Therefore, this research aims to explore Freelancers' perceptions of their job security and quality of work life by examining factors affecting job security for Freelancers in Chiang Mai, Thailand.

## Objectives

- 1) To explore the Freelancers' perception of job security and quality of work life for Freelancers in Chiang Mai, Thailand.
- 2) To examine the quality work-life factors affecting job security for Freelancers in Chiang Mai, Thailand.

## Literature Review

The theories of quality of life have been widely researched both in Thailand and other countries because academics recognize the importance that quality of life affects work and the key principles of labor management. When personnel is in good physical and mental condition, they have stable feeling and social well-being. Academics agree that it enables people to work efficiently (Yonk et al., 2017).

The quality of work life, formulated by the ideas of foreign guru Richard E. Walton (Walton, Cutcher-Gershenfeld, & McKersie, 2000), considers eight key elements for determining the quality of life at work as a whole such element are:

- (1) Fair and adequate compensation
- (2) Safety and health in working conditions
- (3) Opportunities to use knowledge and abilities to develop oneself.
- (4) Career opportunities
- (5) Constitutionalism in the organization of work
- (6) The Social Relevance of work life
- (7) Work and living space
- (8) Social integration in the organization

The directly related and socially relevant work styles are important principles that will help explain whether groups of people in different areas, both in the organization and society, have a sufficiently high quality of work life (Anindita et al., 2018).

For this research, the panel also needed to study the components of quality of life appropriate for the group of salaried operating-level employees daily, which must be considered in terms of contributing to the living conditions of employees in the freelance delivery. It relies on the factors and elements necessary for such groups of employees and considers the elements of quality of life as principles in the practice and management of labor.

According to the theory, when organizations hire Freelancers, employees should respond favorably by engaging in positive behaviors (Kirchner & Wilhelm, 2017). Thus, the researcher assumed that job security is considered how freelance protected employment as part of their indirect contract with the employer and expected that

the organization would offer them benefits in terms of job security when they work for the organizations (Shipton et al., 2006). In contrast, Freelancers faced with the threat of job loss may perceive an imbalance in their quality of work life, weakening their motivation. The imbalances resulting from low job security damage, and employees may restore the balance of their lives. However, Freelancers with high job security may view it as beneficial (Nicholas, 2014). They are likelier to find trust and mutual care relationships by becoming freelance rather than working within organizations. Numerous empirical research also demonstrates job security positively (Katsimi, 2008; Wright, 2009; Walker & Foushee, 2014). The research perspective is usually associated 3 factors that explain the level of job security such as;

- (1) Employment Status
- (2) Psychological Contract Breach
- (3) Organizational Identification

Therefore, this research concept examines the quality of work-life affecting job security. Moreover, this research will also affect job security and could confirm human employment by reducing employee fears about job loss.

## Research Methodology

### 1) The participants

The population in this research is Freelancers working in Chiang Mai. Unknown population, the data were collected from 400 employees. The sample size formula can be used in the following (Hair et al., 2021):

$$n = [Z^2 * p * (1-p)] / e^2$$

Where:

- n is the required sample size
- Z is the Z-score or standard deviation corresponding to the desired confidence level for a 95% confidence level; Z is 1.96.
- p is the estimated proportion or percentage of the population, with the characteristic being measured at approximately 70%.
- e is the desired level of precision or margin of error, expressed as a decimal 0.05

Then:

$$n = [(1.96)^2 * 0.7 * (1-0.7)] / (0.05)^2$$

$$n = 384.16$$

This research would need a sample size of approximately 384 freelance workers to estimate the proportion of them with 95% confidence and a margin of error of 5%. Since sample sizes are typically rounded up to the nearest whole number, a sample size of 400 would be appropriate. Moreover, the researcher found that the majority of the respondent was male (85.5%); the largest age group was 31 to 40 years old (43.0%), followed by samples over 51 years old (28.5%). Most have more than 5 years of experience in freelance jobs (43.0%), followed by 3-5 years of experience (35.8%), and the respondent who has less than 2 years (21.2%) also consent to us using data for research and academic dimension.

## 2) Scope of content

The researcher applied the concept of two factors: (1) The factors of quality of work life applied from the thought of Richard E. Walton (1975) and (2) The factors of job security developed by Wenzhou Lu, Xiaolang Liu, Shanshi Liu, and Chuanyan Qin (2021), including employment status, psychological contract breach, and organizational identification.

## 3) Instruments

This paper's main objectives are to explore the Freelancers' perception of job security and quality of work life and examine the quality of work-life factors affecting job security for Freelancers in Chiang Mai, Thailand. The researcher used self-administered questionnaires to collect the data from Freelancers who work in Chiang Mai, Thailand, which were divided into 3 parts as:

Part 1: Demographic Information, a multi-choice question focusing on the respondent's personal information, including gender, age, and work experience.

Part 2: Perspective on the job security of Freelancers, which covers the factors of job security measured with a five-item Likert scale.

Part 3: The Quality of work life, which has 5 levels of rating scale covering the Quality of Life at Work, for a total of 24 questions.

#### 4) Data Analysis

The analysis techniques were divided into 2 parts, followed by the research objectives, such as

Part 1: To explore the Freelancers' perception of job security and quality of work life for Freelancers using ANOVA-testing.

Part 2: To examine the quality work-life factors affecting job security for Freelancers using multiple regression.

#### 5) Construction Validity

The reliability analysis for this research was performed with a Cronbach alpha coefficient of  $\alpha = 0.928$  and was determined to represent acceptable internal consistency ((Hair et al., 2021). For this research, the 37 items per questionnaire were considered due to all items showing Cronbach alpha values higher than 0.7.

### Results

#### 1) Demographic Information

The researcher found that most respondents were male, 85.5%, and female, 14.5%. The largest age group was 31 to 40 years old, with 43.0%, followed by a sample over 51 years old, with 28.5%; 41 to 50-year-olds was 21.5%; and under 30 years old was 7.0%. Most have more than 5 years of experience in freelance jobs, followed by 3-5 years of experience 35.8%, and the respondent who has less than 2 years 21.2%, as shown in Table 1 below.

**Table 1:** Demographic of the 400 Sample

	Frequency	Percentage
Gender		
Male	342	85.5
Female	58	14.5
<b>Total</b>	<b>400</b>	<b>100.0</b>
Age		
Under 30	28	7.0
31-40	172	43.0
41-50	86	21.5
Over 51	114	28.5
<b>Total</b>	<b>400</b>	<b>100.0</b>
Experience		
Less than 2 years	85	21.2
3-5 years	143	35.8
More than 5 years	172	43.0
<b>Total</b>	<b>400</b>	<b>100.0</b>

## 2) Freelancers' Perception of Freelance Job

Table 2 presents the perspective means and standard deviations in 3 dimensions of job security. All factors were satisfactory, as the mean was between 3.582 to 3.750

**Table 2:** Perspective in Freelance Job Security

Job Security	Mean	SD
Employment Status	3.750	0.680
Psychological Contract Breach	3.582	0.660
Organizational Identification	3.680	0.950
<b>Total</b>	<b>3.670</b>	<b>0.690</b>

When comparing the demographic of participants and their perspective on freelance job security, the data showed no difference among participants who were different in gender, age, and experience as significant at 0.05. as shown in Table 3 below.

**Table 3:** Comparing between Demographic of Participants and Job Security

	Mean	SD	Sig.
Gender			.778
Male	3.666	.7269	
Female	3.695	.6527	
<b>Total</b>	<b>3.670</b>	<b>.7160</b>	
Age			.042
Under 30	3.619	.9588	
31-40	3.688	.7019	
41-50	3.651	.7651	
Over 51	3.672	.6349	
<b>Total</b>	<b>3.670</b>	<b>.7160</b>	
Experience			.731
Less than 2 years	3.619	.8500	
3-5 years	3.697	.6964	
More than 5 years	3.674	.6607	
<b>Total</b>	<b>3.670</b>	<b>.7160</b>	

### 3) The Quality of Work Life for Freelancers

The respondents perceived their quality of work life was high while were least likely to agree as a mean between 3.549 to 3.816 and a standard deviation between 0.555 to 0.846, as shown in Table 4 below.

**Table 4:** The Quality of Work Life for Freelancers in Chiang Mai, Thailand

Quality of Work Life	Mean	SD
Fair and adequate compensation	3.670	.716
Safety and health in working conditions	3.811	.846
Opportunities to use knowledge and abilities to develop oneself.	3.816	.711
Career opportunities	3.662	.656
Constitutionalism in the organization of work	3.750	.709
The Social Relevance of work life	3.710	.723
Work and living space	3.549	.681
Social integration in the organization	3.666	.720
<b>Total</b>	<b>3.704</b>	<b>.555</b>

#### 4) Hypothesis Testing

The research's objectives were determined by the relationship between work quality of life factors, comprising 8 factors, and job security, using statistics analyzing multiple regression analysis. To test the hypothesis, the researchers examined the data appropriate to the analysis by examining the multicollinearity from Variance Inflation Factors (VIF) and Tolerance; shown that the Tolerance was over 0.2 and VIF was not over 4.000 meaning these factors were no collinearity and can further test multiple regression analysis as shown in Table 5.

**Table 5:** Collinearity Statistics

	Collinearity Statistics	
	Tolerance	VIF
X <sub>1</sub> Fair and adequate compensation	.547	1.828
X <sub>2</sub> Safety and health in working conditions	.403	2.481
X <sub>3</sub> Opportunities to use knowledge and abilities to develop oneself.	.380	2.635
X <sub>4</sub> Career opportunities	.341	2.930
X <sub>5</sub> Constitutionalism in the organization of work	.503	1.990
X <sub>6</sub> Social relevance of work life	.411	2.433
X <sub>7</sub> Work and living space	.564	1.773
X <sub>8</sub> Social integration in the organization	.410	2.439

As these factors were not collinearity, the researcher tested multiple regression to test job security and the quality of working life of independent employees using complex regression equation analysis shown the standardized coefficients as follows:

By requiring that

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8$$

Y = Job security

X<sub>1</sub> = Fair and adequate compensation

X<sub>2</sub> = Safety and health in working conditions

X<sub>3</sub> = Opportunities to use knowledge and abilities to develop oneself.

X<sub>4</sub> = Career opportunities

X<sub>5</sub> = Constitutionalism in the organization of work

X<sub>6</sub> = Individual right

X<sub>7</sub> = Work and living space

X<sub>8</sub> = Social relevance

$\alpha$  = Constant

$\beta$  = Standardized Coefficients Beta

**Table 6:** Multiple Regression Analysis between Job Security and Quality of Work Life Factors

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.592	.319		4.985	.000
X1	-.001	.086	-.001	-.009	.993
X2	.006	.084	.006	.076	.940
X3	.003	.104	.003	.033	.974
X4	-.011	.118	-.008	-.092	.927
X5	.002	.090	.002	.024	.981
X6	.005	.098	.004	.052	.959
X7	.003	.089	.002	.035	.972
X8	.006	.098	.005	.064	.949

Then, the formulation of quality of work-life factors which affect job security for Freelancers in Chiang Mai, Thailand is;

$$Y = -.001X_1 + .006X_2 + .003X_3 - .008X_4 + .002X_5 + .004X_6 + .00X_7 + .005X_8$$

Freelancers feel positive and secure in their job when they have safe and healthy working conditions (X2), opportunities to use knowledge and abilities to develop themselves (X3), constitutionalism in the organization of work (X5), individual rights (X6), work and living space (X7), and social relevance (X8) with minus factor as fair and adequate compensation (X1) and career opportunities (X4).

## Discussion and Concluding

The research result demonstrated that gender and age are not biased against freelance workers in Thailand. They prefer to disrupt themselves into a new s-curve and confirm that freelance makes them secure in job perception. The research result explored 2 dimensions, indicating that.

1. Freelancers believe that their works are secure because they have their own choices to work. If they work hard, they will be received fair and adequate compensation. They make for their benefit and do not depend on anyone or organizations. They confirmed that every quality of work-life factor is positive, similar to what Kirchner & Wilhelm (2017) pointed out in their book. Moreover, Jarosch (2021) added the wages model, which employment dynamics in finances themselves.

2. Employees in Chiang Mai, Thailand, similarly to other countries, feel working-balance in their work-life because of feeling positive job security in terms of health in working conditions, using their knowledge and abilities to develop themselves both soft skill and hard skills, feeling free with constitutional and individual rights. They pointed out that they can manage their work land, living space, and social activities even though they are concerned about compensation and career opportunities. However, if they stay in Chiang Mai, their hometown, they will be familiar with this area. This issue, confirmed by Kadnichanskaya & Galkina (2019), summarized that the number of temporary workers was increasing as a new employment model in the labor market: freelance living in the city.

In conclusion, this research examines the level of job security in 3 dimensions; employment status, psychological contract breach, and organizational identification confirmed that most respondents feel positive views toward their job security and quality of work-life. The more they control work-life balance, the more they feel security. As the literature pointed out by Richard E. Walton, this research shows more elements that impact workers in Thailand as job security.

## Recommendation

Despite the increasing number of freelancers in Chiang Mai, Thailand, companies enable them to disrupt or transform dynamic and innovative markets. Freelancers can be substitutes for taskforce without permanent salaries. However, they still feel positive about their job. This trend may affect future employment models in Chiang Mai and the number of full-time employees in the organizations.

Freelance workers may need to up their skills in any field, such as technology, social relevance, and living space. Based on this research results, the main concern for these workers is how to make them fair and adequate compensation and how they can

receive welfare benefits. They are self-employed workers with no leader or boss, no teamwork, and no colleague, whether they do create a working atmosphere for themselves in the long term. The self-employment model will be highly studied in nearly future research.

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# Factors Related to Remote Working Affecting Knowledge Sharing: Case Study of an Industrial Printing Ink Distributor in Samut Sakhon Province

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## Abstract

In this paper, the research aims to study factors related to remote working affecting knowledge sharing, which is one of the most important factors to develop an organization's competitiveness. To find out what factors might influence employees to share knowledge with their colleagues during remote working, their behavior of knowledge sharing was observed. The selected factors, in addition to remote working itself, consisted of four aspects namely job satisfaction, trust in colleagues, interpersonal bond, and perceived organization support. The census was collected from a selected industrial printing ink distributor in Samut Sakhon province using both online and document questionnaires and testing the hypotheses with paired-sample t-test.

The research results revealed that remote working itself had positive effects on the factors of job satisfaction, perceived organization support, and behavior of knowledge sharing significantly. On the contrary, however, it had negative effects on the factor of interpersonal bond. The remote working, paired with the trust in colleagues, had no statistical significance therefore did not affect the trust in colleagues.

**Keywords:** Remote Working, Knowledge Sharing, Influencing Factors, Behavior

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## ปัจจัยที่เกี่ยวข้องกับการทำงานระยะไกลที่ส่งผลต่อการแลกเปลี่ยนเรียนรู้ : กรณีศึกษา บริษัทผู้จำหน่ายหมึกพิมพ์อุตสาหกรรมแห่งหนึ่งในจังหวัดสมุทรสาคร

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### บทคัดย่อ

เป็นที่ทราบกันดีว่า การแลกเปลี่ยนเรียนรู้นั้น มีความสำคัญต่อการเพิ่มขีดความสามารถในการแข่งขันขององค์กร งานวิจัยนี้จึงมีวัตถุประสงค์ที่จะศึกษาปัจจัยที่ส่งผลต่อการแลกเปลี่ยนเรียนรู้ภายใต้การทำงานจากระยะไกล โดยการสังเกตพฤติกรรมของการแลกเปลี่ยนเรียนรู้ของบุคลากรของบริษัทผู้จำหน่ายหมึกพิมพ์อุตสาหกรรมแห่งหนึ่งในจังหวัดสมุทรสาคร พร้อมด้วยการทำทดสอบปัจจัยที่น่าสนใจอีกสี่ปัจจัย คือ ความพึงพอใจในงาน ความไว้ใจต่อเพื่อนร่วมงาน ความสัมพันธ์ระหว่างบุคคล และการรับรู้การสนับสนุนขององค์กร การเก็บข้อมูลใช้ทั้งแบบสอบถามออนไลน์และแบบเอกสาร ชุดแบบสอบถาม ทั้งนี้ ทดสอบสมมติฐานด้วย การทดสอบสมมติฐานของกลุ่มตัวอย่างสองกลุ่มที่สัมพันธ์กัน (Paired Samples T-Test)

ผลการวิจัย พบว่า การทำงานจากระยะไกลส่งผลเชิงบวกต่อความพึงพอใจในงาน การรับรู้การสนับสนุนขององค์กร และพฤติกรรมการแลกเปลี่ยนเรียนรู้ในทางตรงกันข้าม การทำงานจากระยะไกล ส่งผลเชิงลบต่อสายสัมพันธ์ระหว่างบุคคล ในขณะที่ปัจจัยด้านความไว้วางใจต่อเพื่อนร่วมงานนั้น ไม่มีนัยสำคัญทางสถิติ กล่าวคือ ไม่ส่งผลทั้งเชิงลบและเชิงบวก

**คำสำคัญ:** การทำงานจากระยะไกล การแลกเปลี่ยนเรียนรู้ ปัจจัยที่มีอิทธิพล พฤติกรรม

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## Introduction and Objectives

Today, the advancement of technology has changed the way of working. Office-based working has gradually become off-site work such as coffee shops, co-working space, and work from home. In terms of off-site work, it is necessary and very important to have the technology and equipment that can support work such as computers, internet connection, various computer programs, as well as well-allocated working environment which will reduce stress, increase concentration during work, and enhance job satisfaction for employees (Fonner & Roloff, 2010). On the other hand, office-based working is full of distractions, which causes stress and leads to lower job satisfaction (Makin, Rout, & Cooper, 1988).

Knowledge sharing, the wish of each employee to share valuable knowledge with others (King, 2006, cited in Trivellas, Akrivouli, Tsifora, & Tsoutsas, 2015), is an important factor to develop the potential of an organization to compete internationally, both in providing knowledge and acquiring new knowledge (Ardichvili, Page, & Wentling, 2003, cited in De Vries, Van den Hooff, & de Ridder, 2006), and has direct impact on employees' competency development. According to De Vries (De Vries et al., 2006), the factors affecting the behavior of knowledge sharing are significantly related to attitude. Recognition from team members and job satisfaction have positive impact on the wish to share knowledge with others. During the COVID-19 epidemic, there was the need to curb contact and personal interaction. Various measures were issued to effectively reduce the rate of infectious transmission. Work from home was one of the social distancing measures. Many companies started to adapt by allowing staff members to work from home. But some was hesitant or not ready to cope with a sudden change in the work model, and feared that the productivity of employees would decrease, resulting in slow adaptation, and not keeping up with the situations.

From a case study of Thailand Development Research Institute (TDRI) by Saowaruj Rattanakhamfu and Methavee Rachatavijin (2020), it was found that work from home had positive effect on both the organization and its employees. Employees were able to reduce direct expenses from travel, accommodation, cosmetics, clothes, social activities, and indirect expenses in the form of reducing travel time to and from work, which accorded employees more time to do desired activities, enjoy better quality of life, and increase

their work productivity. On the other hand, the organization could reduce utility costs such as water, electricity and petrol, but there were additional costs from the supply of alcohol gel, face masks, online meeting programs, and improvement of the internet system. The increase of work productivity was a result of employees' positive feeling from being allowed to work from home, and the reduction of unnecessary meetings or appointments. Although at first some employees might feel good about working from home, but after a long period of time, they started to feel lonely, which could affect their mental health and productivity. Therefore, organizations should regularly ask employees, and should not force the employees to work from home.

According to the satisfaction survey conducted by the National Innovation Agency (NIA) of new generation of employees in organizations on the work model in both the public and private sectors (NIA, 2020), it could be expected that, after the COVID-19 pandemic, work from home may became the New Normal in Thailand. It was also found in (NIA, 2020) that the majority were satisfied with the said model. The model met their lifestyle expectation, and the employees were able to work efficiently and to use digital technology as a management tool. Hence, the organization should be prepared to cope with the changes that may occur, starting with improvement of necessary infrastructure, procurement of equipment such as computers, external storages. Work processes that post major obstacles preventing some employees to work from home should also be detected and modified. In addition, work system that is conducive to work from home such as use of electronic documents instead of paper, promotion of voluntary work from home, for instances. Nevertheless, activities in the organization that allow employees to meet face-to-face, which will foster employees' organizational attachment, generate knowledge sharing, as well as strengthen teamwork, should be organized.

Many organizations still question the effectiveness of remote working and how it will affect the organization during the social distancing and work from home measures. The researchers observed the behavior of knowledge sharing during remote working and factors that might influence employees to share useful knowledge with their colleagues during remote working.

### Research Problem

What are the factors related to remote working that influence knowledge sharing?

## Objective

To study the factors affecting knowledge sharing under remote working environment.

## Scope of Research

The research was viewed that remote working model was different for each organization both in terms of business process and organizational culture, and therefore the census method was chosen to collect data from the employees in an industrial printing ink distributor in Samut Sakhon province with experience in remote working in 2020.

## Expected Benefits

Information obtained from the research and results of the analysis can be used for businesses to make decisions relating to appropriate length of time for remote working, to promote positive factors, and to find ways and means to prevent the potential negative impact of having employees work remotely or work from home.

## Literature Review

Remote working is a type of work that is not a form of work in the office as usual but outside of the location or working from home (WFH) while still being able to do the same work as in the office. It relies on technological support and Internet connectivity (Fitzer, 1997, p. 65, cited in Fonner et al., 2010).

Fonner (Fonner et al., 2010) commented that remote working might help employees get away from the hustle and bustle, distractions and politics in the workplace, and that remote working changed the atmosphere, reduced stress, and had positive effect on job satisfaction.

Trust was also a critical point in remote working (Kowalski & Swanson, 2005, p. 243, cited in Golden & Raghuram, 2010) since, for remote working, there were fewer contact and it would be formal with the supervisor and co-workers, if any. Building trust could be difficult without getting to know each other. Trust was often characterized by openness, honesty, and mutual respect. Knowledge sharing was often a result of open communication (Golden et al., 2010). Hence, remote working from different location might post an obstacle in building trust among one another.

An Interpersonal bond was created by intimacy with colleagues, including knowing or having admiration for similar things. So, the closer the interpersonal bond, the greater the sense of responsibility and the desire of knowledge sharing (Blau, 2004, cited in Golden et al., 2010).

Remote working or work from home required organizational support for devices, and availability of appropriate work system. If employees received good support, they tended to collaborate and work closely together (Daft & Lengel, 1986, cited in Golden et al., 2010), which would forge confidence and correctness in communication, and improve work efficiency.

Knowledge sharing was a process in which individuals exchanged knowledge with one another, leading to the integration of new knowledge (De Vries et al., 2006). The desire of individual employees to share valuable knowledge with others (King, 2006, cited in Trivellas, Akrivouli, Tsifora & Tsoutsas, 2015) constituted an important factor in the development of the organization's potential to compete internationally, both in providing knowledge and acquiring new knowledge (Ardichvili, Page, & Wentling, 2003, cited in De Vries, Van den Hooff & de Ridder, 2006), with direct impact on the employees' skill and competency development (De Vries et al., 2006).

## Methodology

Based on the literature review previously shown, conceptual framework is shown in Figure 1 and hypotheses are as follows:

Hypothesis H1: Remote working had positive effect on job satisfaction.

Hypothesis H2: Remote working had positive effect on trust among individuals.

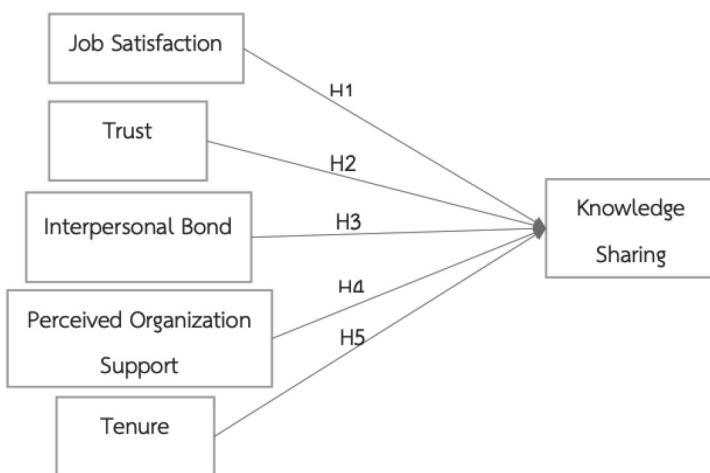
Hypothesis H3: Remote working had negative effect on interpersonal bond.

Hypothesis H4: Remote working had positive effect on perceived organizational support.

Hypothesis H5: Remote working had positive effect on knowledge sharing.

This research used a quantitative research method in data collection by the census method from the population to be studied, by comparing only the time working in the office with the time working remotely or working from home. The population used in the study included 55 employees of an industrial printing ink distributor in Samut Sakhon Province

who worked remotely or worked from home in 2020. A questionnaire was constructed in accordance with the objectives, the scope of research, and the variables to be studied. The questions were both closed and open ended. It was a 5-point Likert Scale. Before distributing to informants, the questionnaire was verified by experts and received an Index of Concordance (IOC) more than 0.5. Also, its Cronbach alpha coefficient value was greater than 0.7, meaning that it was reliable. For the data collection, the tools were used including Google Form and survey documents. The applications used to analyze the data were SPSS and Microsoft Excel.



**Figure 1:** Conceptual Framework

## Results

The data collection and aggregation were summarized as shown in Table 1-7.

Table 1: Percentage of the questionnaire respondents

Variables		Number	Percentage
Gender			
	Male	16	29.1
	Female	39	70.9
	Total	55	100
Age Range			
	Under 26 years old	5	9.1
	Between 27-35 years old	20	36.4
	Between 36-45 years old	15	27.3
	Between 46-55 years old	9	16.4
	56 years or older	6	10.9
	Total	55	100
Education			
	Vocational Certificate/High Vocational Certificate/ Diploma	6	10.9
	B.A. degree	39	70.9
	Post-graduate	10	18.2
	Total	55	100
Work experience			
	Not more than 3 years	13	23.6
	4-7 years	15	27.3
	8-11 years	9	16.4
	12-15 years	7	12.7
	16 years or more	11	20
	Total	55	100

Table 1 shows that most of the respondents were female with 39 persons (70.9%), aged between 27-35 years old or 20 persons (36.4%), with B.A. degree or 39 persons (70.9%), and work experience in the range of 4-7 years or 15 persons (27.3%).

**Table 2:** Average, Standard Deviation, Opinion Level of People Who Have Experience Working Both in the Office and at Home, in Terms of Job Satisfaction, Classified by Questions

Job Satisfaction When Working from Home	$\bar{X}$	N	S.D.	Opinion Level
When working from home, you feel a sense of balance between your personal life and work.	4.05	55	0.97	High
When working from home, you feel comfortable working without being disturbed while working.	4.13	55	0.92	High
When working from home, you do not feel stressed by communication, receiving - sending emails, and messages about work in large quantity.	3.00	55	0.88	Moderate
When working from home, you still receive complete information related to work.	3.56	55	0.60	High
Overall	3.69	55	0.84	High
Job Satisfaction When Working in the Office	$\bar{X}$	N	S.D.	Opinion Level
You feel a sense of balance between your personal life and work.	3.67	55	1.00	High
You feel comfortable working without being disturbed while working.	3.55	55	1.15	High
You do not feel stressed by communication, receiving – sending emails, and messages about work in large quantity.	2.69	55	0.81	Moderate
You receive complete information related to work.	3.22	55	0.99	Moderate
Overall	3.28	55	0.99	Moderate

In Table 2, the level of opinion in job satisfaction was high for remote working. When working in office, its opinion level was moderate.

**Table 3:** Average, Standard Deviation, Opinion Level of People Who Have Experience Working Both in the Office and at Home, In Terms of Trust in Colleagues, Classified by Questions

Trust in Colleagues When Working from Home	$\bar{X}$	N	S.D.	Opinion Level
When working from home, you have trust in your colleagues, and you are able to share concepts and ideas, and express opinions to one another.	3.85	55	0.80	High
When working from home, you feel that your colleagues are ready to listen to your problems and always ready to help you.	4.05	55	0.78	High
When working from home, you have trust and confidence that your colleagues are competent and can perform their duties professionally.	4.36	55	0.65	Highest
When working from home, you feel trusted by your superiors to perform tasks.	4.04	55	0.84	High
Trust in Colleagues When Working in the Office	$\bar{X}$	N	0.77	High
You have trust in your colleagues, and you are able to share concepts and ideas, and express opinions to one another.	3.84	55	0.90	High
You feel that your colleagues are ready to listen to your problems, and always ready to help you.	3.91	55	0.70	High
You have trust and confidence that your colleagues are competent and can perform their duties professionally.	4.24	55	0.94	Highest
You feel trusted by your superiors in performing tasks.	3.87	55	1.04	High
Overall	3.96	55	0.89	High

Table 3 shows the high level of opinion in trust in colleagues for remote working as much as when working in the office.

**Table 4:** Averages, Standard Deviation, Opinion Level of People Who Have Experience Working Both in the Office and at Home, In Terms of Interpersonal Bond, Classified by Questions

Interpersonal Bond When Working from Home	$\bar{X}$	N	S.D.	Opinion Level
When working from home, you feel a sense of closeness and intimacy with your colleagues.	2.96	55	0.84	Moderate
When working from home, you can discuss personal matters that are not related to work with your colleagues.	2.73	55	0.87	Moderate
When working from home, your colleagues influence your ideas and decisions.	2.6	55	0.97	Moderate
Overall	2.76	55	0.89	Moderate
Interpersonal Bond When Working in the Office	$\bar{X}$	N	S.D.	Opinion Level
You feel a sense of closeness and intimacy with your colleagues.	3.42	55	0.96	High
You can discuss personal matters that are not related to work with your colleagues.	3.09	55	1.09	Moderate
Your colleagues influence your ideas and decisions.	2.93	55	0.77	Moderate
Overall	3.15	55	0.94	Moderate

In Table 4, the level of opinion in interpersonal bond for remote working was moderate, as well as when working in the office.

**Table 5:** Average, Standard Deviation, Opinion Level of People Who Have Experience Working Both in the Office and at Home, In Terms of Perceived Organization Support, Classified by Questions

Perceived Organization Support When Working from Home	$\bar{X}$	N	S.D.	Opinion Level
When working from home, you receive support from your organization regarding computers and equipment needed for work.	4.00	55	0.75	High
When working from home, you can use equipment and programs for teleconference provided by IT department.	4.13	55	0.77	High
When working from home, you get assistance and technical support from IT department.	4.51	55	0.57	Highest
Overall	4.21	55	0.70	Highest
Perceived Organization Support When Working in the Office	$\bar{X}$	N	S.D.	Opinion Level
You receive support from your organization regarding computers and equipment needed for work.	3.55	55	1.10	High
You can use equipment and programs for teleconference provided by IT department.	3.82	55	1.14	High
You receive assistance and technical support from IT department.	4.27	55	0.85	Highest
Overall	3.88	55	1.03	High

Table 5 shows the highest level of opinion in perceived organization support for remote working. For working in the office, with a little lower, the level of opinion is high.

**Table 6:** Average, Standard Deviation of Behavior of Knowledge Sharing, Based on the Opinions of Those Who Have Experience Working Both in the Office and at Home, Classified by Questions

Behavior of Knowledge Sharing When Working from Home	$\bar{X}$	N	S.D.	Opinion Level
When working from home, you can find work information you want from your organization's server.	4.51	55	0.505	Highest
When working from home, you receive complete and correct work information.	3.87	55	0.771	High
When working from home, you feel the exchange of information is useful for your work.	4.60	55	0.494	Highest
Overall	4.41	55	0.56	Highest
Behavior of Knowledge Sharing When Working in the Office	X	N	S.D.	Opinion Level
You can find work information you want from your organization's server.	4.36	55	0.485	High
You receive complete and correct work information.	3.56	55	0.501	High
You feel the exchange of information is useful for your work.	4.38	55	0.490	Highest
Overall	4.13	55	0.55	High

In Table 6, the level of opinion in knowledge sharing behavior was in the highest level for remote working while it was high for working in the office.

**Table 7:** Average, Standard Deviation, Overall Factors, Based on the Opinions of Those Who Have Experience Working Both in the Office and at Home, Classified by Factor Topics

All Factors Affecting Knowledge Sharing When Working from Home	$\bar{X}$	N	S.D.	Opinion Level
Job satisfaction	3.69	55	0.84	High
Trust in colleagues	4.08	55	0.77	High
Interpersonal bond in the workplace	2.76	55	0.89	Moderate
Perceived organization support	4.21	55	0.70	Highest
All Factors Affecting Knowledge Sharing When Working in the Office	$\bar{X}$	N	S.D.	Opinion Level
Job satisfaction	3.28	55	0.99	Moderate
Trust in colleagues	3.96	55	0.89	High
Interpersonal bond in the workplace	3.15	55	0.94	Moderate
Perceived organization support	3.88	55	1.03	High

In Table 7, the levels of opinion towards all factors related to remote working were high in job satisfaction and trust in colleagues, moderate in interpersonal bond, and highest in perceived organization supports. For working in the office, the levels of those opinions were high in trust in colleagues and perceived organization supports and moderate in job satisfaction and interpersonal bond.

## Hypothesis Test Results

The researchers collected data from the questionnaire, divided into working from home, and working in the office, and tested the obtained value for the average of the repeated measurement of the sample (Paired-Sample t-test). The hypothesis test results, which were used to study the effects of remote working on knowledge sharing and related factors, are shown in Table 8 and concluded as follows:

Hypothesis H1: Remote working had positive effect on job satisfaction, with the statistical significance at the level of 0.05 for all pairs shown in Table 8.

Hypothesis H2: Remote working did not affect trust among individuals. The statistical significance for all pairs divided by 2 shown in Table 9 were more than 0.05.

Hypothesis H3: Remote working had negative effect on interpersonal bond, with the statistical significance divided by 2 at the level of 0.05 for all pairs shown in Table 10.

Hypothesis H4: Remote working had positive effect on perceived organization support, with the statistical significance divided by 2 at the level of 0.05 shown in Table 11.

Hypothesis H5: Remote working had positive effect on the behavior of knowledge sharing, with the statistical significance divided by 2 at the level of 0.05 shown in Table 12.

**Table 8:** Paired Samples Test (Paired Differences) for Hypothesis 1

Compared Pair Description	Sig. (2-tailed)
- When working from home, you feel a sense of balance between your personal life and work. - You feel a sense of balance between your personal and work.	.037
- When working from home, you feel comfortable working without being disturbed while working. - You feel comfortable working without being disturbed while working.	.003
- When working from home, you do not feel stressed by communication, receiving -sending emails, and messages about work in large quantity. - You do not feel stressed by communication, receiving – sending emails, and messages about work in large quantity.	.031
- When working from home, you still receive complete information related to work. - You receive complete information related to work.	.029

**Table 9:** Paired Samples Test (Paired Differences) for Hypothesis 2

Compared Pair Description	Sig. (2-tailed)
- When working from home, you have trust in your colleagues, and you can share concepts and ideas, and express opinions to one another.	.907
- You have trust in your colleagues, and you are able to share concepts and ideas, and express opinions to one another.	
- When working from home, you feel that your colleagues are ready to listen to your problems and always ready to help you.	.322
- You feel that your colleagues are ready to listen to your problems, and always ready to help you.	
- When working from home, you have trust and confidence that your colleagues are competent and can perform their duties professionally.	.397
- You have trust and confidence that your colleagues are competent and can perform their duties professionally.	
- When working from home, you feel trusted by your superiors to perform tasks.	.245
- You feel trusted by your superiors in performing tasks.	

**Table 10:** Paired Samples Test (Paired Differences) for Hypothesis 3

Compared Pair Description	Sig. (2-tailed)
- When working from home, you feel a sense of closeness and intimacy with your colleagues.	.011
- You feel a sense of closeness and intimacy with your colleagues.	
- When working from home, you can discuss personal matters that are not related to work with your colleagues.	.058
- You can discuss personal matters that are not related to work with your colleagues.	
- When working from home, your colleagues influence your ideas and decisions.	.038
- Your colleagues influence your ideas and decisions.	

**Table 11:** Paired Samples Test (Paired Differences) for Hypothesis 4

Compared Pair Description	Sig. (2-tailed)
- When working from home, you receive support from your organization regarding computers and equipment needed for work.	.022
- You receive support from your organization regarding computers and equipment needed for work.	
- When working from home, you can use equipment and programs for teleconference provided by IT department.	.016
- You can use equipment and programs for teleconference provided by IT department.	
- When working from home, you get assistance and technical support from IT department.	.074
- You receive assistance and technical support from IT department.	

**Table 12:** Paired Samples Test (Paired Differences) for Hypothesis 5

Compared Pair Description	Sig. (2-tailed)
- When working from home, you can find work information you want from your organization's server.	.063
- You can find work information you want from your organization's server.	
- When working from home, you receive complete and correct work information.	.000
- You receive complete and correct work information.	
- When working from home, you feel the exchange of information is useful for your work.	.038
- You feel the exchange of information is useful for your work.	

## Conclusions and Discussions

From the research results, it was found that remote working positively affected on knowledge sharing and related factors included job satisfaction and perceived organization support, which were consistent with the research hypothesis. These results were the bright side of remote working that should be preserved if the organization thought of starting

to use the model of work from home in its workplace. The main obstacles of working from home were loneliness, less participation with colleagues, and several inconveniences due to unreadiness of equipment as in the office. Also, some executive remained concerning that remote workers were irresponsible and unable to complete their tasks. If one looked at increasing job satisfaction for employees, it would help the company to be productive. It would reduce stress, create new working atmosphere, and it might also reduce employee turnover rate (Baernholdt, M., & Mark, BA. (2009)). According to the research results, remote working was one of success factors to increase job satisfaction. In addition, supports from organization perceived by employees could help remote working work appropriately. Organizations who try to promote remote working should prepare their remote working related equipment, such as infrastructure, computers, etc., to be ready for the purpose.

In term of negative effect i.e., interpersonal bond, organizations should periodically arrange events or meetings to get remote working and in-office employees together. Doing so would reduce the problem of interpersonal bond cause by remote working for long time.

Scheduling work from home was another important factor in making work from home a success. Given the data in this research, it was surprising that there were people who did not want to work from home at all. Most of them were concerned about rising electricity bills, and some tasks that could not be executed through a computer. Some of them felt lonely when they did not get to see their colleagues for a long time. Being able to choose to work from home on a voluntary basis was a good solution. If the employees could have a slightly more flexible schedule of going into the office, it might help to balance their work and personal life better. According to some questionnaire respondents, work from home helped them get enough exercise and sleep, allowed them more concentration since there was no need to leave home in the morning and encounter daily traffic congestion, pollution, and the risk of contracting the COVID-19. But some commented that the environment at home made them lose their concentration, since there were too many distractions. This problem might be addressed by providing advice on proper preparation of the working area to make it feel more like a workplace.

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# Role of Public Participation in an Environmental Impact Assessment System in Thailand: A Case of Rayong Industrial Estate (Ban Khai)

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## Abstract

This research has the objective to study the public participation's process in EIA (Environmental impact assessment), including evaluation of the effectiveness of the public participation and recommending new processes in developing the development of public participation processes in EIA in the case study of The Rayong Industrial Estate Project (Ban Khai) Zone. This research uses semi-structured interviews, non-participatory observation, and site survey with the stakeholders of the project as methods of data collection. The study indicates that the public hearing has obstacles and does not cover all stakeholders. Furthermore, some citizens are not informed of the project which leads to the protest from the opposing groups against the participation in every activities. For the participation of citizens, it was found that citizens do not have enough time to prepare for the hearing of the project. As a result, the citizens do not have confidence in the decisions of government. In order for the development process with public participation in environmental impact assessment to be successful, government and project developers have to realize the importance of the participation of the public, transparency in operations and provide accurate and complete information about the project. Also, they have to be ready to receive the public's feedback from the start of the project to know the real demand of the people in the area. The public needs to learn about the environmental impact assessment, participation of citizens and relevant legislations.

**Keywords:** Public Participation, Environmental Impact Assessment, Environmental Conflict, Industrial Estate, Legislations

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## บทบาทของการมีส่วนร่วมของประชาชน ในระบบการประเมินผลกระทบสิ่งแวดล้อมของประเทศไทย: กรณีศึกษา นิคมอุตสาหกรรมระยอง (บ้านค่าย)

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### บทคัดย่อ

งานวิจัยนี้มีวัตถุประสงค์เพื่อศึกษาระบวนการมีส่วนร่วมของประชาชนของระบบการประเมินผลกระทบสิ่งแวดล้อม รวมถึงการประเมินประสิทธิผลของระบบการมีส่วนร่วมของประชาชน และเสนอแนะแนวทางในการเสริมสร้างระบบการมีส่วนร่วมของประชาชนในกระบวนการประเมินผลกระทบสิ่งแวดล้อม กรณีศึกษา นิคมอุตสาหกรรมระยอง (บ้านค่าย) งานวิจัยนี้ใช้วิธีการเก็บรวบรวมข้อมูล คือ การสัมภาษณ์แบบกึ่งโครงสร้าง การสังเกตการณ์แบบไม่มีส่วนร่วม และการสำรวจพื้นที่ กับกลุ่มผู้มีส่วนได้ส่วนเสียของโครงการ ผลการศึกษา พบว่า กระบวนการมีส่วนร่วมของประชาชนประสบปัญหา อุปสรรคและไม่ครอบคลุมกลุ่มผู้มีส่วนได้ส่วนเสีย โดยประชาชนบางส่วนยังไม่ทราบข้อมูลข่าวสารเกี่ยวกับโครงการ นำไปสู่การรวมตัวคัดค้านไม่เข้าร่วมกระบวนการ มีส่วนร่วมของประชาชนของกลุ่มผู้ต่อต้าน ประเด็นด้านกระบวนการรับฟังความคิดเห็นของประชาชน พบว่า ประชาชนมีระยะเวลาไม่เพียงพอในการเตรียมตัวเพื่อเข้าร่วมกระบวนการรับฟังความคิดเห็นของประชาชน ส่งผลให้ประชาชนขาดความเชื่อมั่นต่อกระบวนการตัดสินใจของภาครัฐ ส่วนแนวทางในการสร้างเสริมกระบวนการมีส่วนร่วมของประชาชนในการประเมินผลกระทบสิ่งแวดล้อมให้ประสบความสำเร็จนั้น ภาครัฐและผู้พัฒนาโครงการควรตระหนักรถึงความสำคัญของกระบวนการมีส่วนร่วมของประชาชน ความโปร่งใสของกระบวนการปฏิบัติงาน การให้ข้อมูลของโครงการอย่างถูกต้องและครบถ้วน นอกเหนือจากนี้ ควรต้องจัดให้มีกระบวนการรับฟังความคิดเห็นของประชาชนตั้งแต่เริ่มพัฒนาโครงการ เพื่อให้ผู้พัฒนาโครงการทราบถึงความต้องการที่แท้จริงของประชาชนในพื้นที่ ภาคประชาชนต้องทำความเข้าใจ เรียนรู้เกี่ยวกับกระบวนการประเมินผลกระทบสิ่งแวดล้อม กระบวนการมีส่วนร่วมของประชาชน รวมถึงกฎหมายต่าง ๆ ที่เกี่ยวข้อง

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## Introduction

The development of Thailand, in the past, has led to the use of natural resources as a cost to build various development projects for economic and industrial development and to increase income and raise the status of the people. Various development projects have both benefits and negative impacts, especially large-scale development projects that may affect the spread of pollution to the environment and people. In addition, the environmental and natural resource problems that arise are the result of rapid economic and industrial expansion, together with wasteful use of resources and no process of proper planning. This results in the remaining natural resources being deteriorated, especially several large projects that take place to support the development of the economy. Environmental impact assessment is therefore very necessary to help solve environmental problems arising from various development projects and also help in preventing future environmental problems.

The Environmental Impact Assessment (EIA) is a measure that must be implemented in accordance with the applicable legal framework and specified in the current constitution. Therefore, it is important to have people within the affected area participate, think, and take part in the decision-making process that will occur, which will result in meaningful participation from the public, implementation of the development program for sustainable development goals and preservation of the integrity and diversity of natural resources, especially for people whose livelihoods are dependent on natural resources. Therefore, public participation in environmental impact assessment is extremely important.

Rayong Industrial Estate Project (Ban Khai) is a project of IRPC Public Company Limited, located in Nong Bua Sub-district and Bang Son Sub-district, Ban Khai District, Rayong Province, on Hua Chua-Rong Nam Road, which is separated from Route 3138 (between km 59- 60). This project is implemented with the goal of establishing an industrial estate, in order to support the expansion of the industrial sector, as well as development planning for community agriculture promotion , social development and the quality of life of nearby communities by promoting environmentally friendly alternative industrial activities.

In Thailand, there are many environmental conflict cases from the implementation of development projects. It is often found that public participation practices, in particular, the public hearings often lead conflicts among stakeholders which often ends in violence. An abolishment of the public hearings is clearly presented the incapability to resolve conflicts in society. The environmental conflict cases were such as the public participation of Hin Krut Power Plant, Bo Nok Power Plant, Thai-Malaysia gas pipeline project and the latest case of the public hearing on the Krabi coal-fired power plant. The confrontation between supporter groups and those who opposed the project with different opinions on the project are increasing numerous in the Thai context (Chompunth, 2015).

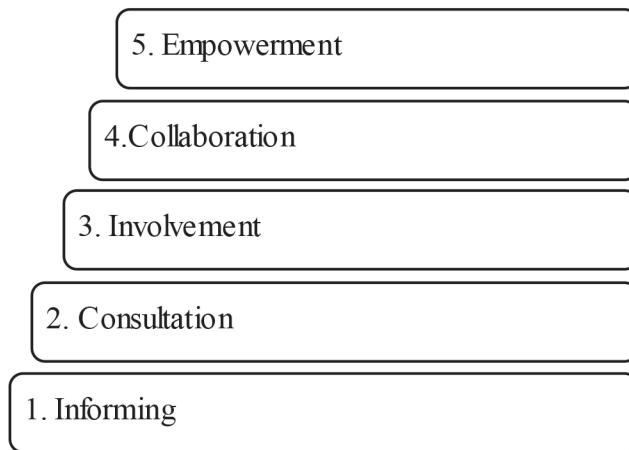
Due to the resistance of the public against the aforementioned project, the researcher therefore is interested in studying the problems or obstacles of public participation in the environmental impact assessment of the project and finding guidelines for promoting and supporting the participation of people in environmental impact assessment, in order to bring meaningful results that can be used in the process of public participation in a meaningful and beneficial way to make decisions in the implementation of successful large-scale development projects in the future.

This research aims to study the process of public participation in environmental impact assessment with the concept of related theories and research as follows:

### **Public Participation**

Public participation is a process by which people or stakeholders have the opportunity to express opinions, suggestions or exchange information, in order to find alternatives for joint decision making about the project appropriately. Bureau of Environmental Impact Analysis (2011).

The International Association for Public Participation has divided the level of public participation into 5 levels, as shown in Figure 1 , with the following details: Creighton (2005) and Petts (1999).



**Figure 1:** The Level of Public Participation

1. Informing is the lowest level of public participation, yet still important because it is an opportunity for people to participate in various matters. The main objective is to provide information to the public and enhance public understanding about issues, options and solutions using various channels such as documents, publications, media, newsletters, exhibitions, press conference, online media etc.

2. Consultation is a process that allows people to participate in providing information, facts, and opinions to be a part of the decision for the project. The objective is to receive information and opinions from the public about the problems and solution, in order to be used in the decision-making process, which may be implemented through public hearings, poll, public forum, group meeting, online media comments etc.

3. Involvement is an opportunity for people to participate in the operation or suggest ways to make decisions, in order to create confidence for the public that information, opinions and needs of the people will be considered as an alternative to the management of the project. This can be done through using the workshop method to consider public policy issues, public hearing, establishment of a working group to suggest policy issues, etc.

4. Collaboration is the participation between a group of the people and public sector representatives, in order to allow the public to participate in every step of the decision-making process and have ongoing activities together with the project. This can

be done by using various methods, such as appointing a member of the public as a director of a committee or determining a collective decision-making process.

5. Empowerment is the stage that gives the highest level of public role, allowing people to make decisions such as a referendum on various public issues or technical support etc.

### **Public Participation in the Environmental Impact Assessment Process**

Environmental Impact Assessment: EIA is a regularly used as a decision-making tool in environmental management area and public participation is acknowledged as a key component of EIA. It is mostly accepted that public participation plays a vital role in the development process of the country. That is to say, participation is a social process that allows those engaged as stakeholders to have access to information, problem analysis, commenting, implementation, cooperation and monitoring the impact of operations as well as being involved in any aspect related to solving the problems of their community or area. Public participation in the environmental impact assessment process is a process established in the EIA process of the project with the objective of participation for the people, NGOs, as well as various agencies affected by the project in participating, commenting and presenting information or suggesting ideas related to environmental impact assessment. This is to achieve the actual demands of the public and in accordance with government policies, in order to prevent, correct and manage the issue correctly and efficiently. Regarding the basic rights, Thai people and the local communities are permitted to be involved in all aspects of the government administration, in particular the management of natural resources and the environment in the EIA system in Thailand. This right is provided in many laws and regulations (Chompunth, 2015).

In the process of public participation, it is necessary to work with people who possess knowledge, understanding and experience in working with the community. The operation must therefore be used by those who understand the principles and guidelines for successful participation. Public participation must therefore be planned out in steps, as well as having problem and success assessment in each step. Then, the result must be brought in and used to improve the next operation to be suitable for each context. Therefore, the process of public participation should be managed by adhering to the 4S principles as follows:

1. Starting Early. The process of public participation must start from the beginning, by providing information to encourage feedback and receiving public opinion before making a decision. In addition, implementing the public participation into the process from the beginning helps people to be able to think of more appropriate alternatives or ways to solve community problems and can provide further information for project development.

2. Stakeholders coverage or related parties is another important principle of participation. This process is to allow people to participate extensively. Those who are affected, whether directly or indirectly, are considered a stakeholder. They should have the opportunity to participate in the participation process. However, groups that are directly affected may be considered as a higher priority and may be chosen to listen to information or discuss before others.

3. Sincerity, participation is a delicate process and is related to relationship between the agencies responsible for organizing the process of participation and the public. This is considered an important dimension in managing a successful participation. The state agency that is the owner of the project or the agency, who has the authority to approve, must provide a process that is honest, open, honest and bias-free to respect each other and have two-way communication at all times, especially providing accurate and adequate information to respond to the needs and concerns of stakeholders. This includes the need to report progress of the project or changes made to the project.

4. Suitability: The last important principle of participation management is the selection of techniques or patterns of public participation that are considered appropriate, by considering the type and size of the project, the diversity and the different characteristics of the area and the stakeholders, as well as differences in culture, society and values, levels of community interest in issues or projects, capabilities and readiness. This also includes the limitations of agencies responsible for organizing the participation process.

#### **Laws Related to Public Participation in Environmental Impact Assessment in Thailand**

From the Constitution of the Kingdom of Thailand, B.E. 2550 there are laws relating to the participation of people in environmental impact assessment in Thailand as follows:

Section 57, A person shall have the right to receive information, explanation and reasons from a government agency, state agency, state enterprise or local government organization before granting a license or undertaking a project or activity which may affect the quality of the environment, health and sanitary conditions, the quality of life or any other material interests concerning him or a local community and shall have the right to express his opinions on such matters to the concerned agencies for their consideration.

The state shall arrange for a comprehensive public consultation process prior to the implementation of a social, economic, politic, and cultural development plan, the expropriation of immovable property, the determination of town and country plan, the determination of land use, and the enactment of a rule which may affect the material interests of the public.

Section 67 (paragraph two) Any project or activity which may seriously affect communities with respect to the quality of the environment, natural resources and biological diversity shall not be undertaken, unless its impacts on the quality of the environment and health of the people in the communities have been studied and evaluated and consultation with the public and interested parties have been organized, and opinions of an independent organization, consisting of representatives from private environmental and health organizations and from higher education institutions providing studies in the field of environment, natural resources or health, have been obtained prior to the operation of such project or activity.

The 2017 Constitution of Thailand has arranged many advantages for environmental management area in many sections. It endorses and supports the principle of public participation to have a vital role in decision making and project development in particular, the EIA system. Section 58 states that, “Implementation of any projects or activities that may have massive impact on the community in terms of environmental quality, natural resources and health will not be conducted until the stakeholders involved carry out studies and assessment on the impact of the proposed project on environmental quality, and the health of the community. After the impact assessment, the decision-makers in charge should set up a public hearing process for the public and stakeholders. The government should give importance to public participation process as the views of all stakeholders will help in reducing the negative affect of a project from the public. Moreover, the NEQA 1992 and the NEQA 2017 stipulates requirements for the Environmental

Impact Assessment (EIA) procedure making the EIA process more practical and reducing the time needed for its completion. In practice, the Thai laws have composed for the holding of public participations on 35 types of development projects for EIA and on 12 types of major-development projects, EHIA. This provided the need to pay attention to the affected communities about the overall impacts of these projects. In practice, the EIA report should comprise of a pollution mitigation plan as well as a pollution monitoring program which have to be judged by the assessment committee prior to the project approval. In some significant cases, such as a huge project that may cause harmful effects to the wider public, this kind of project must be permitted by the cabinet (Chompunth, 2017).

From the study of public participation in environmental impact assessment, the researcher found the relevant research as follows:

The results of the study of the Public Participation in Environmental Impact Assessment, Natural Gas Separation Plant-Malaysia Project showed that most sample households and key informants agreed that they should be able to participate in the environmental impact assessment of the project. The sample group of households saw that the public should be allowed to participate in the survey process and the public education results should be published. The main informant saw that, due to the implementation of the project, it may affect the way of life of people in the area. People who are affected should therefore receive adequate information, opportunity to share opinions and exchange information. The public should be able to participate from the step of planning, follow-up, and evaluation in the implementation phase. The problems and obstacles in participation in environmental impact assessment are caused by inadequate information given to the public, misunderstanding of information and difficulty of data that may be difficult to understand. This may cause the public to be disinterested in the process of participation and some of the public may still lack the proper understanding about participation. The process of suggestions and guidelines on public participation should disseminate educational results thoroughly, implement meetings to clarify and listen to comments on the environmental impact assessment thoroughly and frequently. Also, the project manager should publicize the project thoroughly by using a variety of media, including the coordination for local leaders who have been accepted as the core in persuading more people to participate.

The assessment of public participation in environmental impact assessment in the case of Khao Hin Son Coal Power Plant Chachoengsao province found that, in the context of the project, the process of is still a new matter which requires time for the public to learn and get used to. In the public sector, there is still a lack of proper understanding about public participation in environmental impact assessment. The project operator has implemented the process of public participation in assessing environmental impacts appropriately, but there are still some stakeholders who didn't participate in the process. This results in the lack of coverage of stakeholders. The impact of the use of public participation processes in environmental impact assessment since the project feasibility study will reduce conflict, including the organization of activities by project operators to benefit the people in the area as much as possible. This will lead to sustainable coexistence between the project and the people. The success factors in the operation are enhancing knowledge and understanding in the process of public participation for all sectors.

Chatarat Chompunth (2013), Good governance and public participation in the decision-making process in the development project, the study found that the past development of the country has used natural resources as a cost of activities and various development projects for economic and industrial development to increase national income, which results in abundant natural resources that are diminished and deteriorated, especially the large development projects that affect the environment and health of people in the area. This leads to environmental conflicts between project owners and local people. The problems and obstacles to the creation of good governance and public participation in the decision-making process in development projects in Thailand are top-to-bottom order, lack of promotion from the government, lack of transparency in project development management, lack of coverage for stakeholders or related parties in all sectors in the process of public participation. Also, the level of public participation in decision making is low, which cause the results of participation to be inefficient. This leads to conflict within society because most decisions are not accepted by the public.

Manida Fuangchoonuch and Chatarat Chompunth (2017) found that the participation of people in environmental and health impact analysis: a case study of Krabi power plant expansion project, the related laws contains loopholes which makes such participation process still unable to achieve the true intent in practice. Furthermore, the public faces obstacles in obtaining information, which may not be sufficient for the decision-making

process because the information presented to the public is one-sided and not clear enough. This causes people to be confused. As for the environmental and health impact analysis report, it was found that the country's health database system was not able to analyze the environmental impacts and health impacts of the project, leading to unclear measures in decreasing health effects. In order to establish the guidelines for a successful development of participatory processes of the project, the government sector should consider modernizing the law to clearly determine the penalties of relevant laws, develop a health database system with transparency within the operation process, listening to public opinion from the beginning of the process, in order to know the real needs of people in the area. Also, the project manager should enhance the academic capacity of the community. The public sector should be open to accepting both positive and negative information about the project without prejudice.

From the study of concepts, theories and related research, the conceptual framework for research is as shown in Figure 2.

**General context**

- Basic information of the study area
- Laws relating to public participation in environmental impact assessment



**Issues of the study**

- The level of public participation in environmental impact assessment
- Patterns of public participation in environmental impact assessment
- The transparency of the process of public participation in environmental impact assessment
- Data accuracy
- Coverage of stakeholders
- Confidence in the project



**Problems or Obstacles of Public Participation in Environmental Impact assessment**



**Guidelines for Promoting and Supporting Public Participation in Environmental Impact Assessment**



**Successful Public Participation in EIA Assessments**

**Figure 2:** Research Concept Frameworks

This study has the objective of research 1) to study the process of public participation in environmental impact assessment of Rayong Industrial Estate Project (Ban Khai) 2) to study the problems or obstacles of public participation in the evaluation of the Environmental Impact of Rayong Industrial Estate (Ban Khai) and 3) to propose guidelines for promoting and supporting the participation of the public in the Environmental Impact Assessment of Rayong Industrial Estate Project (Ban Khai).

## Research Methodology

### 1. Data collection method

The public participation research in environmental impact assessment in the case of Rayong Industrial Estate (Ban Khai), Rayong Province is a qualitative research by semi-structured interviews with stakeholders of Rayong Industrial Estate Project (Ban Khai) in conjunction with non-participant observation and document research. Afterwards, the data was compiled and analyzed, using the triangulation technique to find information from multiple sources. It is also a study that seeks truth in the natural conditions. The research tools used in this data collection are semi-structured interview forms, which is characterized by open-ended questions.

### 2. Target groups and key informants

The researcher determined the target groups and key informants, consisting of 5 groups, including 30 key informants, including 1) People and community leaders in Nong Bua Subdistrict and Bangbut Subdistrict Ban Khai District, Rayong Province 2) Central and local government officials involved 3) Consulting companies 4) Environmental academics and 5) Environmental NGOs. The researcher began to interview the community leaders who had initially known and then inquired the next person using the Snowball Technique, while the central and local government officials, including consulting companies, environmental scholar and environmental NGOs are chosen by using purposive selection method of selection.

## Result

The results of the study public participation in environmental impact assessment in the case of Rayong Industrial Estate (Ban Khai) project can be summarized as follows:

1. The level of public participation in environmental impact assessment from the study found that the project has provided project information to the public, which is in the level 1 of public participation. This refers to the provision of project information to the public by community leaders in Bangbut Subdistrict. The second person gave an interview and stated that “The project operator gave out all the documents. There are also forums to provide project information to the public because they had to complete

the EIA process. Therefore, they provide high level of information because they had to do this through the hearing process.” The first person from Nong Bua district also claimed that “First, there was someone who came to talk first about the process of this project. But the information was not sufficient, and it wasn’t delivered directly to the villagers. That person talked to the leader first, not the villagers. However, there was more distribution of information later on.”

2. The method of public participation from the study, it was found that the method of public participation in the environmental impact assessment that the project operators and consulting firms chose is still not correctly in accordance to the principles and is not consistent with the community conditions and the characteristics of people in the area. The 4th person from Bangbut Subdistrict gave an interview and stated that “I think the participation of the project is not appropriate. They should give more importance to the villagers. They came to explore the village but didn’t ask us everything. Also, when they held a forum to listen to comments, not everyone knew about the forum. There was only a few people and the forum was very short and they did not allow the villagers to participate by asking questions or inquiries” and the 1st environmental NGOs member claimed that “Project operators should choose to use community participation methods appropriately, which may require many methods. In order to choose a method that is suitable for the area and community conditions, I think that various development projects should be used in many ways to cover stakeholders. I believe this will enable the public to open up more to the project.”

3. Transparency: From the study, it was found that the project operators still lacked transparency in the various operations by the staff of Nong Bua Subdistrict Administrative Organization. “The process of studying the effects contains some uncanny loopholes. For example, when preparing a small meeting, they will take the documents to the villagers to sign with no other supporting documents. There is no telling to what the document is about or for. they did it only to complete the legal process. However, they did not explain to the villagers to understand how this study will be done.” A community leader in Bangbut Sub-District gave an interview that “Formerly, the area was a green area. The law defined it as a green area, which is an area for agriculture. Therefore, it is prohibited to build a factory. I don’t really know how they managed to occupy the area. Many villagers are not satisfied at this point.”

4. The accuracy of the data from the study found that people in the area received insufficient information. In addition, some people are unable to access the project information and the information is still unclear. People in the area are still confused about the information provided by the project on whether they will operate or not and the kind of project that will be implemented. The 4<sup>th</sup> person from Nong Bua Subdistrict stated in an interview that “I don’t know how much the project information is complete and accurate because they provided very little project information to villagers. Therefore, the villagers can’t judge anything. Some villagers only know that they will build a factory, but they don’t know the types of factory and the impact that the public will face in the future. The thing is that we know very little of the project information and there is no clear information.” The third Bangbut Sub-district member gave an interview that “Is the information correct? I don’t know. Because I rarely get information, therefore I have no idea if they are going to really create the project or not. The communication is not clear at all. They have held public hearings to clarify project information, but it wasn’t official. We didn’t know what they were planning to do or how they were going to do it. There were no clear details. Even the officials who come to clarify the project information weren’t clear at all.”

5. Coverage of Stakeholders: From the study, it was found that the scope of the study area is mainly focused on people in the study area, 5 kilometers radius around the project area, which may not yet cover the area and people that may be affected by all relevant projects. Additional context and factors should be considered by the people of Nong Bua Sub-District. “I don’t know who the stakeholders of the project are. But I think that the project haven’t covered all of the stakeholders yet because the villagers in the area are not well aware. Most of the project information will be directly informed to village leaders or leaders. Some villagers do not have the basic information on the project at all, while other has a moderate amount of knowledge and background information that varies.” This is true in the case of the 2nd member from Bangbut Subdistrict, who stated that “I didn’t receive information from the project. There were no meetings, only distant news that the project operator were coming. But there were no discussion or information provided. They will come only in this zone. I am a little too far away. They probably thought that my area was not affected or not in the radius, therefore they gave less importance to this path.” And the second environmental scholar also gave

an interview that “I think that the procedure of defining the stakeholders of the Office of Natural Resources and Environmental Policy and Planning or the Ministry of Industry has a certain level of coverage. But the project must look at the condition or context of the area, as well as whether or not it is appropriate to add stakeholders to suit the area. This is because each area is different; the project should be adapted to suit each specific area.”

6. Confidence in the project: The study found that people in the area do not believe in the project, due to seeing the past impact that occurred in other areas that the project operator is responsible for. The 2nd community leader from Nong Bua Subdistrict gave an interview that “We think that the project is not reliable because we have seen in the past that the industry, in which they operate, is a petrochemical industry. This means that it will make an impact on other areas. If this project is implemented, it'll have many effects on the villagers who will definitely be affected.” And the second officer of the Bangbut Subdistrict Administrative Organization gave an interview that “In the past, the factory had caused many impacts in Rayong city. How would they make people trust them when the public already lack trust in the project because the effects of the environmental impact is a significant factor. If the factory is implemented, the villager would surely be affected through their health and agriculture product, not to mention the long term effect on future generations.”

For problems or obstacles of public participation in environmental impact assessment, it was found that most people in the area still lack knowledge and understanding about the process of public participation in environmental impact assessment and there are also concerns that the project will affect the livelihoods and the agriculture sector. This is because the public have already seen the impact that occurred in other areas that the project operator is responsible for, which caused the public to oppose the implementation of the project. In addition, it was found that project operators and consulting firms provide vague information that does not thoroughly cover stakeholders. People get confused by project information which leads to the public not placing their trust in the project.

The guidelines for promoting and supporting the participation of people in the EIA can be divided into 3 parts by

The government should enact laws regarding the environmental impact assessment in Thailand and give priority to creating a clear scope and criteria, In order for law enforcement to be effective. In addition, the EIA laws should be improved to be consistent with the current situation. The last suggestion is that the relevant departments should undergo training to create knowledge and understanding for people in the area, In order for them to be able to understand the public participation process in assessing the environmental impact correctly.

For the entrepreneur / private sector, project operators and consulting companies must be aware of the importance of the process of public participation in environmental impact assessment by providing information to interested parties, as well as listening to opinions from stakeholders fairly. Also, they should conduct an environmental impact assessment with transparency, which means that the assessment must provide accurate data to stakeholders and can be verified. There must be an implementation of a plan or preparation of project information ready before the information is published to the public for acknowledgment. This is to ensure that the public will not be confused by the information received. This should ultimately encourage the public to participate at a higher level, so that people can play a greater role in participation. Furthermore, they should choose a suitable method of participation for the area and community conditions, which will help reduce conflict problems and can increase the credibility of the project.

For the public sector, people in the area should have more knowledge about the applicable laws and the environmental impact assessment process, in order to be able to obtain basic understanding. Also, they should prioritize the process of listening to project information, keep an open mind to accept information and cooperate in the environmental impact assessment process to benefit the community and the project. However, the public participation pattern in the EIA can be summarized as follows in Figure 3:

**General context**

- Preliminary information of the study area: consider the condition of the area, community condition, occupation and community culture
- Laws relating to public participation in environmental impact assessment: There should be improvement of relevant laws, method of guidelines for preparation and consideration of reports for standards



**Educational issues**

- The level of public participation: allow people to participate at a higher level to enable the public to play a greater role in participation
- Public participation method: choose the method of participation to suit the area and community
- Transparency: should be sincere, transparent, able to be verified in the implementation of various projects
- Accuracy of information: provide accurate and clear project information to the public
- Stakeholders' coverage: setting the boundary of the study area around the project area, this may not yet cover areas and people who may be affected by the whole project. However, additional context and factors should be considered
- Confidence towards the project: The project must be approached by the public sincerely with complete and clear project information and listen to public opinion fairly.



Guidelines for promoting and supporting public participation in environmental impact assessment government

1. Laws on Environmental Impact Assessment in Thailand should give priority to clear boundaries and criteria to make law enforcement effective
2. The law on EIA should be improved to match the current situation
3. Relevant agencies should have training to create knowledge and understanding for people in the area to be able to understand the public participation process in assessing the environmental impact correctly

Entrepreneur / private sector

1. Be aware of the importance of public participation in environmental impact assessment by providing information to interested parties, as well as listening to opinions from stakeholders fairly
2. The environmental impact assessment should be conducted with transparency which means that they can be checked and provide accurate and clear information to stakeholders
3. There should be a plan or preparation of project information ready before the data is published to avoid confusion of information
4. They should allow people to participate at higher levels to allow the public to play a greater role in participation and should choose a method of participation to suit the area and community conditions, which will help reduce conflict problems and can create credibility of the project

Public sector

1. Learn more about the environmental impact assessment law, in order to use as a basic understanding
2. Focus on listening to project information, keep an open mind to accept information and cooperate in the environmental impact assessment process to benefit the community and the project

**Figure 3:** The Model of Public Participation in the Successful EIA

## Summary and Discussion of Results

In the issue of public participation in environmental impact assessment, it was found that the public participation method of the project is still not in accordance with the principles, procedures, and does not correspond to the community conditions and the characteristics of people in the area. This results in the public joining the opposition of the project, which is in accordance with the study of Chatarat Chompunth (2017), who found that the project owner should choose the appropriate participation method by considering the factors of community conditions and the characteristics of people in the area. This is also in accordance with the results of the study of the group, Thomas C. Meredith (1992), in which it was found that the guidelines for public participation should be disseminated thoroughly, there should also implement meetings to clarify and listen to comments on the environmental impact assessment thoroughly and frequently. Also, there should be use of publicity through publicizing thoroughly by using a variety of media, which is in accordance with the results of Pichet Soponpats and Chatarat Chompunth (2012) who found that the use of public participation in environmental impact assessment from the first step of the study of project will help prevent and reduce conflicts, which will lead to sustainable coexistence between the project and the people. Therefore, it can be concluded that public participation in environmental impact assessment methods should choose a method that is suitable for the community conditions and the characteristics of people in the area, which will create alternative or useful information for the development of the project.

In the issue of transparency of participation, it was found that project operators still lack transparency in the various operations of the project, resulting in people lacking confidence in the project. This is in accordance with the results of the study of Marasri Bouchum. (2011) who found that transparency in the work must be based on honesty, creation of mutual trust among all relevant personnel. Also, there must be publication of straightforward information in a language that is easy to understand, clear and can be verified for the personnel and stakeholders to be informed. Therefore, it can be concluded that project operators must conduct public participation in the EIA in a transparent, straightforward and informative manner, which will help increase the trust and faith in the project placed by the public and stakeholders.

The issue of accuracy of information found that people in the area received inadequate and incomplete project information. Moreover, some people are unable to access the project information, including information from the project. This results in confusion among the public about the project's information, which is in accordance with the results of Manida Fuangchoonuch and Chatarat Chompunth (2017) who found that people have obstacles in obtaining information that may not be enough for the decision-making process. This is because the information presented to the public is one-sided and is not clear enough that cause people to be confused. Therefore, it can be concluded that project operators must provide project information that is accurate, complete, clear, and disseminates information by choosing the appropriate method for stakeholders. This will allow stakeholders to understand the project information and helps to reduce prejudice towards past development projects.

For the coverage issues stakeholders, it was found that most people in the area know the information of the project, but the information is unclear and people who live far away from the project did not receive adequate information. This shows that the provision of information did not cover all stakeholders. This evidence is in accordance with the study of Chatarat Chompunth (2013), it was found that the identification of stakeholders must be done with prudence. This is to prevent the process of public participation, particularly consultation or public hearings from which mostly becoming only a voice from the interest group rather than representing the needs of the people. Therefore, it can be concluded that project operators must conduct public participation in environmental impact assessment to cover stakeholders. for the understanding of all parties, successful results for the project. Also, this can help reduce problems that may arise from the issue of inadequate provision of information that does not cover stakeholders. For the public's confidence issues, it was found that people in the area do not believe in the project due to past impact that occurred in other areas that the project operator is responsible for. This includes provision of unclear project information which does not cover all stakeholders. As a result, people are not convinced that entrepreneurs will establish an eco-friendly industrial project, this is therefore in accordance with the study of Satien Rujiravanich (2010), it was found that the public's confidence in the implementation of the project will occur when the project operator builds confidence about ways in solving problems with the public, including the ability in the mass relations which will reflect

the success of the project. The aforementioned method will result in the public having confidence in the project. In conclusion, the project operators must conduct suitable level of public participation in environmental impact assessment for community conditions, provide complete and accurate information, listen to public opinion, and allow the public to participate in the environmental impact assessment. This will help to increase the public's confidence to believe in the project more and also help reduce conflicts.

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# Factors Influencing The Intention to Purchase Smart Home Devices in Generation Y

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## Abstract

The objective of this quantitative research is to study the factors influencing the intention to purchase smart home devices in generation Y by collecting the online survey of 400 samples in Thailand. In order to prove the hypothesis, path analysis has been used to process the data. According to the statistics results, it is obvious that the perceived value directly influences the intention to purchase. The results also reveal that the most positive influencing factor for the people in generation Y is the perceived enjoyment, followed by the perceived compatibility and the perceived usefulness, respectively. On the other hand, the most negative one is the perceived fee, followed the perceived technicality. Compared to the literatures, the outputs are consistent with most of them. In term of benefit, businesses could arrange their smart home device campaigns based on the influencing factors to achieve the intention to purchase of their target customers in generation Y.

**Keywords:** Smart Home Devices, Intention to Purchase, Perception, Generation Y

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## ปัจจัยที่มีอิทธิพลต่อความตั้งใจซื้ออุปกรณ์บ้านอัจฉริยะ สำหรับผู้บริโภคกลุ่มเจนเนอเรชันวาย

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รับวันที่ 28 มีนาคม 2566 ส่งแก้ไขวันที่ 26 กรกฎาคม 2566 ตอบรับตีพิมพ์วันที่ 9 ตุลาคม 2566

### บทคัดย่อ

งานวิจัยเชิงปริมาณนี้มีวัตถุประสงค์เพื่อศึกษาปัจจัยที่มีอิทธิพลต่อความตั้งใจซื้ออุปกรณ์บ้านอัจฉริยะสำหรับผู้บริโภคกลุ่มเจนเนอเรชันวาย กลุ่มตัวอย่าง คือ ผู้ที่ใช้งานอินเทอร์เน็ตในประเทศไทยจำนวน 400 คน ผู้วิจัยใช้แบบสอบถามออนไลน์เป็นเครื่องมือในการเก็บรวบรวมข้อมูล สถิติที่ใช้ในการวิเคราะห์ข้อมูล คือ สถิติเชิงพรรณนา ในส่วนของสถิติที่ทดสอบสมมติฐานนั้น ได้แก่ การวิเคราะห์แบบเส้นทาง (Path Analysis) เพื่อหาความสัมพันธ์ที่เกิดจากอิทธิพลส่งผ่านจากตัวแปรค่านกลางรวมทั้งวิเคราะห์อิทธิพลทางตรงและทางอ้อมของตัวแปรที่มีต่อความตั้งใจซื้ออุปกรณ์บ้านอัจฉริยะจากการศึกษา พบว่า ปัจจัยที่มีอิทธิพลต่อการรับรู้คุณค่าในเชิงบวกมากที่สุดคือ การรับรู้ถึงความสนุกสนานในการใช้งาน รองลงมาเป็นการรับรู้ถึงความเข้ากันได้ และการรับรู้ถึงประโยชน์ในการใช้งานตามลำดับ ส่วนปัจจัยที่มีอิทธิพลต่อการรับรู้คุณค่าในเชิงลบมากที่สุดคือ การรับรู้ถึงต้นทุน และการรับรู้ถึงลักษณะของการใช้งานทางเทคนิคเป็นอันดับรองลงมา เมื่อเปรียบเทียบกับงานวิจัยอื่น ๆ ในเรื่องที่ใกล้เคียงกัน พบว่า มีความสอดคล้องกัน ในส่วนของประโยชน์ในภาคธุรกิจสามารถนำไปใช้ที่มีอิทธิพลไปปรับแผนการณรงค์ทางการตลาดเพื่อให้บรรลุวัตถุประสงค์ในด้านการทำให้ลูกค้าเกิดความตั้งใจซื้อสินค้าของตนได้

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## Introduction and Objectives

### Background and Significance of the Study

At present, technology greatly assumes an important role in the lives of the people around the globe. Their livelihood is affected as it changes following the global trend. Smart home is to connect the convenient electrical home devices with the internet or network system. The sensor is embedded in various devices to allow users to give order through smart home devices such as control of indoor lights, turning on/off lights and air condition, turning on television and music, indoor security system (Shin et al., 2017).

It is found that the reason for the consumers' concern is the costs. The development of smart home devices at the beginning costs a lot (Mani & Chouk, 2017). However, the functioning of the smart home devices requires the entrepreneur's awareness of the concern of consumers' privacy. The explanation must be made of the methods of data storage, and data analysis, as well as the increased ability of the devices to be able to delete the data not required by the customers for self-storage (Manager Online, 2019).

According to the information of smart home in Thailand from the statistic website Statista, it was found that the revenue in the smart home market in Thailand was expected to be as high as US\$ 151 million in 2020 and the household growth rate was 1.1% in 2020 and is expected to increase 8.8% by 2024. At present, the average income of installation of smart home per house values US\$ 18.35 (570.69 Baht).

**Table 1:** Comparison of Average Income per Current Installation of Smart Home

Countries	Average Income per Installation of Smart Home
Singapore	US\$41.01 (1,275.41 Baht)
Lao PDR	US\$41.22 (1,281.94 Baht)
Cambodia	US\$37.19 (1,156.61 Baht)
Malaysia	US\$21.30 (662.43 Baht))
Thailand	US\$18.35 (570.69 Baht)

Source: Search on June 27, 2020 from <https://www.statista.com/outlook/126/283/smart-home/thailand>

Although the installation rate per household increased 1.1% but the average data of the installation per household revealed that compared to Thailand and her neighboring countries, the average cost rate for installation in Thailand was lower than in many neighboring countries. Based on the statistics, the two groups of consumers with the age ranges of 34-25 years and 44-35 years were the consumer groups with the highest market share of smart home market in Thailand.

### **Research Question**

What are the factors that influence the intention to purchase smart home devices in Generation Y?

### **Objective**

To study the factors influencing the intention to purchase smart home devices in Generation Y.

### **Scope of Study**

This study was the quantitative research. It studied the factors influencing the intention to purchase smart home devices with the following scope. The sample used in this study included Generation Y who had already used or bought smart home devices. The sample in this study included Generation Y born between 1980-2000.

### **Expected Benefits**

- 1) To plan the entrepreneurs' adjustment to accommodate the growth of smart home that will happen in Thailand in the future.
- 2) To understand the demands of customers who constitute an important group to accommodate the increased purchases and utilize the factors impacting the intention to buy smart home devices for the formulation of marketing strategy.

## **Literature review**

### **Concept of Smart Home**

Smart home means the setting of convenience and comfort in a home where the automatic tools and equipment can be controlled from a long distance from

everywhere with the connection to the internet using the smart phone or other network tools. The tools in smart home connected to the internet will enable the users to control various functions such as access to home safety, temperature, light, and home theatre from long distance.

The smart home devices connected to one central point can have access with smart phone, tablet, laptop, or game console. Home devices such as door locks, televisions, temperature controller, camera, lighting, or even refrigerator can be controlled through the only automatic system in the house. The system can be installed on the smart phone or other network devices and the users can create programs or rectify or change various setups by themselves.

The smart home devices come with the ability to learn by oneself in order to learn the timetable of the homeowner and modify as needed. The smart home with the light control system will help the owner to reduce the electricity consumption and benefit from the energy savings. Some automatic home systems will warn the owner of any movement in the house while he or she is away. Other systems can phone officials such as the police or the fire brigade when there are situations. The smart doorbell, smart safety system, and smart devices are all part of the technology of Internet of Things (IoT) which is a network system that can compile and share electronic data.

The smart home has wire or wireless systems or both. The wireless system is easier installed. The wireless automatic home system with qualities such as smart lighting system, weather control, and safety may not be expensive. On the contrary, the wire system is more reliable and not easily hacked. The wire system can increase value in reselling the house but the disadvantage is that it is more expensive than the wireless system (Chen, 2020).

### **Concepts and Theories of the Generation (Classification of People According to Time Period)**

The definition of Gen Y according to economists is the group of people born at the beginning of 1980s to 1990s. They form a big group of population that the world gives importance to and studies their behavior for understanding and communication. So, there are a lot of definitions given to this group of people. The definition of Gen Y started in 1993.

At the beginning, no condition of age was determined but the definition was given at the age of the Millennials. Some gave the definition of the group as the border line between Gen Y and Gen Z, tend to move back to their families due to economic problems, and tend to get married late.

In terms of the behavior of Gen Y according to the concept of economists, Gen Y are mostly the children of Gen X. Gen X is born at the period of economic growth which makes the parents of Gen Y succeed and can afford their Gen Y children to have higher education. At present, most of Gen Y are university-educated or at the beginning of their career. Gen Y constitutes the group with the highest rate among the four groups of consumers. This group of population has high income and purchasing power. Gen Y can do many things at the same time by connecting two types of devices to the internet at the same time (Ministry of Public Health, 2020).

### **Value based Adoption Model (VAM)**

It is presented by Kim et al., 2007 as Technology Acceptance Model (TAM) has constraints to explain the recognition of new ICT at the individual level. Most workers and users of traditional technology work as employees in organizations. Their objective is to use technology for work only. The recognition and the use will become the burden of the organization instead. On the contrary, the users of new ICT who are ordinary people have the double role of users of technology and consumers. Most recognize the use of technology for personal objective. The costs are voluntary and personally paid. The use depends on the individual. One main problem in recognizing the use of ICT technology is financial costs such as usage fees. Therefore, consumers will recognize the use of new technology more than general technology users. The objective is to inspect the recognition of the use of the new ICT technology from the perspective of the consumers and not that of the technology users (Kim et al., 2007). Therefore, the VAM model looks at the additional factor in some loss to compensate for something (Sacrifice). It consists of recognition of Perceived technicality, and Perceived fee. As for the Benefit, it consists of Perceived usefulness and Perceived enjoyment (Kim et al., 2017).

Perceived Value means the overall assessment of the net benefit of consumers of goods or services according to the assessment of the customers which will offset between recognition of the received benefit and the lost benefit. If one feels that one

receives benefit more than loses the benefit, one will perceive value. Perceived Usefulness means the level that an individual believes that the use of the system will make his or her work more efficient. Perceived Enjoyment means the level that an individual participates in an activity and perceives enjoyment that he or she experiences apart from the expected efficiency due to usage. Perceived Fee means payment according to the goods' real prices. Generally, it is measured by the perception of the consumers' real paid prices. The perception of lost benefit will have negative impact on the perception of value. Perceived Technicality means the level of perception of new technology of technical service. Because money is not the only factor that the consumer feels the loss. The consumer also takes into account the perceived fee that is not only money but also the time spent in the efforts to seek or costs that need to be spent for convenience. Purchase Intention means the intention to purchase depends on each individual's intention in the efforts and the plan to purchase goods.

**Table 2:** Summary of Relevant Theories and Research Works

Theories/Research References	Names of Inventor/Researcher (Years A.D.)	Variables							
		Perceived Usefulness (PU)	Perceived Enjoyment (PE)	Perceived Technicality (PT)	Perceived Fee (PF)	Perceived Privacy Risk (PR)	Perceived Compatibility (PC)	Perceived Value (PV)	Purchase Intention (PI)
Value based Adoption Model (VAM)	(Kim, Chan & Gupta, 2007)	X	X	X	X			X	X
Predicting e-services adoption: a perceived risk facets perspective	(Featherman & Pavlou, 2003)	X				X			
Perceived Risk and Product Involvement on Taobao.com	(Han, Chung, Kim & Youjeong, 2017)					X			
Understanding consumer intention to participate in online travel community and effects on consumer intention to purchase travel online and WOM	(Agag & El-Masry, 2016)	X					X		

## Research Conceptual Framework and Hypotheses

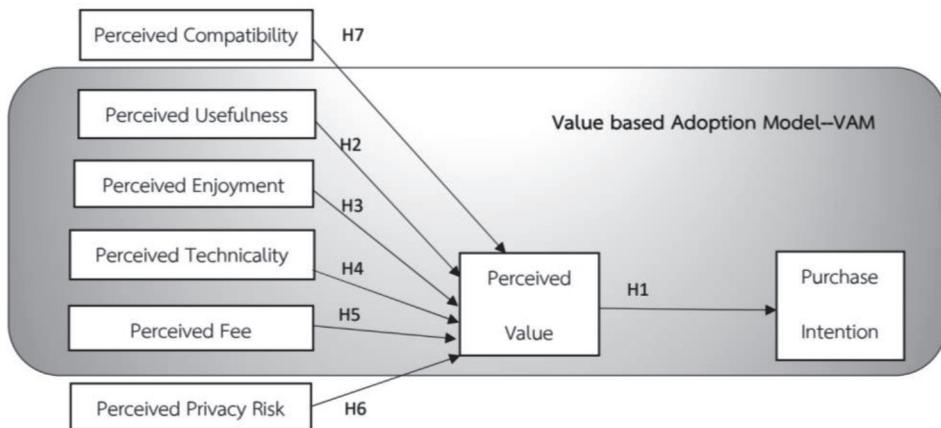


Figure 1: Research Conceptual Framework

- H1: Positive perceived value influenced the intention to purchase smart home devices in Generation Y.
- H2: Positive perceived usefulness influenced the intention to purchase smart home devices in Generation Y through the perceived value.
- H3: Positive perceived enjoyment influenced the intention to purchase smart home devices in Generation Y through the perceived value.
- H4: Negative perceived technicality influenced the intention to purchase smart home devices in Generation Y through the perceived value.
- H5: Negative perceived fee influenced the intention to purchase smart home devices in Generation Y through the perceived value.
- H6: Negative perceived privacy risk influenced the intention to purchase smart home devices in Generation Y through the perceived value.
- H7: Positive perceived compatibility influenced the intention to purchase smart home devices in Generation Y through the perceived value.

## Methodology

### Research Sample

There were 35,954,165 internet users in Thailand (The Information and Communication Technology Survey on Household, National Statistical Office, 2018). In selecting the sample in this study, the size of the sample was determined in case the population size was known using the Krejcie & Morgan formula as follows:

$$n = \frac{\chi^2 N p (1-p)}{e^2 (N-1) + \chi^2 p (1-p)}$$

**n** = Size of sample

**N** = Size of population

**e** = Tolerance level of sample

$\chi^2$  = Chi-Square at df equals 1 and level of confidence %95 ( $\chi^2 = 3.841$ )

**p** = Proportion of interesting traits in population (If not known, determine **p** = 5.0) represented as follows:

$$\frac{3.841 \times 35,954,165 \times 0.5 \times 0.5}{(0.05)^2 (35,954,165-1) + 3.841 \times 0.5 \times 0.5}$$

$$n = 095.384$$

Therefore, taking into account the error in data collection that did not meet the set number, the sample size of 400 persons were added for the study.

### Data Analysis

After collecting all the data, the researchers conducted data analysis using SPSS and AMOS program in the following processes:

1) In terms of data inspection, the researchers must inspect the correctness and completeness of the data in the questionnaire and separate incomplete questionnaires.

2) Record the questionnaire in the data processing program using the statistical program for the data processing. This research used the statistical significance at the level of 0.05.

3) Data analysis in the questionnaire, statistical analysis with Descriptive Statistics to describe the demographic data in the analysis of the general, basic data.

4) Inference Statistics through Path Analysis (using AMOS) to analyze the direct and indirect influences of the variables of the factors and directions of relationship.

## Empirical Results

### Data Processing Outputs

In Table 3, the descriptive statistics outputs consisting of genders, status, education levels, occupation and monthly income are shown. In addition, the perception levels of each factor can be seen in Table 4. In Table 5, the congruence analysis, which was proceeded after model arrangement, shows that the model was fit enough to process further.

**Table 3:** Number and Percentage of the Questionnaire Respondents

Gender	Number (persons)	Percentage
Male	170	42.50
Female	193	48.25
LGBT+	37	9.25
<b>Total</b>	<b>400</b>	<b>100</b>
Status	Number (persons)	Percentage
Single	262	65.5
Married	129	32.25
Divorced	9	2.25
<b>Total</b>	<b>400</b>	<b>100</b>
Education	Number (persons)	Percentage
Lower than B.A. degree	16	4.0
B.A. degree	227	56.75
M.A. degree	146	36.50
Doctoral degree	11	2.75
<b>Total</b>	<b>400</b>	<b>100</b>

**Table 3:** Number and Percentage of the Questionnaire Respondents (cont.)

Occupation	Number (persons)	Percentage
Private company employees	161	40.25
Government officials	29	7.25
State enterprise employees	62	15.50
Business owners	63	15.75
Students	76	19.0
Others	9	2.25
<b>Total</b>	<b>400</b>	<b>100</b>
Monthly income	Number (persons)	Percentage
Lower than 10,000 baht	29	7.25
10,001-20,000 baht	63	15.75
20,001-30,000 baht	95	23.75
30,001-40,000 baht	89	22.25
40,001-50,000 baht	62	15.5
Over 50,000 baht	62	15.5
<b>Total</b>	<b>400</b>	<b>100</b>

**Table 4:** Analytical Results of the Perception Levels of the Questions for Each Factor

Factors	Mean	Standard Deviation (SD)	Perception Levels
Perceived usefulness (PU)	4.33	0.53	Highest
Perceived enjoyment (PE)	4.08	0.67	High
Perceived compatibility (PC)	4.28	0.53	Highest
Perceived technicality (PT)	2.59	1.19	Low
Perceived fee (PF)	2.70	1.08	Moderate
Perceived privacy risk (PR)	2.89	1.14	Moderate
Perceived value (PV)	3.99	0.64	High
Purchase intention (PI)	4.18	0.55	High
<b>Overall factors</b>	<b>3.63</b>	<b>0.79</b>	<b>High</b>

Table 5: Results of Congruence Analysis

Statistical Criteria	Tolerance Level	Analytical Results (After Model Improvement)
CMIN/DF	$\leq 3.00$	2.714
GFI	[0, 1]	0.979
RMR	$\leq 0.08$	0.058
RMSEA	$<0.5$	0.066
AGFI	$\geq 0.70$	0.941
NFI	[0, 1]	0.980
CFI	[0, 1]	0.987
PNFI	[0, 1]	0.455
PCFI	[0, 1]	0.458

Afterwards, the model was analyzed with the Structural Equation Modeling to find if a variable influenced another variable. The results of the data analysis show in Figure 2 and Table 6.

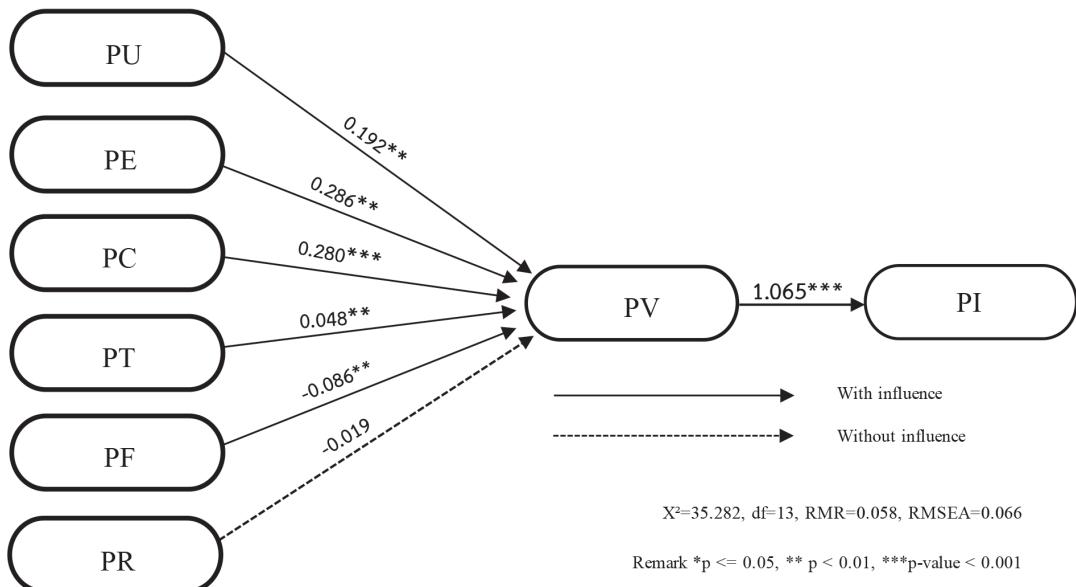


Figure 2: Standard Path Coefficient of the Model According to the Research Hypothesis

**Table 6:** Analytical Results of the Causal Influences within the Model

		Independent Variables						
Dependent Variables	Influences	PC	PE	PU	PR	PF	PT	PV
PV	Direct	0.280***	0.286***	0.192***	-0.019	-0.086**	0.048**	
	Indirect	-	-	-	-	-	-	-
PI	Direct	-	-	-	-	-	-	1.065***
	Indirect	0.299***	0.304***	0.204***	-0.020	-0.092**	0.051**	

**Remark** \*p < 0.05, \*\* p < 0.01, \*\*\* p-value < 0.001

### Results of Hypothesis Tests

Each hypothesis was tested and analyzed as follows and summarized in Table 7.

Hypothesis 1 (H1): Positive perceived value influencing the intention to purchase smart home devices in Generation Y revealed that the influence had the weight of 1.065 with the relationship in the same direction at the statistical significance at 0.001 in accordance with the research hypothesis.

Hypothesis 2 (H2): Positive perceived usefulness influencing the intention to purchase smart home devices in Generation Y through perceived value revealed that the influence had the weight of 0.204 with the relationship in the same direction at the statistical significance at 0.001 in accordance with the research hypothesis.

Hypothesis 3 (H3): Positive perceived enjoyment influencing the intention to purchase smart home devices in Generation Y through perceived value revealed that the influence had the weight of 0.304 with the relationship in the same direction at the statistical significance at 0.001 in accordance with the research hypothesis.

Hypothesis 4 (H4): Negative perceived technicality influencing the intention to purchase smart home devices in Generation Y through perceived value revealed that the influence had the weight of 0.051 with the relationship in the same direction at the statistical significance at 0.01 in accordance with the research hypothesis.

Hypothesis 5 (H5): Negative perceived fee influencing the intention to purchase smart home devices in Generation Y through perceived value revealed that the influence had the weight of 0.092 with the relationship in the opposite direction at the statistical significance at 0.01 in accordance with the research hypothesis.

Hypothesis 6 (H6): Negative perceived privacy risk influencing the intention to purchase smart home devices in Generation Y through perceived value revealed that there was no influence because the Sig. (2-tailed) equaled 0.438 which was higher than the statistical significance at 0.05 which was not in accordance with the research hypothesis.

Hypothesis 7 (H7): Positive perceived compatibility influencing the intention to purchase smart home devices in Generation Y through perceived value revealed that the influence had the weight of 0.299 with the relationship in the same direction at the statistical significance at 0.001 which was in accordance with the research hypothesis.

**Table 7:** Summary of the Test Results of Research Hypotheses

	Hypotheses	Test Results
H1	Positive perceived value influencing the intention to purchase smart home devices in Generation Y.	Hypothesis acceptance
H2	Positive perceived usefulness influencing the intention to purchase smart home devices in Generation Y through perceived value.	Hypothesis acceptance
H3	Positive perceived enjoyment influencing the intention to purchase smart home devices in Generation Y through perceived value.	Hypothesis acceptance
H4	Negative perceived technicality influencing the intention to purchase smart home devices in Generation Y through perceived value.	Hypothesis acceptance
H5	Negative perceived fee influencing the intention to purchase smart home devices in Generation Y through perceived value.	Hypothesis acceptance
H6	Negative perceived privacy risk influencing the intention to purchase smart home devices in Generation Y through perceived value	Hypothesis refusal
H7	Positive perceived compatibility influencing the intention to purchase smart home devices in Generation Y through perceived value.	Hypothesis acceptance

## Summary and Discussion

Based on the empirical results shown in the previous section, it was obvious that, for people in generation Y, the perceived value (PV) was directly and significantly influencing the purchase intention (PI). Also, the perceived usefulness (PU), perceived enjoyment (PE), perceived technicality (PT), perceived fee (PF) and perceived compatibility (PC) were influencing the purchase intention through the perceived value. Comparisons with literature are shown in Table 8:

**Table 8:** Summary of the Factor Comparisons with the Literature

Hypotheses	In accordance with
Positive perceived value influencing the intention to purchase smart home devices.	Kim et al., 2007 Ponte et al., 2005 Kwon et al., 2007
Positive perceived usefulness influencing the intention to purchase smart home devices through perceived value.	Jamal et al., 2015
Positive perceived enjoyment influencing the intention to purchase smart home devices through perceived value.	Nguyen, 2015
Negative perceived technicality influencing the intention to purchase smart home devices through perceived value.	Kim et al., 2019
Negative perceived fee influencing the intention to purchase smart home devices through perceived value.	Liu et al., 2015
Negative perceived privacy risk influencing the intention to purchase smart home devices through perceived value.	-
Positive perceived compatibility influencing the intention to purchase smart home devices through perceived value.	Ifinedo & Princely, 2018 Agag & El-Masry, 2016

According to the results, the perceived value was something that happened before the intention to buy. In the case of perceived usefulness, labeling is an option and could increase an opportunity for customers to perceive the value. Additionally, making the product with enjoyment such as games in smartphones may influence customers to perceive the value. With respect to the result, compatibility should be considered with caution to ensure that it meets with the demand of consumers' value and lifestyle.

In the part of influencing negative factors, businesses should make it clear to their customers that less technical knowledge and affordable cost are required. Although the perceived privacy risk is not an influencing factor, businesses still need to aware of due to responsibility and regulations.

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# Developing Institutional Structural Frameworks for Promoting The Eco-Industrial Towns under The Context of Thailand

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## Abstract

This paper explores the development of institutional structural frameworks for promoting eco-industrial towns in the context of Thailand. Eco-industrial towns are sustainable development models that aim to integrate industrial activities with environmental stewardship and social well-being. The study examines the unique challenges and opportunities in Thailand and proposes a comprehensive framework to facilitate the establishment and successful operation of eco-industrial towns.

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The research identifies the need for a holistic approach that balances economic growth, environmental protection, and community engagement. Drawing on international best practices and lessons learned from existing eco-industrial towns worldwide, the paper presents a conceptual framework tailored to the Thai context. The proposed institutional structural framework comprises several key elements. First, it emphasizes the establishment of a dedicated regulatory and policy framework that incentivizes sustainable practices and sets clear environmental and social performance standards. Second, it promotes the formation of partnerships among various stakeholders, including government agencies, industries, local communities, and non-governmental organizations, to foster collaboration and knowledge exchange. Furthermore, the framework highlights the importance of capacity building and knowledge dissemination to enhance understanding and implementation of eco-industrial principles. It suggests the establishment of training programs, research institutes, and platforms for sharing best practices and technological innovations. Additionally, the involvement of financial institutions and mechanisms to facilitate access to capital for eco-industrial projects is underscored.

**Keywords:** Eco-industrial Towns, Institutional Framework, Sustainable Development, Thailand, Environmental Stewardship, Social Well-being

## การพัฒนากรอบโครงสร้างสถาบันสำหรับการส่งเสริมเมืองอุตสาหกรรมเชิงนิเวศในบริบทของประเทศไทย

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### บทคัดย่อ

บทความนี้ศึกษาการพัฒนากรอบโครงสร้างสถาบันสำหรับการส่งเสริมเมืองอุตสาหกรรมเชิงนิเวศในบริบทของประเทศไทย โดยที่เมืองอุตสาหกรรมเชิงนิเวศ คือ โมเดลการพัฒนาแบบยั่งยืน ที่มุ่งบูรณาการกิจกรรมเชิงอุตสาหกรรมกับภาระการให้บริการดูแลสิ่งแวดล้อมและสุขภาวะทางสังคม งานวิจัยนี้ศึกษาความท้าทายเฉพาะและโอกาสในประเทศไทย ประกอบกับเสนอแนะกรอบในการอำนวยความสะดวกการจัดตั้งและดำเนินการให้เกิดผลสำเร็จของเมืองอุตสาหกรรมเชิงนิเวศ งานวิจัย พบว่า มีความต้องการด้านรูปแบบองค์รวมที่สามารถสมดุลการเจริญเติบโตทางเศรษฐกิจ การป้องกันสิ่งแวดล้อม และการมีส่วนร่วมของชุมชน โดยการใช้แนวทางปฏิบัติที่ดีที่สุดระดับสากล และบทเรียนจากเมืองอุตสาหกรรมสิ่งแวดล้อมที่มีอยู่ทั่วโลก ทั้งนี้ บทความจะนำเสนอกรอบแนวคิด เนื้อหาในบริบทของประเทศไทย กรอบโครงสร้างสถาบันที่นำเสนอนั้น มีองค์ประกอบสำคัญหลาย

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องค์ประกอบหนึ่ง คือ เน้นการจัดให้มีกรอบเชิงนโยบายและกำกับดูแลที่เฉพาะเจาะจง อันจะเป็นการผลักดันวิธีปฏิบัติที่ยั่งยืนและกำหนดมาตรฐานศักยภาพด้านสังคมและสิ่งแวดล้อมที่ดีด้วย สอง คือ การส่งเสริมการสร้างพันธมิตรในกลุ่มผู้มีส่วนได้ส่วนเสีย รวมทั้งหน่วยงานรัฐบาล ชุมชนท้องถิ่น และองค์กรอิสระ ทั้งนี้ เพื่อสนับสนุนความร่วมมือและการแลกเปลี่ยนความรู้ นอกจากรัฐบาล ที่ได้ดำเนินการด้านหลักการของเมืองอุตสาหกรรมเชิงนิเวศเพิ่มมากขึ้น ให้เกิดความเข้าใจและการดำเนินงานด้านหลักการของเมืองอุตสาหกรรมเชิงนิเวศเพิ่มมากขึ้น งานวิจัยยังเสนอให้จัดทำโปรแกรมการอบรม สร้างสถาบันวิจัยและช่องทางอื่น ๆ เพื่อแลกเปลี่ยน วิธีปฏิบัติที่ดีที่สุดและนวัตกรรมทางเทคโนโลยี อย่างไรก็ตาม สถาบันการเงินและกลไกเพื่อ อำนวยความสะดวกในการเข้าถึงต้นทุนสำหรับโครงการอุตสาหกรรมเชิงนิเวศนั้น พบร่วมกับ ยังอยู่ในระดับต่ำกว่าเกณฑ์

**คำสำคัญ:** เมืองอุตสาหกรรมเชิงนิเวศ ครอบคลุมสถาบัน การพัฒนาที่ยั่งยืน ประเทศไทย ภาวะ การให้บริการดูแลสิ่งแวดล้อม สุขภาวะทางสังคม

## Introduction

Institutional Structural Frameworks (ISFs) can usually be divided into two levels: tall structure and wide structure. The process will be delayed due to the scrutiny of several committees, as is the case with the ISF regarding the driving of Thailand's Eco-Industrial Towns (EIT). After cabinet approval, It must be reviewed by the National Industrial Development Board (NIDB) before the policy can be passed on to EIT Development Steering Committee, EIT Development Integration Subcommittee, EIT Development Specialist Committee, Provincial EIT Development Committee, Provincial EIT Development Committee, Local Eco-Industry Mobility Working Group, and Eco Industry Network Working Group. The hallmark of a narrow high IFS is that administration committees are closely aligned with policymakers. In addition, the work that is academically produced is of high quality because it is under the control of specialized experts such as the Board of Experts in Urban Development, Eco-Industrial Committee, etc. However, the limitation of a narrow high ISF is that it has a long working period due to the range of controls. (Span of Control) that is quite wide compared to the wide-ranging low ISF. There are also several limitations associated with a narrow high ISF. For instance, there is a relatively high cost of holding each meeting. There is an over-management level. The distance between policymaker level (cabinet) and worker level (local EISWG and eco-industry network working group) is quite prominent. Another weakness is that workers are more likely to be eliminated from freedom of expression.

The authoritarian nature of the administration may bring about the problem of neglecting the true resonance of the people, including local stakeholders. On the other hand, a broad, low-ranging ISF can reduce administrative costs by a smaller number of meetings. Workers are highly independent to work, because policymakers or cabinets have so many policymakers, there is little control over them. However, the limitations of the broad ISF are short. It is necessary for policymakers to have an understanding of the problems that drive the right EIT, and be aware that policy fulfillment controls may not be possible thoroughly due to the excessive number of policy responders. Weighing between the hallmarks of a narrow high-rise ISF, subtracted by the limitations mentioned earlier, it is important as well as allowing other committees involved in driving EIT with a variety of dimensions. It is another channel that, in addition to saving government

budgets and costs, contributes significantly to the integration between government organizations to fight the sustainable development goals effectively.

## The Methodology

The objective of this study is to describe how an ISF shapes the policy implementation of Thailand's Resource Efficiency concepts and Clean Production (RECP) (Berkel, 2016; UNIDO, 2016, 2017, 2021). It applies a qualitative approach via focus group to acquire how roles and responsibilities of a variety of policy actors (i.e., the prime minister, the cabinet, the policy boards, the local governments) determine the results of RECP. This study conducted 17 focus groups during November 11, 2021, and December 9, 2021 with the total of 467 participants mainly the representatives from the related boards, the senior bureaucrats from Ministry of Industry, the local governments, academics and research institutes, and factory management sections. The questions for open discussion include institutional mechanisms, resource efficiency, industrial-urban symbiosis, the BCG model, EIT, corporate social responsibility (CSR), and concerns over the disadvantaged participating in the sustainability scheme. After that, this study used constant comparative technique to analyze qualitative data from focus group. The coders identified the main themes including expected results of RECP policy and key characteristics of its implementation.

## Policy Proposals and Measures Associated with ISF to Drive EIT

The EIT is an initiative to promote and gear the economic development and environmental sustainability of industrial estates. The EIT award is granted to an industrial estate which focuses on and actively promotes organization governance, human rights, labor practices, environment, community involvement and development (WHA Corporation, 2021). Meanwhile, The BCG economic model is a part of Thailand's post-COVID sustainable development strategy which centers on integrating knowledge, technology, and innovation to promote resource wealth, cultural diversity, and nurturing the country's spirit (NSTDA, 2023). Specifically, the BCG economic model urges the entrepreneurs to apply the concepts of bioeconomy, circular economy, as well as green economy when designing and offering high value products and services to their customers. As a result, production following the BCG economic model is eco-friendly and requires less resource input, while conserving natural and biological resources.

## Proposed Policies/Measures

ISFs that are framed in a high, narrow manner undermine the development of EIT as a consequence of its tall-narrow structure, which is still a lack of players to become key locomotives in driving the policy. The working group has therefore drawn up proposals to improve the ISF in three different ways, which can be described as below:

### 1) ISF Proposal Type 1

The first proposal the panel has analyzed is to maintain the same tall-narrow structure (Figure 1), but added the “*new players*” part to ensure sustainability towards driving EIT, such as the “National Reform Commission (NRC)” representatives should be filled. It is part of an ISF such as the NIDB, which consists of: The Prime Minister is a chairman of the Board of Directors. The Deputy Prime Minister is a vice chairman of the Board of Directors. Minister of Finance, Minister of Foreign Affairs, Minister of Higher Education, Science, Research and Innovation, Minister of Agriculture and Cooperatives, Minister of Digital Economy and Society, Minister of Natural Resources and Environment, Minister of Energy, Minister of Commerce, Minister of Interior, Minister of Labour, Minister of Education, Minister of Health, Minister of Industry, Secretary-General of the Board of Investment, Secretary-General of the National Economic and Social Development, Council Director of Budget Office, Secretary-General of the Eastern Special Development Zone, Policy Committee Director, Office of Small and Medium Enterprises Promotion, Chairman of the National Farmers’ Council, Chairman of the Chamber of Commerce of Thailand, Chairman of the Industry Authority of Thailand, Chairman of the Thai Bankers Association, and no more than three qualified persons appointed by the Prime Minister as directors. It is known that the NRC has been appointed accordingly. The National Planning and Reform Act B.E. 2560 (2017), or National Reform Act, is responsible for developing plans to reform the countries in various areas set out in the 2017 Constitution and the National Reform Act, as well as doing other tasks as assigned by the National Strategy Committee (NSC). NSC requires the preparation of reform plans and procedures in the following areas: 1) Politics, 2) Public Administration, 3) Law, 4) Justice, 5) Education, 6) Economics, 7) Natural Resources and Environment, 8) Public Health, 9) Journalism Information Technology 10) Social, 11) Energy, 12) Culture, Sports, Labor and Human Resource Development, and 13) the Prevention and Suppression of Corruption and Misconduct.

The working groups (i.e. the National Economic Reform Commission, Natural Resources and Environment and Public Health, and the NRC) propose the establishment of a “National Industrial Reform Commission (NIRC)”. To be responsible for framing the the Eco-Industrial Urban Development (EIUD) policy for the country. In order for the Local EISWG and the Eco-Industry Network Working Group (EINWG) to work with the Local Quality of Life Development Policy Committee in accordance with Sections 11 (6) and (8) of the Public Order Act B.E. 2534 (1991), the Prime Minister, with the approval of the Cabinet, has designated a committee called the “Area Quality of Life Development Policy Committee (AQLDPC)”. The permanent secretary of the Interior Ministry is a chairman of the board of directors. The Permanent Secretary of The Ministry of Public Health is a vice chairman of the Board of Directors.

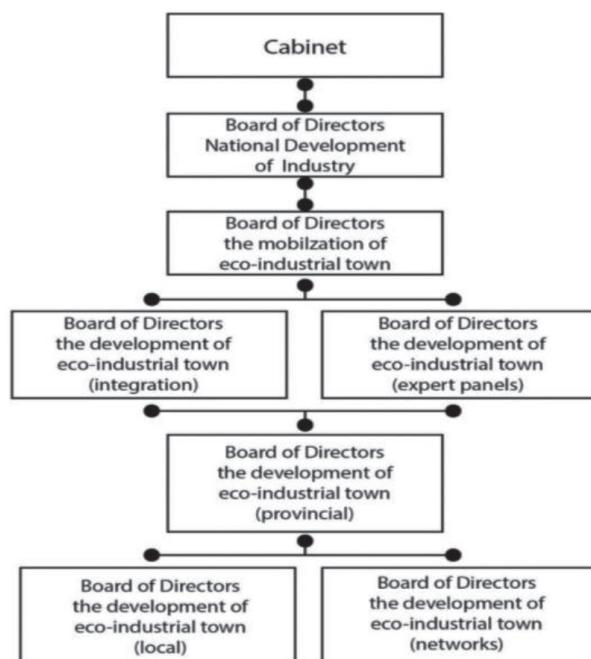


Figure 1: The Tall-Narrow Structure- Type 1

There are directors whose positions are: Permanent Secretary, Ministry of Social Development and Human Security Permanent Secretary, Ministry of Education, Director-General of the Department of Government Director-General of the Department of Community Development, Director-General of the CDC, Director-General of the Department of Health

Service Support, Director-General of the Department of Local Government, Director-General of the Department of Health Permanent, Secretary of Bangkok, Secretary-General of the National Health Board, Secretary-General of the National Health Security Agency, and the Fund Manager of Health Promotion Support Fund. The essence of the “AQLDPC” is to drive districts in provinces to achieve their goals based on the concepts of “Wellbeing/Quality of Life” and “People of the same district do not abandon each other/Thai people care about each other”. At the heart of the “AQLDPC”, it is to drive policy in the form of a centralized process to the board. EIT indicators should be integrated as part of the indicators of the well-being of people in the districts. In order to resolve the complicated ISF of high-narrow structure (Figure 1), the “Prime Minister’s Performance Delivery Unit “ or “PMDU”, which is a special unit in the Office of the Secretary-General of the Prime Minister can be used to support the government’s work in strategic and integrated missions. The emphasis is on solving problems for civilians who have failed to follow normal bureaucracy or have delays, which can cause damage to the wider public, are responsible by increasing integrated work between agencies in all sectors and having a duty to report on the progress of EIT to the Prime Minister directly.

## 2) ISF Proposal Type 2

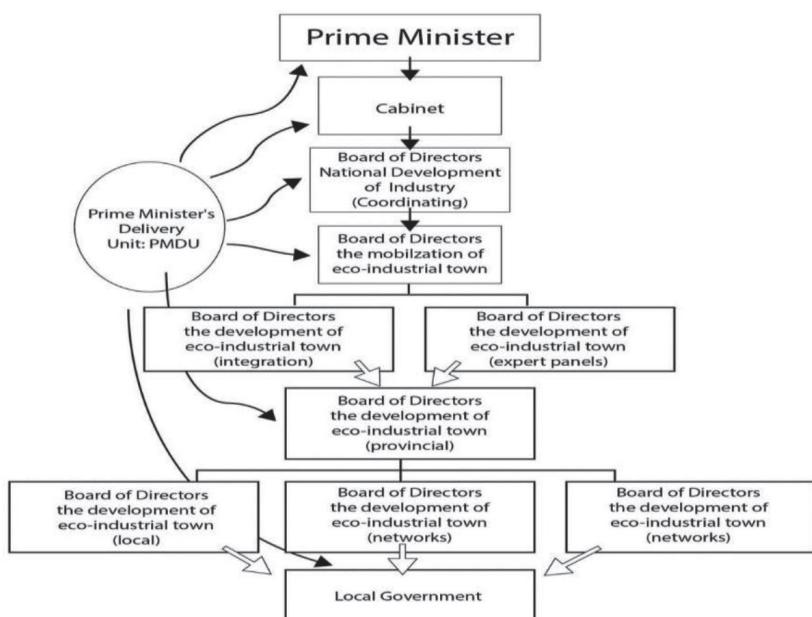


Figure 2: The Tall-Wide Structure - Type 2

The solution to the problem of ISF with a tall-narrow structure, the eco-industrial urban mobility or tall-wide structure (Figure 2), which not lie in increasing the number of players to become more complicated than ever. But it reduces the number of players to only the necessary amount, such as the dissolution of the EIUD Steering Committee. The EIUD Integration Subcommittee and the EIUD Specialist Committee are left with only the NIDB and the Provincial EIUD Board. Likewise, the local EISWG and the EINWG should be dissolved, leaving only the Subdistrict Administrative Organization (SAO) directly responsible.

### 3) ISF Proposal Type 3

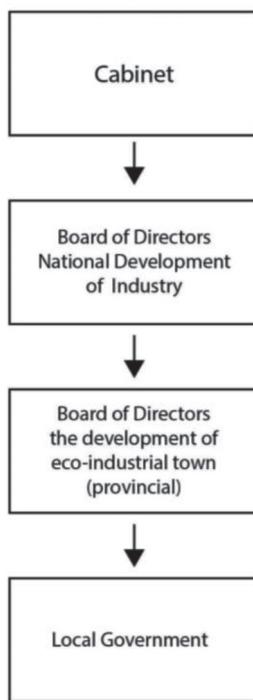


Figure 3: The Short-Narrow structures – Type 3

The Short-Narrow structure is the transfer of authority to drive EIT at the local level of the Eco-Industry Steering Working Group (EISWG) and the Eco-Industry Network Working Group (EINWG) to the supervision of municipalities, district administrations and provincial administrations instead, to modify the duties of the EIUD Steering Committee. The EIUD Committee and the Provincial EIUD Committee are in the form of consultants

instead to minimize the number of redundant and unnecessary meetings as possible. By using the “Quadruple Helix” concept, the BCG economic model was designed for moving forward together. According to Seesung, 2021, the BCG economic model can be considered as joining forces in the public-private/community/society-university/research institutes-international networks to “transform comparative advantage” in Thailand’s biodiversity and multiculturalism into competitive advantage, transforming more efficient production systems by using these ideas. By reducing inequality and building a strong and environmentally friendly community, one can lead to sustainable development. The BCG economic model can be applied to drive the country with innovation with the assistance of Ministry of Higher Education, Science, Research and Innovation (MHESI), which can also be involved in driving EIT. MHESI, which merges higher education and research and development agencies, has been established by the Ministry of Science and Technology with the Office of the Higher Education Commission, the Office of the National Research Council and the Office of Research Support Fund. Therefore, the workforce of MHESI is to develop high skills in line with the development of the country, including supervision and innovation development. For the drive of innovation by private companies, it can be done through the Science and Technology Park, where the company is located. Startups of universities, both central and local, are administrators. For example, Chiang Mai University has launched four Deep Tech Startups (November Innovation Co., Ltd., Innovation in Research and Development of Implant Devices; Smile Migraine Co., Ltd. is an AI platform for migraine patients; LogixAid Co., Ltd. produces GoGo Board, a series of learning robots for youth; Inno-edge company. Gogo Co., Ltd., who designed a pain assessment platform in the elderly, dementia), entered “Angkaew Holding Co., Ltd.” and has launched Venture Capital Fundraising, underpinning startups using advanced technology to create business value of over 3.2 billion baht. In addition, Chulalongkorn University has cultivated 50 “Deep Tech Startups” companies worth over 1.67 billion baht by bringing research and innovation from faculty members to help revive the Thai economy from the COVID-19 crisis. Increase competitiveness with internationals. This is an example of a party from the higher education sector for driving an EIT in the future (Figure 4).

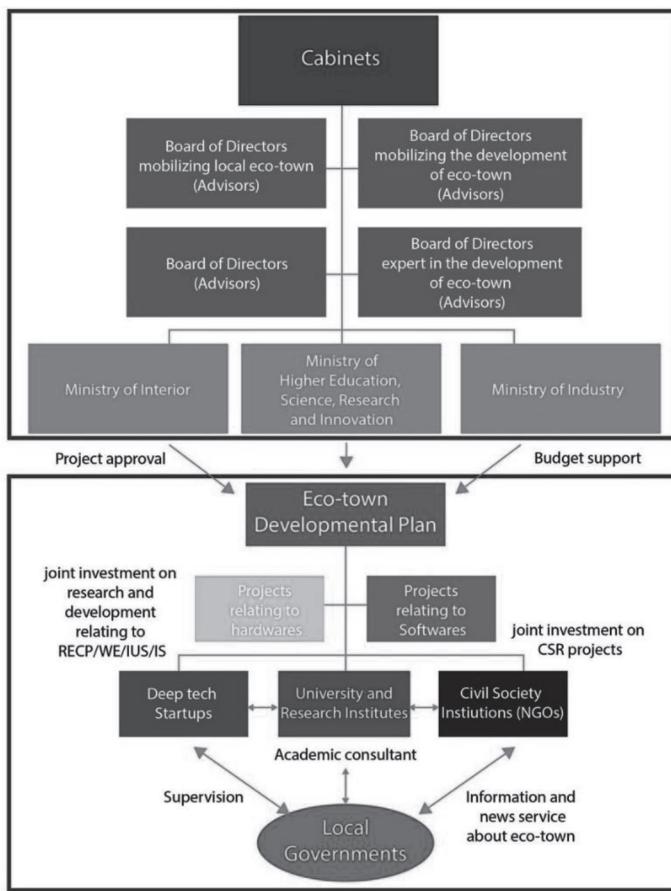


Figure 4: The Mixed Model Structure

#### Policy connection with 20-year national strategy and action plan to drive Thailand's development with the BCG economic model

The second ISF proposal is in line with the 20-year national strategy and Thailand's development drive action plan with the BCG economic model as follows:

- 1) The 20-year national strategy for rebalancing and developing a public sector management system whose main goal is to make the public sector smaller and adaptable to changing conditions. Meet the needs of the people quickly and easily. Transparently, section 4.3 clearly states that the government should be smaller, appropriate for the mission, encourage people and all sectors to participate in the development of the country, and establish the relationship between the central government administration and SAO. It also has the right level of critical mission transfer and decentralization to strengthen

communities and localities. Dissolution of EIUD steering committee, the EIUD integration subcommittee and the EIUD committee remain only the NIDB in line with the concept of the 20-year National Strategy on balancing and developing the government management system title 4.3.

2) The 20-year national strategy for rebalancing and developing the public sector management system, title 4.3.3, clearly outlines the concept of promoting decentralization and supporting the role of local communities to make local governments high-performance agencies. It is based on good governance principles, in line with the concept of requiring a smaller ISF and in relation to the practical sector. In addition, the 20-year national strategy outlines mechanisms for properly collecting taxes and local income to be used in activities for responding to problem solving and developing eco-industrial areas in conjunction with local communities.

#### **Expected results from policy proposals and measures related to ISF**

Since the first ISF Proposal is tied to the structure in the traditional tall structure manner, where all government agencies, including the private sector, are already familiar with, what is added is that the new players, which are the “National Reform Commission on Industry”. In case of any problems or obstacles, there is a PMDU to report directly to the Prime Minister to have a command down to deal with such issues. The second ISF proposal is characterized by structural simplifying, leaving only the agencies or committees necessary for real mobility. As a consequence, the number of meetings will be significantly reduced. Hence, the procedure for obtaining board approval has a comparatively shorter processing period. This institutional structure can attract more financial support from foreign investors than traditional institutional structures, as the second ISF proposal is based on a 20-year national strategic plan for rebalancing and developing a public sector management system, reducing workload and reducing operational redundancies from government agencies. For that reason, negative echoes or resistances from ministry officials who are associated with driving EIT are likely to be less than the the first ISF proposal. The third ISF proposal is characterized by a combination of high-profile, wide and short structural frameworks, compromising the concept of public administration in both the top-down approach, which focuses on centralized power (Sabatier, 1986) and the bottom-up approach, which highlights primarily on the needs and contributions of

civil society (Imperial, 2021), the influx of opportunities for creativity from research institutions and universities to help stimulate innovation linked to RECP/WE/IUS/IS by the private sector in the form of a company. Start Up Deep Tech is the main organization for driving a new business model, which will bring sustainable development of EIT.

### **Trade-off analysis of policy proposals and measures related to the new ISF compared to traditional policies and measures**

The hallmark of the type-1 proposal is that the mistakes of presenting the policy will be minimized, as they have been carefully considered by a series of departmental panels. Tall structures can inevitably affect decision delays. Due to a comparatively large amount of task forces, it is almost impossible for PMDU to attend all the meetings for approving the projects and launching new policies. The trade-off for minimizing any mistakes associated with project's approval or creating new policies is to loss of opportunities for foreign investment, as well as the response to emergency cases such as cybercrime, which need to be responded as immediately as possible. On the contrary, the advantage of the type-2 proposal has the relatively shorter period of decision making in comparison with the structural framework under the type-1 proposal, which is filled with several committees. However, the declining number of board members inevitably undermines the level of careful consideration associated with the proposed project, which can subsequently lead to the hidden taps in decision making. For such reasons, it is worth bearing in mind that the ease of consideration had to be compensated by the risk that the project proposal may have neglected and overlooked deficiencies, negatively affecting the development of EIT in the broad picture, as well as in technical or cultural dimensions, political landscapes, and social conflict situations that are specific to each area. The strength of the third offer is that it combines the advantages of both the first and second form. MHESI has been urged to become the main host by using universities and research institutes as think tanks to drive EIT and provide opportunities for the SAO to create some new ideas. It has more powers to manage and open channels for civil society to be a part of EIT. What may happen in the future if the third ISF is applied is that there will be a noticeable disparity between SAOs with visionary leaders. The level of leadership (i.e. active leadership vs. reflective leadership) can make a big difference in term of fund raising campaigns to drive EIT (Castelli, 2016; Nawaz and Khan, 2016).

### Overview risk analysis of policy proposals and measures related to ISFs

In this study, the SWOT analysis, including strengths, weaknesses, opportunities, and threats, was used to analyze risks regarding ISFs in three different forms as already proposed above. The following details are written as below:

**Table 1:** SWOT Analysis on the Tall-Wide Structure ISF Proposal - Type 1

<b>Strengths</b> <ul style="list-style-type: none"> <li>- open to each agency to express their opinions fully</li> <li>- carefully moderated. The chances of mistakes are therefore minimized</li> </ul>	<b>Weaknesses</b> <ul style="list-style-type: none"> <li>- takes longer for each policy to crystallize</li> <li>- makes the decision slow</li> <li>- the lost of opportunity to collect foreign investors who may decide to change investment countries</li> <li>- too many government agencies involved</li> <li>- The migration of bureaucratic positions is therefore difficult to reject and directly affects the continuity of eco-industrial urbanization inevitably.</li> </ul>
<b>Opportunities</b> <ul style="list-style-type: none"> <li>- integrated, with a national strategy as the primary goal and linking development at all levels</li> <li>- all issues, every mission in all areas are in line with the concept of the 20-year national strategy for rebalancing and developing the management system title 4.2.1, which focuses on adopting the national strategy as a driving mechanism for national development and the use of the PMDU for driving EIT</li> </ul>	<b>Threats</b> <ul style="list-style-type: none"> <li>- cyber threats are now one of the main problems of large organizations and agencies, especially those and organizations associated with the industry that are vulnerable to be attacked by hackers.</li> <li>- lacks the agility to interact, the necessary emergency situation requires immediacy to make decisions</li> <li>- slow and lacking agility to counter threats that need to be dealt with instantly.</li> </ul>

**Table 2:** SWOT Analysis on the Short-Narrow Structure ISF Proposal – type 2

<b>Strengths</b> The fact that the ISF is relatively short leads to the faster and more agile management than the ISF in type-1 and type-3.	<b>Weaknesses</b> When the duration of consideration decreases, the number of committee members to carefully discuss the problems/issues were automatically decreased as a result of reduced consideration time. Hence, the risk of mistakes from decision-making has also increased.
<b>Opportunities</b> Speed is one of the main factors that plays an important part in determining whether EIT will succeed or fail. In a real world situation with full of competition, It is not only Thailand that needs to attract investors from overseas. There are many other countries in Southeast Asia, South America, Africa, and Central Asia that also need financial support for promoting the industry. The second structure can create the best opportunities to welcome new investors because they are more agile in management than those type-1 and type-3.	<b>Threats</b> There are several issues that need to be carefully considered such as local culture, ethnic groups and gender inequality. These issues require a wide range of prudence and various perspectives from a committee with different expertises. Shortening the procedure can create new, more serious and complex problems.

Table 3: SWOT Analysis on the mixed model structure ISF Proposal – Type 3

Strengths	Weaknesses
<p>Type 3 can attract private investors who are willing to inject capital into the new project. This influx of funds can provide financial support for existing operations and also enable the initiation of new projects. With increased investment, there is a higher likelihood of funding being available for projects related to industrial symbiosis, which involves collaborative efforts between different industries to optimize resource utilization. Furthermore, type-3 can bring in private sector expertise and management practices. Private companies often have a strong focus on efficiency, innovation, and profitability. Their expertise can lead to better financial management and strategic decision-making, allowing for the identification and pursuit of new projects that promote industrial symbiosis. It's important to note that type-3 can introduce competition and market forces into previously state-controlled industries. This competitive environment can foster innovation and drive companies to explore new projects that align with industrial symbiosis principles. The need to differentiate themselves in the market and gain a competitive advantage can lead to increased investment in symbiotic initiatives, further supporting financial and environmental objectives.</p>	<p>Because it is a new type of administration, which is focused on localization led by SAO. Universities, research institutes and Start Up companies are at the core of the drive, potentially causing resistance from public servants who continue to centrally uphold top-down public administration. However, the problem will be resolved in order as each stakeholder becomes accustomed to the management of a new EIT.</p>

**Table 3:** SWOT Analysis on the mixed model structure ISF Proposal – Type 3 (cont.)

Opportunities	Threats
<p>Mixed structure patterns provide opportunities for the younger generation. In particular, university professors, researchers, as well as start-up owners, who have the power to drive and are in the process of building themselves, have shown their full potential, with research topics related to RECP/WE/IUS/IS being able to use as thesis topics for postgraduate and PhD students as well as creating human resources for the country at the same time.</p>	<p>The Russia-Ukraine war and the spread of the Covid-19 pandemic pose significant risks to global economic decline. Here are some key factors contributing to these risks:</p> <p>Trade Disruptions: The Russia-Ukraine conflict and the pandemic can disrupt global trade flows.</p> <p>Geopolitical Uncertainty: The Russia-Ukraine conflict has geopolitical implications that can create uncertainty and instability in the global economy.</p> <p>Energy Supply Disruptions: Russia is a major energy exporter, and any escalation of the conflict could disrupt energy supplies, particularly natural gas, to Europe.</p> <p>Investor Sentiment and Confidence: Both the Russia-Ukraine conflict and the pandemic can impact investor sentiment and confidence. Uncertainty and geopolitical tensions can lead to capital flight from affected regions, limiting investment opportunities and economic growth.</p> <p>Financial System Vulnerability: The combined impact of the Russia-Ukraine conflict and the pandemic can strain the global financial system. Bank exposures to affected regions or industries could result in loan defaults and financial instability. Furthermore, the economic decline resulting from these events may lead to increased government debt levels, further straining the financial system and increasing the risk of economic recession.</p>

## Conclusion

In conclusion, the development of an ISF for promoting industrial symbiosis and utilizing the concepts of RECP in Thailand is a crucial step towards sustainable industrial growth and environmental stewardship. By embracing these principles, Thailand can effectively address the challenges of resource scarcity, pollution, and waste management while fostering economic development. Implementing an ISF requires collaborative efforts from various stakeholders, including government agencies, industry associations, academic institutions, and environmental organizations. These entities must work together to establish policies, regulations, and incentives that encourage the adoption of RECP practices. One key element of the ISF is the establishment of a national platform or network for industrial symbiosis. This platform would serve as a hub for connecting industries, facilitating the exchange of resources, byproducts, and waste materials. By fostering collaboration and synergy among businesses, the platform can promote resource efficiency, reduce waste generation, and create opportunities for cost savings and innovation. Furthermore, the ISF should prioritize the development of capacity-building programs and technical assistance to support industries in adopting resource-efficient and clean production techniques. This may involve providing training, knowledge sharing, and technical guidance to businesses, particularly small and medium-sized enterprises (SMEs), which constitute a significant portion of Thailand's industrial sector. The ISF should also include monitoring and evaluation mechanisms to assess the progress and effectiveness of the initiatives implemented. Regular monitoring of resource consumption, waste generation, and pollution levels will help identify areas for improvement and guide policy adjustments. By developing an ISF for promoting industrial symbiosis and resource efficiency, Thailand can position itself as a regional leader in sustainable industrial practices. This will not only enhance the country's environmental performance but also contribute to its economic competitiveness and attractiveness for foreign investment. In conclusion, embracing the concepts of industrial symbiosis, RECP through a well-designed ISF will enable Thailand to create a more sustainable and resilient industrial sector, fostering a greener future for the nation and its people.

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# Factors that Affect Bitcoin Investment and Trading in Thailand

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## Abstract

Due to the needs of investors and rapidly changing technology in asset management and financial activities, this research aims to study the factors affecting the investment and trading of Bitcoin in Thailand. To do so, an online questionnaire was sent to 400 bitcoin investors in Thailand, then SPSS and AMOS were used for collected data processing. Structural Equation Modelling (SEM) was also performed to further analyze the data and prove the hypotheses.

The result revealed that the Perceived risk, Trust, and Social influence are significant factors to the intention to invest and trade Bitcoin in Thailand. With these factors in mind, related financial institutions should provide sufficient information and analysis to ensure that all the risks are exposed to their investors. In term of Trust, operations and performance of the institutions should be transparent and accessible. Finally, Social influence could be an important factor in marketing campaign.

**Keywords:** Bitcoin, Investment, Trading, Risks

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## ปัจจัยที่มีผลต่อการลงทุนและซื้อขายสินทรัพย์ ด้วยบิตคอยน์ในประเทศไทย

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### บทคัดย่อ

การเปลี่ยนแปลงอย่างรวดเร็วในกิจกรรมทางการเงินและการจัดการสินทรัพย์ รวมทั้งความต้องการของนักลงทุนในสินทรัพย์ใหม่ ๆ เช่น บิตคอยน์ ทำให้เกิดการศึกษาปัจจัยที่มีผลต่อการลงทุนและซื้อขายสินทรัพย์ด้วยบิตคอยน์ในประเทศไทยขึ้น โดยการใช้แบบสอบถามออนไลน์กับนักลงทุน 400 คน และประมวลผลด้วย SPSS และ AMOS โดยใช้ ตัวแบบสมการโครงสร้างเพื่อวิเคราะห์และพิสูจน์สมมติฐาน

ผลการศึกษา พบร้า การรับรู้ความเสี่ยง ความไว้วางใจ และอิทธิพลทางสังคม เป็นปัจจัยที่มีผลอย่างมีนัยสำคัญต่อความตั้งใจในการลงทุนและการใช้บิตคอยน์ในการซื้อขายสินทรัพย์ในประเทศไทย ด้วยผลการศึกษานี้ สถาบันทางการเงินที่เกี่ยวข้องควรจะดำเนินการให้นักลงทุนมั่นใจว่า ข้อมูลและการวิเคราะห์ต่าง ๆ ได้ถูกเปิดเผยอย่างเพียงพอที่นักลงทุนจะสามารถตัดสินใจโดยตระหนักรถึงความเสี่ยงต่าง ๆ แล้ว ในส่วนของความไว้วางใจ การดำเนินการที่โปร่งใสและผลกระทบจากการน่าจะสามารถสร้างความมั่นใจให้นักลงทุนได้ ในด้านของอิทธิพลทางสังคม สามารถนำไปใช้เป็นปัจจัยหนึ่งของโครงการรณรงค์ทางการตลาดได้

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## Introduction

The topic of the financial news attracting people's interest for the past many years both in and outside the country has been the Crypto Currency called "Bitcoin."

Bitcoin is virtual currency. It is the digital currency that uses the Decentralized System without the central bank or the system supervisor involved. Bitcoin is designed by using the Blockchain technology. It is the public account that records the bitcoin trading. Bitcoin is a peer to peer network. At present, in other countries, bitcoin is widely used for trading. As a result, the economic and technological trends are better. The aim is to facilitate financial transaction leading to exchange without needing support from financial institutions. Bitcoin is one of the digital currencies attracting a lot of interest both in and outside the country. In particular, from the end of 2020 to the beginning of 2021, the trading prices of bitcoin increased tremendously (CoinDesk 2010-2021). Using digital currency in financial transaction based on anonymity makes it difficult to investigate the number of trading relevant to bitcoin in Thailand. As there is either little research on bitcoin in Thailand which may lead to the risk of usage or investment, the use of bitcoin for trading of objects, houses, or cars in Thailand are not recognized or exchanged.

Therefore, this research was conducted to seek information and perspectives of the use of bitcoin currency as virtual currency in the digital world and its direction of the usage to ensure that investors and related financial institutions acknowledge the factors significantly affecting Bitcoin investment in Thailand.

## Objectives

1. To study the factors affecting the current use of Bitcoin in Thailand
2. To serve as information and guideline of investment and asset trading for people in the future

## Literature Review

Awareness (Shahzad, Xiu et al., 2018): Awareness is perception of anything that is a key factor to understand the perceptions of technology and the benefit of the use of technology, as well as perception of the concept of technology creating interest and change to decide to use technology. It also changes the concept and decision-making (Saif Almuraqab

2020). Everyone should be aware of the digital currency, its benefits, and methods of usage prior to real usage. In other words, awareness is the first condition before real usage. It is the indirect factor in usage resulting in the assumption of H1: Awareness is in correlation to the usage of bitcoin.

Perceived Risk (Mendoza-Tello, Mora et al., 2019): Risk means uncertainty in something. Risks derive from numerous factors such as the risk from attack when the dangerous attacker can make use of the ability to modify the system size and attack while refusing to provide service of payment, or the risk from the delay in receiving information, as well as the risk from fast changing price fluctuations. It renders the risk of digital currency significantly higher than the traditional currency. The risk will lead to speculation and the fluctuation leads to serious changes in trading (Folkinshteyn and Lennon 2016). Risk come from many factors such as:

#### *Business risk factors*

As bitcoin is the software that reveals the principle or source of origin, the development of digital currency may cause the risk of non-acceptance or the compensation that may not worth the loss.

#### *Safety risk factors*

As the computer security system is important for bitcoin and as bitcoin is a valuable asset like money, security is crucial for those who possess it or those who pay with bitcoin. The insecure system may lead to tremendous loss of resources.

#### *Risk factors from errors in encryption*

Exchange of digital currency or bitcoin must operate through electronic wallet with the risk of possible errors in application and security. If it is the case, the spenders of the digital wallet can lose the digital money.

#### *Risk factors from uncertainties of rules and regulations*

As bitcoin trading cannot be controlled, the trading is independent. But the risks may derive from the uncertainties of rules and regulations by the government of each country who may issue rules and regulations to control the trading measures. But each country has its own rules which make rules and regulations uncertain. Therefore, the concept leads to the hypothesis H2: Perception of risks has a correlation to the use of bitcoin.

Trust (Shahzad, Xiu et al., 2018): Trust means the belief that the trustee will render support in response to the expectations of the person who trusts. Trust from accountability is the result of the attitude of the trustee, system, belief, and trading power. Trust is an important factor to create good attitude to use the system or technology (Lee, Hong et al., 2018). Trust is a key factor for economic transaction with high volatility. Bitcoin is technology with the structure of dispersion system, without center, and with credibility that the connection points of various systems are reliable, unlike the old monetary system or e-money system requiring the central system. Bitcoin does not rely on any point but is recognized that all points as correct. Only investors with confidence in the dispersion system decide to invest in bitcoin. Therefore, it is possible to set the hypothesis of H3: Trust has a correlation to the use of bitcoin, and H6: Trust has a correlation to the perception of risks in the use of bitcoin.

Anonymity (Murko and Vrhovec, 2019): Anonymity is a key feature of cash banknote compared with money (such as money in bank account). As cash does not have Transaction specifying the source of the money, it is difficult to trace it similarly to Bitcoin which is the currency with anonymity as well. It might lead to the use of new technologies in the future and to the hypothesis H4: Anonymity has a correlation to the use of bitcoin.

Social influence (Putra and Darma, 2019): Social influence means the levels of opinions and interests of an individual on reliable technology or recommended by others for the use of new technology (Saif Almuraqab, 2020). In the perspective of social influence, those not familiar with the digital currency will have confidence in families, or friends. The study results reveal that social influence will affect the use of technology and lead to the hypothesis H5: Social influence has a correlation to the use of bitcoin.

## Conceptual Framework

Based on the literature review and the study of factors relevant to the factors and influences affecting investment in and trading of asset with bitcoin in Thailand, the research conceptual framework is proposed as shown in Figure 1.

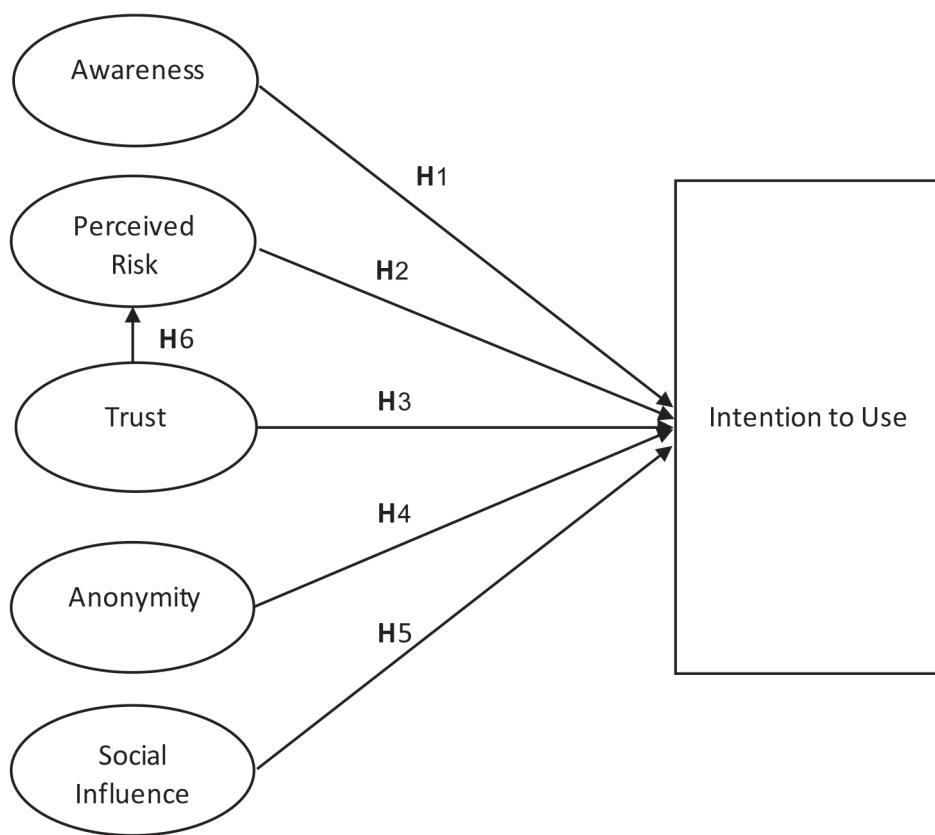


Figure 1: Research Conceptual Framework

## Methodology

This research was quantitative research. An online survey was created and distributed using Google Form to collect the data from the sample between 11 June-11 July 2021. The population consisted of 400 samples, calculated by W.G. Cochran's formula, of those who had invested in bitcoin. Those samples are used to find the result of the research objectives. Another 30 samples were collected to measure the precision. The samples were constituted the group of people who used the internet through smartphone, computer, tablet, or laptop. With this online survey, data was easily collected and accessed by the target group without constraints of location or time.

After data collection, the Content Validity of the questionnaire was verified by experts as the questionnaire assessors. Once the validity was approved, the Reliability Analysis, based on Cronbach's Alpha Coefficient, from 30 copies of the questionnaire was conducted. The analytical results is shown in Table 1.

**Table 1:** Cronbach's Alpha Coefficient

Variables	Number (questions)	Cronbach's Alpha Coefficient
Awareness	5	0.746
Perceived risk	6	0.728
Trust	5	0.720
Anonymity	5	0.771
Social influence	5	0.813
Intention to use	5	0.888

Because the Cronbach's Alpha Coefficient of each variable was between 0.70 and 1.0, it meant that the questionnaire was reliable enough to use in the research.

In terms of the testing hypotheses, Path Analysis was used based on the Simple Regression using IBM SPSS and AMOS statistical tools for an analysis of the influence of the independent variables, dependent variables, and intervening variables. Before doing that, consistency testing between the data and the research framework was performed. As a result, some questions were removed to improve the data consistency with the research framework. The remaining questions consisted of the following: Questionnaire used to assess awareness with 4 questions, questionnaire on perceived risks with 4 questions, questionnaire on trust with 3 questions, questionnaire on anonymity with 3 questions, and questionnaire on social influence with 3 questions. The results of the modified model consistent with the data were in Table 2.

**Table 2:** The Assessment of Congruence with Empirical Data of the Model

Statistical Value	Standard Criteria	Acquired Value	Results
P-Value	Over 0.05	0.254	Meet the criteria
CMIN/DF	Below 5	1.075	Meet the criteria
GFI	Over 0.95	0.964	Meet the criteria
AGFI	Over 0.90	0.943	Meet the criteria
NFI	Over 0.95	0.950	Meet the criteria
TLI	Over 0.95	0.995	Meet the criteria
CFI	Over 0.90	0.996	Meet the criteria
RMSE	Below 0.08	0.014	Meet the criteria

## Research Results

The results of the data collection of the investors in bitcoin constituted 203 males (50.75%) and 197 females (49.25%), most aged between 31-40 years old or 205 persons (51.25%), followed by those aged between 21-30 years old or 142 persons (35.50%), those with B.A. degrees or 357 persons (89.25%), followed by those with higher than B.A. degrees or 36 persons (9.00%), those with profession of company employees or 205 persons (51.25%), followed by government officials/state enterprise employees or 104 persons (26.00%), with monthly income between 15,001-30,000 baht with 183 persons (45.75%), followed by those who lower income or equal to 15,000 baht with 163 persons (40.75%). The researchers used the improved analytical results of the model to explain the correlation of each variable as in Figure 2 and Table 3, respectively.

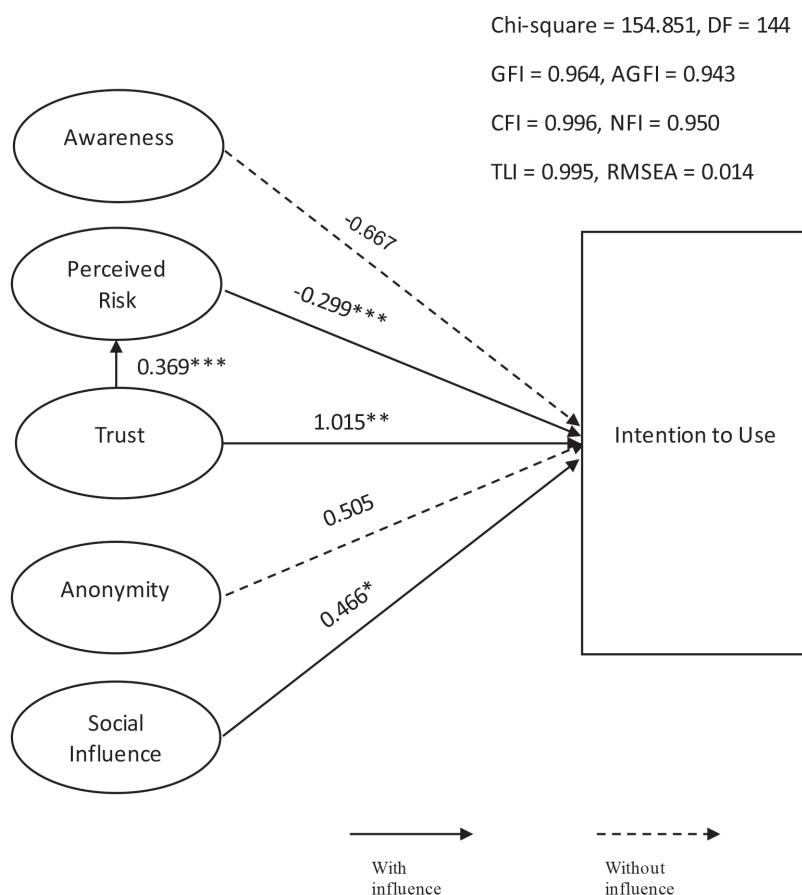


Figure 2: Path Coefficient of the Model

**Table 3:** Analytical Results of Each Factor

Dependent Variables	Influence	Independent Variables				
		Awareness	Perceived Risk	Trust	Anonymity	Social Influence
Perceived Risk	Direct	-	-	0.369***	-	-
	Indirect	-	-	-	-	-
Intention to Use	Direct	-0.667	-0.299***	1.015**	0.505	0.466*
	Indirect	-	-	-0.110	-	-

**Remark** \*p <= 0.05, \*\* p < 0.01, \*\*\* p-value < 0.001

**Table 4:** Summary of Analytical Results of the Hypothesis

Research Hypothesis	Research Results	Conclusion
H1: Awareness had a correlation to the use of bitcoin	Refusal	Awareness did not affect the intention to use with P equaled to 0.238 which was higher than the significant level of 0.05
H2: Perceived risks had a correlation to the use of bitcoin	Acceptance	Perceived risks affected the intention to use with the statistical significance at the level lower than 0.001
H3: Trust had a correlation to the use of bitcoin	Acceptance	Trust affected the intention to use with the statistical significance at the level lower than 0.010 with P equaled to 0.010
H4: Anonymity had a correlation to the use of bitcoin	Refusal	Anonymity did not affect the intention to use with P equaled to 0.204 which was higher than the significant level of 0.05
H5: Social influence had a correlation to the use of bitcoin	Acceptance	Social influence affected the intention to use with the statistical significance at the level lower than 0.05 with P equaled to 0.046
H6: Trust had a correlation to perceived risks in the use of bitcoin	Acceptance	Trust affected perceived risks with the statistical significance at the level lower than 0.001

## Conclusions and Discussions

The results of the hypothesis testing according to the research conceptual framework are shown in Table 4. The factors significantly affecting Bitcoin investment and asset trading using Bitcoin are Perceived Risk, Trust, and Social influence. In contrast, Awareness and Anonymity were not the factors. Note here that, no indirect factors were detected as an influence one.

The result of the data processing could answer the research question that risk factors significantly affected the use of bitcoin in asset trading in Thailand. This was in accordance with the research of Mendoza-Tello, Mora et al. (2019). Moreover, the trust factor was consistent with the research of Shahzad, Xiu et al. (2018) and the social influence factor was consistent with the research of Putra and Darma (2019). These factors significantly affected the use of bitcoin. These were consistent with the set hypothesis as these factors were the factors that the investors in bitcoin should have or accept prior to investment in bitcoin trading. The anonymity factor did not affect the use as it might be viewed as insignificant in the use of bitcoin which was in accordance with the research of Murko and Vrhovec (2019). The awareness factor did not significantly affect the use of bitcoin which was contrary to the research of Shahzad, Xiu et al. (2018) who stated that awareness would bring about perception of the methods of use and affect the intention to use. But the results were consistent with the research of Saif Almuraqab (2020) who stated that awareness would not directly affect the intention to use.

## Recommendations

### *Recommendations for the utilization of the research results*

The study of the factors that affect bitcoin investment and trading in Thailand considered the factors that made investors turn to study or take interest in bitcoin investment in order to provide information to the public or financial institutions to adapt themselves or develop technology in a par with the present era, as well as marketing for people to turn to digital currency more. This was because the use of digital currency such as bitcoin had lower fees than financial institutions, and transaction could be undertaken faster than financial institutions as well.

*Recommendations for future research*

For this research, the researchers studied the overall sample of investors without classifying into general investors and professional investors. Consequently, there lacked specific information and perspectives of the investors. If we set the hypothesis that divided general investors from professional investors, the result would be different from the overall investment. As general investors and professional investors might have different perspectives, therefore the study should be conducted on the specific form that could use the different analytical results in order to study and analyze for more precise results and diverse perspectives for better utilization and adaptation.

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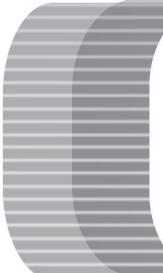
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# The Impact of Resource Threat on Chinese Overseas Students' Online Learning Behavioral Intentions in Thailand: The Moderating Role of Attitude

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## Abstract

Under the influence of social disruption, university students experience a significant loss effect on their resources, which greatly impacts their learning motivation. This study, based on Conservation of Resources Theory (COR) combining Social Impact Theory (SIT), examines students' willingness to adopt online learning under considerable pressure during significant social environmental changes. The research explores the potential moderating role of attitude towards online learning, shaped by factors such as social isolation and fear of the virus.

This study employs Partial Least Squares Structural Equation Modeling (PLS-SEM) based on COR theory and SIT for empirical analysis. A survey was conducted among Chinese students studying in Thailand (n=527), using online questionnaires and convenience sampling to collect data.

The analysis demonstrates that the model created for this study exhibits a good fit with the data. Exogenous latent variables, such as social influence resource (SIR), personal performance resources (PPR) show a positive correlation with online

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learning behavioral intentions(BI) ( $R^2=0.379$ ). Moreover, social isolation (SI) and COVID-Fear (CF) have a significant positive impact on the attitude ( $R^2=0.148$ ) toward online learning. Simultaneously, attitude (ATT) exerts a negative moderating effect on the relationship between PPR and BI, as evidenced by a significant interaction term in the regression analysis.

By employing COR theory, this study reveals that students are willing to prevent further resource depletion when resources are threatened, they are more inclined to engage in online learning when facing social isolation and pandemic fear, mitigating the impact of social impact. The research uncovers a significant negative moderating effect of attitude on the relationship between individual performance resources and behavioral intentions.

**Keywords:** COR Theory, Social Impact, Behavioral Intention, Moderating Effect of Attitude

## ผลกระทบของการคุณความเหลื่องทรัพยากร ต่อความตั้งใจเรียนออนไลน์ของนักศึกษาจีนในประเทศไทย: บทบาทตัวแปรด้านทัศนคติ

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### บทคัดย่อ

จากอิทธิพลด้านการเปลี่ยนแปลงของสังคม ส่งผลให้นักศึกษาระดับมหาวิทยาลัยประสบกับผลกระทบจากการสูญเสียด้านทรัพยากรเป็นอย่างมาก ซึ่งผลกระทบต่อแรงบันดาลใจในการเรียนอีกด้วย งานวิจัยนี้ใช้ทฤษฎีการอนุรักษ์ทรัพยากร (Conservation of Resources Theory - COR) ประกอบกับทฤษฎีผลกระทบทางสังคม (Social Impact Theory - SIT) โดยศึกษาความสมัครใจของนักศึกษาในการเรียนออนไลน์ภายใต้ความกดดันอย่างมากระหว่างช่วงการเปลี่ยนแปลงสิ่งแวดล้อมสังคม งานวิจัยศึกษาตัวแปรด้านทัศนคติต่อการเรียนออนไลน์ โดยมีปัจจัยต่าง ๆ เช่น ภาวะโอดเดี่ยวทางสังคม และการกลัวไวรัส

งานวิจัยใช้สมการโครงสร้างกำลังสองน้อยที่สุดบางส่วน (Partial Least Squares Structural Equation Modeling - PLS-SEM) ภายใต้ทฤษฎีการอนุรักษ์ทรัพยากรและทฤษฎีผลกระทบทางสังคมในการวิเคราะห์ข้อมูลเชิงประจักษ์ โดยสำรวจนักศึกษาชาวจีนที่กำลังศึกษาอยู่ในประเทศไทย (จำนวน 527 คน) ด้วยการใช้แบบสอบถามออนไลน์และการสุ่มตัวอย่างแบบง่ายเพื่อเก็บข้อมูล

ผลการวิเคราะห์แสดงให้เห็นว่าโมเดลที่สร้างขึ้นสำหรับงานวิจัยนี้มีความเหมาะสมกับข้อมูลทั้งนี้ตัวแปรแฟรงก์ยานอก เช่น ทรัพยากรอิทธิพลทางสังคม (Social Influence Resource - SIR) ทรัพยากรความสามารถส่วนบุคคล (Personal Performance Resources - PPR) และให้เห็นว่า มีสหสัมพันธ์เชิงบวกกับพฤติกรรมความตั้งใจเรียนออนไลน์ ( $R^2 = 0.379$ ) นอกจากนี้ ภาวะโอดเดี่ยวทางสังคม และความกลัวไวรัสโคโรนา วิด มีผลกระทบทางบวกต่อทัศนคติอย่างมีนัยสำคัญ ( $R^2 = 0.148$ )

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ต่อการเรียนออนไลน์ ในขณะเดียวกัน ทัศนคติเป็นอิทธิพลการกำกับต่อความสัมพันธ์ระหว่างทรัพยากร ความสามารถส่วนตัว และพฤติกรรมความตั้งใจเรียนออนไลน์ ดังที่ปรากฏในปฏิสัมพันธ์จาก การวิเคราะห์ผลโดย

การใช้ทฤษฎีการอนุรักษ์ทรัพยากรนั้น ผลการวิจัยแสดงให้เห็นว่าなくศึกษามีความยินดีที่จะ ป้องกันการใช้ทรัพยากรจนหมดเมื่อเกิดภาวะคุกคามด้านทรัพยากร โดยมีแนวโน้มที่จะทำการเรียน การศึกษาออนไลน์เมื่อประสบกับภาวะโศดเดี่ยวทางสังคมและความกลัวโรคระบาด เป็นการลด ผลกระทบทางด้านสังคม งานวิจัย ยังพบว่า ตัวแปรด้านทัศนคติมีความสัมพันธ์เชิงลบอย่างมีนัยสำคัญ ระหว่างทรัพยากรความสามารถส่วนบุคคลและพฤติกรรมความตั้งใจ

**คำสำคัญ:** ทฤษฎีอนุรักษ์ทรัพยากร ผลกระทบทางสังคม พฤติกรรมความตั้งใจ ตัวแปรด้านทัศนคติ

## Introduction

Since 2022, global uncertainty has increased. Factors such as pandemics, wars, energy and environmental crises, inflation, and economic recessions have significantly impacted people's lives and altered social structures (Mbah & Wasum, 2022). Furthermore, COVID-19 has transformed the way people live and learn (Sun & Ma, 2022). Governments worldwide have implemented public policies such as social distancing and self-isolation, leading to widespread feelings of loneliness and fear of viral infection (Hwang et al., 2020). Thailand serves as a specific context for this study, and it is imperative to understand its educational landscape. The Thai educational system has its own set of administrative policies and practices, particularly in response to the COVID-19 pandemic (Poungjinda & Pathak, 2022). These policies underscore the adaptability and resilience of educational systems in integrating online learning as a viable solution, not just in Thailand but as a model that could have broader global applications(Pal et al., 2022).

In this context, online learning has played a crucial role during these unique times (Basilaia & Kvavadze, 2020). Chinese students studying in Thailand have also experienced the impact of societal changes and adopted online learning. This study centers on Chinese students studying in Thailand, a demographic that has been uniquely impacted by these societal changes. Chinese students represent a significant portion of the international student body in Thailand(Sutthasian & Tiangsoongnern), and their experiences offer a microcosm of the broader challenges and opportunities presented by online learning in a cross-cultural context. The focus on this particular group is justified by their substantial presence and the unique socio-cultural dynamics they navigate, thereby making their experiences highly relevant for this study(Sun et al., 2020). This study focuses on this group, exploring whether online learning can help maintain and preserve resources when students experience social isolation and fear of the virus, and their personal and social resources are under threat.

Conservation of Resources (COR) theory suggests that individuals experience psychological stress when facing resource loss or threat and will adopt coping strategies to protect and accumulate resources (Hobfoll et al., 2018). Social impact theory posits that individual behavior is influenced by other individuals or groups within the social environment (Latane, 1981). Combining these two theories, this paper aims to investigate

whether online learning can provide better learning support for overseas students, reduce resource loss, and thus minimize the impact on their academic progress.

Early researchers have examined students' satisfaction and experiences with online learning (Azizan et al., 2022), factors affecting online teaching and learning (Yunus et al., 2021), and the state of online learning during the pandemic (Cao et al., 2021; Yunus et al., 2021). Related scholars have also developed the Fear of COVID-19 Scale (FCV-19S) (Ahorsu et al., 2020). Cao and colleagues found that prolonged social isolation could lead to mental health issues, further affecting individual attitudes and behaviors (Cao et al., 2020). Some researchers, based on the COR theory, have compared the differences between school and online learning under COVID-19 stress by gender (Rui et al., 2021).

However, there is limited research combining Social Impact Theory (SIT) and Conservation of Resources Theory (COR), integrating variables from the Unified Theory of Acceptance and Use of Technology (UTAUT) model (Venkatesh et al., 2003) with relevant resources in COR theory to investigate the relationship between students' social and personal resources in specific periods and environments, and their impact on learning motivation. To the best of our knowledge, limited literature has discussed the moderating effect of attitudes formed by the combined influence of social isolation and COVID-Fear on related resources and intentions.

This study also seeks to explore the moderating role of attitudes under stress, formed by societal impact, on the relationship between personal performance resources, social influence resources, and behavioral intentions to use online learning among international students. The attitudes formed after social isolation and fear of the virus represent a specific manifestation of students' intrinsic defense psychology, whereby individuals experience psychological stress when facing resource loss or threat and adopt coping strategies to protect and accumulate resources. This contributes a novel perspective and reference value to the study of students' resource conservation intentions and behaviors.

This paper builds upon previous research by integrating variables from the UTAUT model with SIT and COR theory to explore the relationship between students' social and personal resources and their impact on learning motivation. It also contributes to the existing literature by examining the relationship between personal and social

resources in specific environments. Additionally, this research provides a theoretical reference for schools and teachers on how to employ appropriate teaching methods to focus on and support students' psychological and social resources in situations where their resources may be at risk of loss.

## **Literature Review**

### **Online Learning**

Online learning is a form of education that occurs over the Internet, facilitated by various digital devices such as computers and mobile phones with internet access (Yunus et al., 2021). Teaching is no longer confined to the classroom, as online learning has become a viable alternative to traditional face-to-face learning (Devisakti & Ramayah, 2019; Jongpil Cheon 2012). Chinese students studying in Thailand have also been affected by COVID-19, necessitating a shift from onsite to online learning. This transition has altered both teaching methods and learning experiences (Sakka, 2022). In the online learning context, the learning environment differs significantly from traditional classroom settings. The challenges are exacerbated during COVID-19 due to social isolation, making immediate discussion and communication between teachers and students difficult. In addition, the fear of viruses also leads to some psychological anxiety among students, which affects the learning effect. Given these challenges, it becomes imperative to examine how students adapt to online learning, particularly in the psychological context of social isolation and fear induced by COVID-19.

## **Theory and Hypothesis Development**

### **1) Conservation Resources Theory**

COR theory was first introduced by Hobfoll, primarily focuses on the acquisition, maintenance, and depletion of resources and their impact on individual psychology and behavior(Hobfoll, 1989). COR theory posits that resources are entities that either have inherent core value (e.g., self-esteem, intimate relationships, health, and inner peace) or serve as a means to achieve core value goals (e.g., money, social support, and credit) (Hobfoll, 2002). Hobfoll suggests that stress results from threats of resource loss, actual loss, or insufficient resource gain to compensate for existing resource investment (Hobfoll, 1988). To avoid and protect themselves from the effects of stressful

situations, individuals are motivated to conserve, restore, and cultivate existing resources and acquire other, more valuable resources (Hobfoll et al., 2018).

In recent years, scholars have applied COR theory to online learning during the COVID-19 pandemic, such as (Rui et al., 2021), which investigated pandemic-related stress associated with schools and online learning and potential mediating factors within the resource conservation framework, including social support, academic stress, and negative emotion regulation. Hasan & Bao found that students' loss of learning performance was a key factor leading to psychological distress during the COVID-19 lockdown (Hasan & Bao, 2020). COR theory provides researchers with a theoretical framework to analyze students' attitudes and behavioral intentions toward online learning during the pandemic from a resource perspective. Online learning behavioral intentions serve as a prerequisite for students' actual use of online learning in the future and are considered the dependent variable in this study.

In this study, we focus on students' personal performance resources (PPR) and social influence resources (SIR) as essential factors in forming their online learning behavioral intentions (BI). Operational Definition Personal Performance Resources (PPR): COR theory emphasizes the importance of resource conservation and accumulation for individual performance and well-being(Hobfoll, 1998). Within this theoretical framework, personal performance resources can be defined as the various tangible and intangible resources that individuals possess in their work and life, which assist them in more effectively completing tasks, reducing stress, and enhancing quality of life. Under this study, student personal performance resources can be any resources that can improve an individual's ability and efficiency in using online learning technology. Social Impact Resources (SIR) Operational Definition: Within COR theory theoretical framework (Hobfoll, 1998), Social Impact Resources (SIR) can be defined as resources that individuals possess in social interactions and communications, which aid them in more effectively influencing others and social structures. Latane's Dynamic Social Impact Theory underscores the dynamic process by which individuals and groups create culture and social structures through social communication(Latane, 1996). In this research model, Social Impact Resources (SIR) can be any resources that enhance students' ability to make a positive impact in social interactions.

Prior research has already confirmed that performance expectations significantly impact students' behavioral intentions (Ngampornchai & Adams, 2016). Some researchers have found that students' behavioral intentions are significantly influenced by social factors (Ping Qiao, 2021), and Venkatesh argues that social influence plays a crucial role in shaping behavioral intentions (Venkatesh et al., 2003).

Based on the aforementioned theories and empirical studies, this study proposes the following hypotheses:

H1: Personal performance resources (PPR) have a positive effect on students' behavioral intentions (BI).

H2: Social influence resources (SIR) have a positive effect on students' behavioral intentions (BI) to adopt online learning.

## 2) Social Impact Theory

Society is a self-organizing complex system composed of interacting individuals, and Social Impact Theory (SIT) posits that each individual follows simple principles of social impact (Latane, 1996). Since 2022, there have been significant changes in the social environment, directly affecting people's various behaviors, attitudes, and subsequent actions. Previous research has shown that social isolation and fear of the pandemic are important factors influencing social impact (Raza et al., 2021). In this study, we use two exogenous latent variables, social isolation(SIS) and COVID-Fear(CF), which together form the attitude towards online learning. SIS refers to individuals being detached from social groups or having little actual contact with others, resulting in a state of social isolation (de Jong Gierveld et al., 2006). We predict that the degree of SIS will influence students' attitudes towards online learning. Researchers have considered fear as a predictive factor, suggesting that fear is an adaptive emotion used to generate energy to cope with potential threats (Mertens et al., 2020). COR theory proposes that individuals are motivated to conserve, restore, and cultivate existing resources and acquire other more valuable resources in order to avoid and protect themselves from the effects of stressful situations (Hobfoll et al., 2018). Therefore, this study hypothesizes that when students experience social isolation and feel virus fear, they will adopt a more positive attitude, maintain their psychological resources, and combat resource loss. Thus, the following hypotheses are proposed:

H3: Social isolation (SIS) is significantly correlated with attitude towards online learning.

H4: COVID Fear (CF) is significantly correlated with attitude towards online learning.

### Attitude Influences Behaviour Intention

Fishbein and Ajzen described attitudes towards behavior as an individual's emotions towards engaging in a target behavior, whether positive or negative (Fishbein & Ajzen, 1977). According to Venkatesh et al., attitude refers to an individual's overall emotional reaction to using a system (Venkatesh et al., 2003). Based on pre-research in education using the UTAUT model, there is a significant positive correlation between behavioral intention (BI) and attitude (ATT) (García Botero et al., 2018; Or & Chapman, 2022; Thomas et al., 2013). In this study, the following hypothesis is proposed:

H5: Online learning Attitude (ATT) is significantly correlated with behavioral intention(BI).

### The Moderating Role of Online Learning Attitude

This study proposes that due to the social impact, the ATT formed by students' learning psychology being affected by both SIS and CF will have a moderating effect on the relationship between relevant PPR, SIR, and BI. As an innovation in this study, the following moderating effect hypotheses are proposed:

H6: Online learning Attitude (ATT) will moderate the relationship between personal performance resources(PPR) and behavioral intention (BI).

H7: Online learning Attitude (ATT) will moderate the relationship between social influence resources(SIR) and behavioral intention (BI).

Additionally, the participants are all Chinese students studying in Thailand through online learning at almost the same time. These students have similar characteristics in terms of age, gender, and the use of Chinese online learning platforms. Therefore, this study does not discuss gender or age.

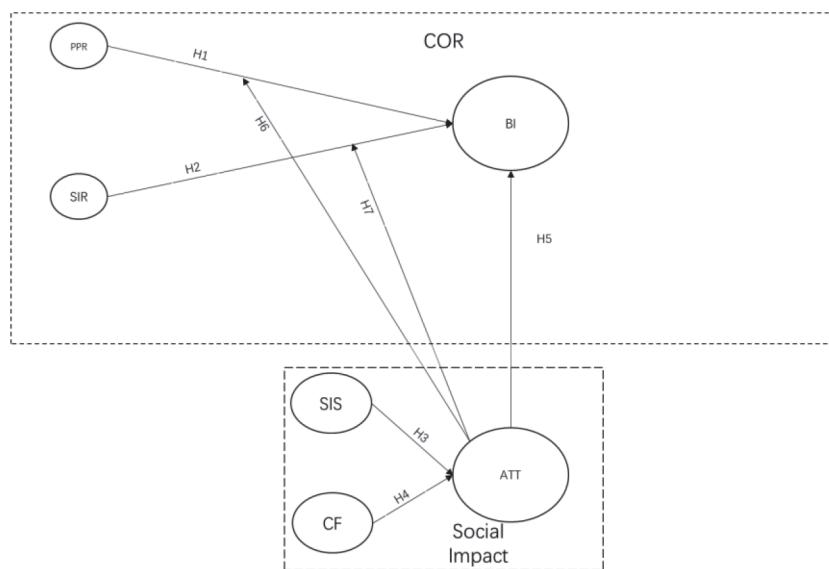


Figure 1: The Conceptual Model

Note: ATT=online learning attitude, BI=behaviour intention, CF=COVID Fear, PPR=personal performance resource, SIR=social influence resource, SIS=social isolation

## Methods

### Research Design

This study employs a cross-sectional design for data collection. Scholars suggest that for exploratory research, cross-sectional methods are suitable for investigating patterns of relationships between variables that are unclear and lack prior research support (Spector, 2019). Specifically, the cross-sectional design is applicable to the exploratory nature of this study, aiming to clarify unknown issues (Spector, 2019). The use of cross-sectional methods is also appropriate for the primary objective of this study, which is to explore relationships between variables rather than confirming causal relationships between them.

### Data Collection and Samples

This study adopts a survey design and questionnaire approach to collect data from Chinese students studying at Thai universities through online learning during the COVID-19 outbreak. Consequently, the data collection process is entirely online. Initially, a pilot survey was conducted by distributing questionnaires to 34 Chinese

students participating in online learning. Researchers adjusted based on suggestions from students regarding the questionnaire. Subsequently, the questionnaire was officially distributed to other Chinese students studying in Thailand and using online learning. Starting from May 10, 2022, questionnaires were distributed online and data was collected through WJX (<https://www.wjx.cn/>) and WeChat (Cao et al., 2021). The justification for using WJX and WeChat platforms for online questionnaire distribution base the reason about: 1. diversity and breadth of data collection: in social science research, the diversity and breadth of data collection are crucial (Rubin & Babbie, 2016). Utilizing platforms like WJX and WeChat allows for the inclusion of participants across different ages, genders, and regions. 2. Real-time and Convenience: Online questionnaire surveys offer the advantage of real-time data collection (Wright, 2017). These platforms enable researchers to collect a large amount of data in a short period. 3. Cost-Effectiveness: Compared to traditional paper-based questionnaires, using online platforms like WJX and WeChat is more cost-effective (Wright, 2017). 4. Data Quality and Reliability: Some studies indicate that the data quality of online questionnaire surveys is comparable or even superior to that of paper-based questionnaires (Gosling et al., 2004). As of May 19, 2022, a total of 785 questionnaires were collected. After organizing the data and removing some self-contradictory answers, 527 were left as valid questionnaires for analysis, with a response rate of 67.1%. The demographic characteristics of the respondents are shown in Table 1.

**Table 1:** Descriptive Statistics of the Respondents (N=527)

Items	Frequency	Percent (%)	Items	Frequency	Percent (%)
Gender			Equipment		
Male	328	62%	SP	254	48%
Female	199	38%	LT	160	30%
Platform			DT	62	12%
TM	267	51%	Pad	51	10%
TC	111	21%			
ZOOM	31	6%			
MT	38	7%			
Ciscowbx	80	15%			

Note: TM=TencentMeeting, TC=TencentClass, SP=Smartphone, LT=Laptop, DT=Desktop, MT=MicrosoftTeams, Ciscowbx=Cisco Webex

According to the data, demographic analyses were conducted using JASP (Goss-Sampson, 2019). Table 1 displays the situation of students using different learning platforms: TM (Tencent Meeting) was the most popular, accounting for the majority with 51%, followed by TC (Tencent Classroom) with 21%, MC (Microsoft Teams) with 7%, ZOOM with only 6%, and others together accounting for 15%. In China, most online learning systems use Tencent Meeting or Tencent Classroom. Thus, the collected data appears to be consistent with the actual situation. Regarding students' preferences for using different electronic devices for online learning, an interesting finding emerges: SP (smartphones) constituted the majority, totaling 48%, followed by LT (laptops) with 30%, DT (desktops) with 12%, and Pad with 10%. Clearly, our research indicates that mobile devices dominate in online learning systems. From this data, we can understand that online learning is very similar to mobile learning, which also supports previous research (Jongpil Cheon 2012; Sabah, 2016).

### Measurements

The scales for PPR, SIR, BI, and ATT are measured using items developed and verified by the UTAUT model (Venkatesh et al., 2003; Viswanath Venkatesh et al., 2011). SIS and CF measurements used SIT (Kelman, 1958; Latane, 1981, 1996) and other mature measurement topics that have been applied to online and mobile learning (Raza et al., 2021; Sitar-Täut, 2021). In total, 26 items were measured on a five-point Likert-type scale (1=strongly disagree, 5=strongly agree).

The demographic variables include gender ("male" = 1; "female" = 2), online study platform ("Tencent Meeting" = 1; "Tencent Classroom" = 2; "ZOOM" = 3; "Microsoft Teams" = 4; "Cisco Webex" = 5), and online study equipment measured (smartphone = 1, laptop = 2, desktop = 3, Pad = 4).

The questionnaire used in this study is presented in Chinese to encourage and facilitate accurate understanding of all questions by respondents. A back-translation technique was used to verify the semantic equivalence of translated items and check the accuracy of the translations. Initially, the researchers translated the original English questions into Chinese. Then, back-translation was performed to check the accuracy of the translations (Brislin, 1970). The back-translation was carried out by a certified translator and compared with the original questionnaire. The results showed that their meanings were consistent. This ensured that the Chinese version of the questionnaire was suitable for use.

### Statistical Analysis

This study employs Partial Least Squares Structural Equation Modelling (PLS-SEM) for model evaluation and hypothesis testing. This method is suitable for conceptual models containing latent variables and multiple indicators and allows for the analysis of complex models (Hair, Risher, et al., 2019). Furthermore, this is an exploratory study aimed at examining complex relationships between variables. In this case, PLS-SEM is appropriate (Wong, 2013). Given the specific circumstances of this study, the use of PLS-SEM is theoretically justified. The Smart-PLS 3.0 software was used for PLS-SEM estimation.

## Results

### Measurement Model Assessment

Before estimating the PLS model, it is critical to validate the measurement model to evaluate the scale quality. The results showed that the factor load of all variables was higher than the cut-off of 0.5, supporting good convergence validity (Hair, Jr., et al., 2019). It is evident from Table 2 that Cronbach's Alpha (CA) and Composite Reliability (CR) values are above the 0.7 criterion (Hair, Risher, et al., 2019; Urbach & Ahleman, 2010). Therefore, the measurement model in this study has strong reliability. According to Henseler, the convergence validity of the measurement model was assessed based on average variance extracted (AVE) (Henseler et al., 2016), with each variable above 0.5. rho\_A values are greater than 0.7, a metric based on Jöreskog's rho ( $\rho$ ) coefficient, which should be greater than 0.7 (Tenenhaus et al., 2005). Based on the data in Table 2, all latent variables met acceptable standards for internal consistency, reliability, and validity, indicating that they were reliable and valid for measurement.

**Table 2:** Construct Reliability and Validity

Construct	CA	rho_A	CR	AVE
ATT	0.904	0.912	0.933	0.777
BI	0.859	0.860	0.905	0.703
CF	0.926	0.937	0.944	0.770
PPR	0.853	0.853	0.895	0.630
SIR	0.872	0.873	0.913	0.723
SIS	0.826	0.829	0.885	0.658

*Note:* ATT=online learning attitude, BI=behaviour intention, CF=COVID Fear, PPR=personal performance resource, SIR=social influence resource, SIS=social isolation.

Fornell and Larcker assessed discriminant validity and proposed that it must be confirmed that the square root of AVE is greater than the correlations between the components (Fornell & Larcker, 1981; Hamid et al., 2017; Henseler et al., 2014). Table 3 show that all variables meet the standard.

**Table 3:** Discriminant Validity

Fornell-Larcker Criterion							Heterotrait-Monotrait Ratio (HTMT)						
Construction	ATT	BI	CF	PPR	SIR	SIS	Construction	ATT	BI	CF	PPR	SIR	
ATT	<b>0.881</b>						ATT						
BI	0.346	<b>0.839</b>					BI	<b>0.391</b>					
CF	0.28	0.339	<b>0.878</b>				CF	<b>0.298</b>	<b>0.377</b>				
PPR	0.282	0.536	0.353	<b>0.794</b>			PPR	<b>0.319</b>	<b>0.625</b>	<b>0.396</b>			
SIR	0.227	0.476	0.269	0.485	<b>0.85</b>		SIR	<b>0.255</b>	<b>0.548</b>	<b>0.298</b>	<b>0.562</b>		
SIS	0.339	0.368	0.319	0.437	0.231	<b>0.811</b>	SIS	<b>0.389</b>	<b>0.438</b>	<b>0.361</b>	<b>0.52</b>	<b>0.272</b>	

*Note:* ATT=online learning attitude, BI=behaviour intention, CF=COVID Fear, PPR=personal performance resource, SIR=social influence resource, SIS=social isolation.

Moreover, discriminant validity was assessed through a higher boundary standard called the Heterotrait-Monotrait (HTMT) ratio (Henseler et al., 2014). Table 3 presents the HTMT values, showing good discriminant validity between constructs, as none of the latent variables' HTMT values exceed 0.85.

Cross-loadings refer to the loadings of observed variables on different latent variables. When evaluating the measurement model, cross-loadings can be used to examine the significance of variables within latent variables and discriminant validity. Ideally, observed variables' loadings on their corresponding latent variables should be much higher than on other latent variables(Hair, Risher, et al., 2019). The data in Table 4 show that the model performs well in terms of cross-loadings, with each observed variable's loading on its corresponding latent variable significantly higher than on other latent variables, and all  $>0.5$ , demonstrating significance, indicating good discriminant validity with other latent variables.

**Table 4:** Cross Loadings

Construction	ATT	BI	CF	PPR	SIR	SIS	Construction	ATT	BI	CF	PPR	SIR	SIS
ATT1	0.9	0.323	0.273	0.263	0.209	0.333	PPR1	0.213	0.433	0.303	0.801	0.384	0.351
ATT2	0.897	0.312	0.258	0.264	0.21	0.298	PPR2	0.229	0.439	0.305	0.79	0.365	0.361
ATT3	0.839	0.281	0.169	0.228	0.18	0.249	PPR3	0.211	0.415	0.282	0.815	0.371	0.321
ATT4	0.887	0.3	0.275	0.238	0.2	0.307	PPR4	0.205	0.399	0.273	0.784	0.384	0.328
BI1	0.246	0.852	0.274	0.475	0.429	0.301	PPR5	0.258	0.437	0.237	0.778	0.421	0.369
BI2	0.313	0.834	0.311	0.432	0.386	0.313	SIR1	0.171	0.417	0.249	0.397	0.856	0.194
BI3	0.331	0.842	0.276	0.448	0.392	0.296	SIR2	0.196	0.415	0.213	0.43	0.851	0.2
BI4	0.269	0.825	0.275	0.443	0.387	0.328	SIR3	0.203	0.378	0.242	0.418	0.856	0.214
CF1	0.208	0.265	0.844	0.297	0.226	0.213	SIR4	0.205	0.404	0.211	0.406	0.838	0.179
CF2	0.287	0.317	0.895	0.312	0.229	0.281	SIS1	0.291	0.324	0.304	0.37	0.2	0.83
CF3	0.204	0.269	0.865	0.278	0.202	0.267	SIS2	0.286	0.28	0.217	0.34	0.202	0.835
CF4	0.257	0.325	0.895	0.333	0.278	0.293	SIS3	0.26	0.303	0.252	0.343	0.17	0.78
CF5	0.257	0.298	0.888	0.324	0.239	0.334	SIS4	0.261	0.289	0.26	0.364	0.176	0.799

Note: ATT=online learning attitude, BI=behaviour intention, CF=COVID Fear, PPR=personal performance resource, SIR=social influence resource, SIS=social isolation.

Ned Kock recommended two methods to assess common method bias (CMB) in PLS-SEM (Kock, 2015): using the correlation matrix method and variance inflation factor (VIF) for full collinearity analysis, with no bias if  $VIF \leq 3.3$ . Table 5 shows that all latent variables have VIF values ranging from 1 to 1.364, which are below the maximum threshold of 3.3, indicating that collinearity and CMB are not significant problems for the analysis.

Therefore, in this context, it can be inferred that the parameter estimates of these independent variables in the model are relatively stable, and the model's explanatory power will not be significantly affected by multicollinearity, demonstrating that the model has good reliability and validity.

**Table 5:** VIF Values

Construction	ATT	BI
ATT		1.099
CF	1.113	
PPR		1.364
SIR		1.324
SIS	1.113	

Note: ATT=online learning attitude, BI=behaviour intention, CF=COVID Fear, PPR=personal performance resource, SIR=social influence resource, SIS=social isolation.

### Structural Model Assessment and Hypotheses Test

After assessing the validity of the measurement model, the structural model is evaluated. A bootstrapping procedure with 5,000 subsamples is used to assign path coefficients.  $R^2$  is an indicator of model fit, used to evaluate the explanatory power of the independent variable(s) on the dependent variable (Hair, Risher, et al., 2019). To evaluate the entire model, the  $R^2$  values for actual use and behavioral intention are calculated, as shown in Table 6. ATT ( $R^2 = 0.148$ ), indicating that in this study, the two independent variables CF and SIS can explain about 14.8% of the variance in ATT. BI ( $R^2 = 0.379$ ), indicating that the independent variables ATT, PPR, and SIR can explain about 37.9% of the variance in BI. This suggests that these independent variables have a relatively high impact on behavioral intention, indicating that the research model is effective and has practical significance.

**Table 6:**  $R^2$  and  $Q^2$

Construction	$R^2$	$Q^2$
ATT	0.148	0.112
BI	0.379	0.263

$Q^2$  is an indicator of model predictive accuracy, typically used to assess the predictive relevance of a model. Generally,  $Q^2$  values greater than 0.25 are considered to have medium predictive ability, while values below 0.25 are considered to have low predictive ability(Hair, Risher, et al., 2019). According toTable 6, the ATT- $Q^2=0.112$ , suggesting that the predictive ability of ATT in the model is relatively low. Thus, need improvement in the predictive ability of attitude in this study. The value for BI ( $Q^2= 0.263$ ), indicating that the predictive ability of this latent variable in the model is relatively good, reaching a medium level. This suggests that the model performs relatively well in predicting behavioral intention.

### Hypotheses Testing

Hypotheses test based on the results of PLS-SEM as shown in Table 7:

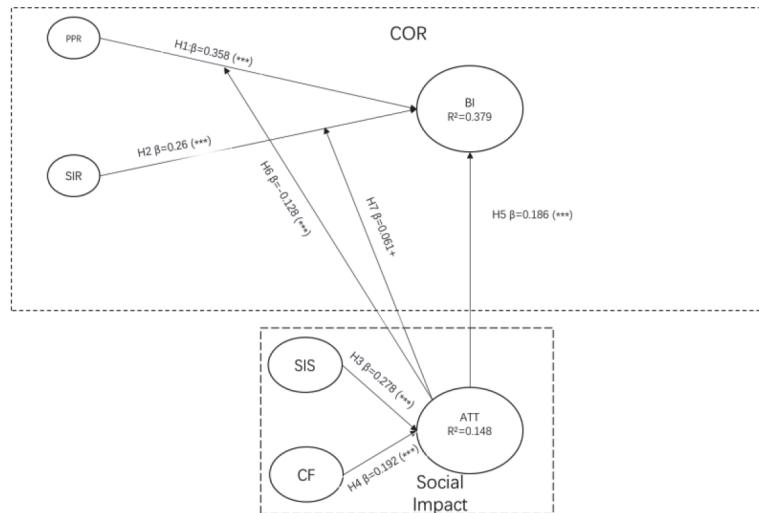
PPR ( $f^2=0.151$ ,  $\beta=0.358$ ,  $p<.001$ ), SIR ( $f^2=0.082$ ,  $\beta=0.26$ ,  $p<.001$ ), and ATT ( $f^2=0.051$ ,  $\beta=0.186$ ,  $p<.001$ ) are significantly related to BI, supporting Hypotheses 1, 2, and 5. SIS ( $f^2=0.082$ ,  $\beta=0.278$ ,  $p<.001$ ) and CF ( $f^2=0.039$ ,  $\beta=0.192$ ,  $p<.001$ ) are significantly related to ATT, supporting Hypotheses 3 and 4. The results empirically confirm that all hypothesized paths exert significant positive effects.

In this study,  $f^2$  values are used to measure the local effect size of the independent variables on the dependent variables, focusing on the relative impact of each independent variable in the model, to assess the relative importance and influence of a given independent variable on the dependent variable. As shown in Table 7: According to the  $f^2$  values standard of 0.02, 0.15, and 0.35 for weak, moderate, and strong effects, respectively (Henseler et al., 2009), indicating that the effect of (ATT on BI), (CF on ATT), (SIR on BI), (SIS on ATT) are relatively small. (PPR on BI)  $f^2=0.151$ , is moderate, suggesting that students' personal performance resources play a significant role in influencing behavioural intention.

**Table 7:** Hypothesized Testing

Hypothesized Path	$f^2$	$\beta$	T Statistics	P Values	Hypotheses
PPR -> BI	0.151	0.358	8.842	0	H1: support
SIR -> BI	0.082	0.26	6.862	0	H2: support
SIS -> ATT	0.082	0.278	6.121	0	H3: support
CF -> ATT	0.039	0.192	4.302	0	H4: support
ATT -> BI	0.051	0.186	4.846	0	H5: support

Note: ATT=online learning attitude, BI=behaviour intention, CF=COVID Fear, PPR=personal performance resource, SIR=social influence resource, SIS=social isolation.

**Figure 2:** Structural Model and Results from PLS Analysis

Note: ATT=online learning attitude, BI=behaviour intention, CF=COVID Fear, PPR=personal performance resource, SIR=social influence resource, SIS=social isolation.

#### Moderating Effect of Attitude:

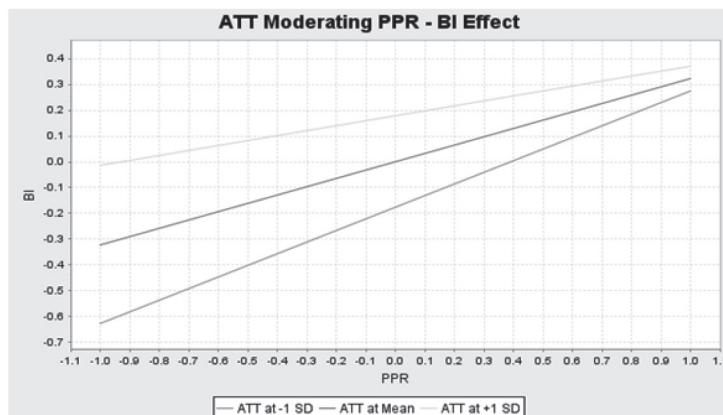
The results for the moderating variable are shown in Table 8:

**Table 8:** Moderate Effect

Moderate Effect	$\beta$	T Statistics	P Values	Hypotheses
ATT Moderating PPR - BI Effect -> BI	-0.128	3.385	0.001	H6: support
ATT Moderating SIR - BI Effect -> BI	0.061	1.564	0.118	H7: not support

Note: ATT=online learning attitude, BI=behaviour intention, CF=COVID Fear, PPR=personal performance resource, SIR=social influence resource, SIS=social isolation.

ATT Moderating PPR -> BI ( $\beta=-0.128$ ,  $P=0.01$ ) indicates that ATT has a significant negative moderating effect on the relationship between PPR and BI. When ATT levels are high, the positive impact of PPR on BI tends to weaken, slope figure show in Figure 3. In this study, we found that an increase in ATT weakens the positive influence of PPR on BI, possibly because the facilitating effect of personal performance resources on behavioral intention diminishes in situations with high ATT.

**Figure 3:** ATT Moderating PPR -BI Effect

ATT Moderating SIR -> BI ( $\beta=0.061$ ,  $P=0.118$ ) shows that the moderating effect of ATT on the relationship between SIR and BI is not significant, Figure 4 indicating that ATT has no moderating effect on the relationship between SIR and BI. This finding suggests that ATT does not have a significant moderating effect on the influence of SIR on BI. Regardless of students' attitudes, the impact of social influence resources on behavioral intention remains relatively stable.

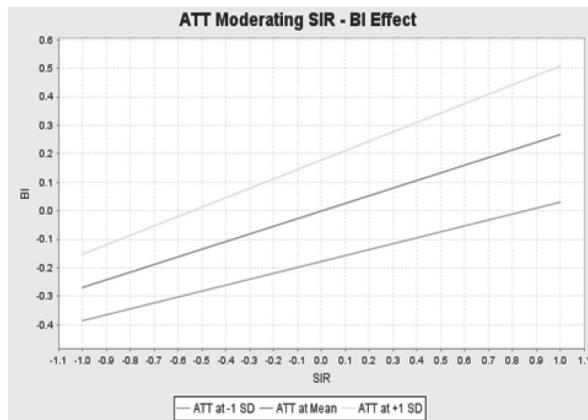


Figure 4: ATT Moderating SIR-BI Effect

## Discussion and Conclusion

### Discussion

In this study, it was found that ATT, PPR, and SIR all have a positive impact on BI. These results indicate that by improving an individual's attitude, personal performance resources, and social influence resources, their behavioral intention can be promoted. This finding supports some previous conclusions (Cao et al., 2021; Yunus et al., 2021), suggesting that online learning and innovative teaching methods are beneficial and necessary to implement new teaching methods under special circumstances, which is consistent with previous research results (Azizan et al., 2022).

Additionally, the research results show that SIS has a significant positive impact on ATT, which is consistent with Cao's finding that prolonged social isolation may lead to mental health problems and further affect an individual's attitude and behavior (Cao et al., 2020). CF also has a significant positive impact on ATT, which is consistent with Ahorsu's research, which found that fear of the virus significantly affects an individual's psychological responses and behavior under the context of the COVID-19 pandemic (Ahorsu et al., 2020). The fact that SIS and CF jointly have a significant impact on ATT is also similar to previous research (Rui et al., 2021). This demonstrates that when social impact cause threats to their social and personal resources, students tend to use online learning to strengthen social connections, achieve academic success, and perform well to alleviate the negative emotions caused by resource loss due to social

isolation and health threats from the pandemic. This suggests that fear of the virus or social isolation may lead to more positive attitudes towards online learning. This may be because, in such situations, people are more focused on and willing to make efforts to maintain and preserve existing resources, resulting in a more positive attitude.

Importantly, this study presents an in-depth analysis and research on the moderation of resources by ATT, which has not been addressed by previous researchers, and found a significant negative moderation between PPR and BI. This means that an increase in ATT weakens the positive effect of PPR on BI, possibly because the facilitating effect of PPR on BI diminishes in situations with high ATT. Here are some possible reasons:

- When ATT is strengthened: In this situation, individuals hold a positive attitude towards a particular goal or behavior, and they may have largely recognized the value and importance of the behavior. Therefore, PPR may have a smaller impact on BI in this situation, as individuals already have strong intrinsic motivation to achieve the goal.

- When ATT wanes: In this situation, individuals hold a negative attitude towards a particular goal or behavior. Although PPR may have some positive impact on BI—due to the negative influence of attitude, individuals may not be willing to fully utilize these resources, making the impact of PPR on BI more significant. From the perspective of conservation of resources theory, this phenomenon can be explained as: when individuals face stress or challenges, they strive to protect and accumulate their resources. In this study, when individuals have a strong attitude, they may reduce personal performance resources to achieve the goal and accumulate more resources in the process. Conversely, when individuals have a weak attitude, they will avoid losing too many personal performance resources in the process of achieving the goal, and increase the proportion of personal performance resources.

## Conclusions

This study integrates COR Theory and SIT by adopting variables related to personal and social resources among students. It aims to explore the relationships between these resources and constructs a new theoretical framework. The study investigates the behavioral intentions of international students towards online learning when faced with social environmental changes and the impact of attitudes formed by social isolation and fear of the virus on related resources and behavioral intentions.

In this study, from the perspective of COR Theory, the data revealed several prominent findings: CF and SIS have a significant positive impact on ATT. This implies that individuals facing resource loss due to CF and SIS will strive to maintain existing psychological and social resources, thus forming a positive attitude to cope with adversity. PPR, SIR, and ATT have a significant positive impact on BI. This indicates that these resources play a crucial role in supporting and promoting individual behavioral intentions, and individuals with abundant resources are more likely to form positive behavioral intentions. The moderating effect reveals that ATT has a significant negative moderating effect on the relationship between PPR and BI. Within the framework of COR theory, this means that individuals have different demands and ways of utilizing personal performance resources at different attitude levels. When attitudes are more positive, individuals may shift their focus towards resource conservation, thereby diminishing the influence of personal performance resources on behavioral intentions.

### **1) Theoretical Contributions of this Study**

This study examines the influence of resources possessed by college students on their behavioral intentions for online learning: revealing the impact of personal performance resources, social influence resources, and attitudes on behavioral intentions, enriching the application of COR theory in the field of behavioral intentions, and providing new empirical support for the theory. This study also reveals the moderating effect of attitude on resources and intentions, finding that attitude has a significant negative moderating effect on the relationship between personal performance resources and behavioral intentions, unveiling the underlying mechanisms that govern behavioral intentions under different resource combinations in the resource conservation process, and expanding the research on the moderating effect of COR theory. The theoretical framework integrates and complements the UTAUT model's performance expectancy and social influence within the COR theory framework, providing new perspectives and ideas for theoretical development.

### **2) Significance and Contributions to Education**

This study's findings suggest that educators should pay attention to the protection of students' psychological resources to enhance psychological support and motivation during learning. Applying COR theory in the context of social impact provides insights

into how educational systems can address resource loss and acquisition to cope with challenges posed by social changes. The study recommends that universities and educators to pay attention to students' resource acquisition in the teaching process, providing more comprehensive care and support. The findings show that the impact of social isolation is significantly greater than the fear of the virus, suggesting that the factors affecting students under social impact are more related to loneliness. Schools are encouraged to strengthen students' psychological construction, and teachers should alleviate students' psychological pressure after social isolation through more frequent interaction and communication. The study also finds that students prefer preserving learning performance resources, suggesting that schools and teachers can specifically ensure that students complete their studies smoothly under social impact, investing resources to reduce the severe consequences of psychological resource loss. The insights gained from this study can assist universities and relevant educational departments optimize online learning programs during special periods, assisting schools and teachers in taking necessary measures to strengthen the effectiveness of online teaching, such as improving the social influences encountered by college students in online learning, maintaining contact to reduce social isolation and alleviate fear of the virus (Hwang et al., 2020), enhancing online learning outcomes, and providing students with teaching assistance and psychological construction to improve the online teaching process.

### 3) Limitations and Future Research

Nonetheless, the scope of this study is confined to Chinese students studying in Thailand, with a limited number of respondents. The resources, attitudes, and intentions towards online learning of these students cannot be generalized to a broader scope. This study only selected a few variables affecting behavioral intentions, but COR theory involves a wide variety of resource types, and there may be other unconsidered resource factors influencing behavioral intentions. This study employed an empirical research method, which, to some extent, reveals the in-depth relationships between variables but may still lack exploration of COR theory's connotations. This study did not delve deeply into the dynamic processes within COR theory.

In future research, we suggest applying online learning scenarios to a broader scope, such as other situations where students are forced to learn online due to an epidemic

environment, or even in non-epidemic situations. Additionally, further expanding to more complex models, introducing more resource variables, such as personal innovation and self-efficacy, to collaborate. Future research can explore different cultural and regional contexts to verify the universality of the research conclusions. Moreover, COR theory emphasizes the dynamic process of resource loss and resource acquisition. Subsequent research could employ longitudinal designs and dynamic analyses to reveal the changing patterns during resource loss and resource acquisition processes. If conditions permit, research can be conducted at multiple levels, such as individuals, teams, and organizations, to discover new rules and phenomena in resource conservation.

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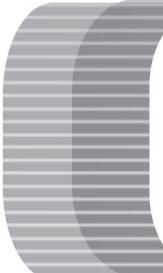
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# Analysis of Key Features Affecting The Effectiveness of English Language Learning among Undergraduate Students Utilizing The Data Mining Techniques

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## Abstract

In this paper there are two folds of study. One was to compare two data mining techniques, which were Random Forest and Decision Tree, while the other was to pick the better one to analyse the key features affecting the effectiveness of English language learning at the undergraduate level.

With the same dataset, the Random Forest had shown that it was more accurate than the other. When applying the Random Forest to the collected data, the results revealed that the factors impacted on the effectiveness of English language learning at undergraduate level of the selected university students were Enjoying learning English, Asking teachers immediately when they didn't understand the content of the lesson, Interest and attention to English, Students that studied in groups to review English lessons with friends when the exam was approaching, Students that invested extra time into research and studying English beyond the classroom, respectively. They could be the keys to success in English learning for the other undergraduate students.

**Keywords:** Data Mining, Decision Tree, Random Forest, Academic Effectiveness, Learning English

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# การวิเคราะห์คุณลักษณะสำคัญที่ส่งผลต่อประสิทธิผล การเรียนวิชาภาษาอังกฤษของนักศึกษาระดับปริญญาตรี โดยใช้เทคนิคเหมืองข้อมูล

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## บทคัดย่อ

ในบทความวิจัยนี้แสดงผลการศึกษาเป็นสองขั้นตอน โดยเริ่มจากการเปรียบเทียบประสิทธิภาพของการทำเหมืองข้อมูลด้วยเทคนิค ตัวแบบป่าไม้ตัดสินใจ (Random Forest) และตัวแบบต้นไม้ตัดสินใจ (Decision Tree) จากนั้น นำเทคนิคที่ดีกว่ามาใช้วิเคราะห์คุณลักษณะสำคัญที่ส่งผลต่อประสิทธิผลการเรียนวิชาภาษาอังกฤษของนักศึกษาระดับปริญญาตรี

ผลการเปรียบเทียบโดยใช้ข้อมูลชุดเดียวกัน พบว่า เทคนิค ตัวแบบป่าไม้ตัดสินใจ ให้ค่าความแม่นยำสูงกว่า และเมื่อใช้เทคนิคดังกล่าวทำการประมวลผลข้อมูล ปรากฏว่า ความสนุกกับการเรียนภาษาอังกฤษมีความสัมพันธ์ การถามอาจารย์ทันทีเมื่อไม่เข้าใจเนื้อหาที่เรียน ความสนใจ และตั้งใจเรียนวิชาภาษาอังกฤษในขณะที่อาจารย์สอน การจับกลุ่มทบทวนบทเรียนภาษาอังกฤษกับเพื่อนเมื่อใกล้สอบ และการศึกษาหรือค้นคว้าข้อมูลเพิ่มเติมเกี่ยวกับภาษาอังกฤษนอกเหนือจากที่อาจารย์สอน มีความสัมพันธ์กับประสิทธิภาพการเรียนวิชาภาษาอังกฤษของนักศึกษาจากมากไปหาน้อย ตามลำดับ ซึ่งคุณลักษณะเหล่านี้จะเป็นกุญแจสำคัญสู่ประสิทธิผลในการเรียนการสอนภาษาอังกฤษในระดับปริญญาตรี

**คำสำคัญ:** การทำเหมืองข้อมูล ตัวแบบต้นไม้ตัดสินใจ ตัวแบบป่าไม้ตัดสินใจ ประสิทธิผลทางการศึกษา การเรียนภาษาอังกฤษ

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## Introduction and Objectives

“English” is a popular foreign language and a common language that conveys meaning to almost four corners of the world. Over 2,000 million people or one third of the global population mainly use English in their communication (Thanakorn and Sangiam, 2016). Therefore, it is crucial to promote the Thais especially those in higher education who will contribute to the country’s future strength. Their English skills should be developed, and their English language learning should be upgraded for higher efficiency. Based on the ranking of English in 100 countries worldwide where the English language skills are not used as a main language by the EF (Education First) Institute, the criteria to measure the level of English is divided into five levels for the use of English ranked from Very high to High, Moderate, Low, and Very low, respectively. It was revealed that the English of the Thais belonged to the last group of Very Low with the score of only 47.61, which decreased for three consecutive years since 2017. The ranking of English of the Thais in 2020 was found that the use of English of the Thais continuously decreased or down to the rank of 89 (Education First, 2020). Therefore, the promotion of the skills in English in higher education must be planned from the compulsory basic courses starting with the understanding of the behavior and motivation which affects English language learning and is probably a factor that promotes the English skills of the Thais for the better future. The research (Supika, 2018) was conducted to find the correlation between the factors of attitude, motivation, and behavior of English language learning of the students at Phuket Rajabhat University. The study results revealed that the factors of attitude, internal motivation, and learning behavior linked with success in English language learning. Good attitude had the most influence on the effectiveness of English language learning. Motivation also had a major role in successful learning of foreign language or the second language although learners’ motivation could change all the time, depending on the context of the language learning (Mitra, 2016). At the same time, Data mining techniques started to attract more interest in finding the correlation within the dataset and apply them in many dimensions including education. For example, the use of the Decision Tree technique to forecast the study results of engineering students in India to acquire the information of the students who tended to fail in the study and plan necessary measures beforehand (Kabra & Bichkar, 2011). Data mining is therefore an instrument that will increase the opportunity for in-depth analysis to know the major factors to plan, accommodate,

and create the paradigm of learning between various correlations based on targets. Thus, the researchers came up with the concept to study the feasibility of utilizing the information from behavior, attitude, and motivation together with the process of data mining to classify and forecast the types of features or behaviors that would affect the effectiveness of English language learning.

This study used the case study of the students of the Faculty of Geoinformatics, Burapha University. The aim was to achieve the effectiveness of the basic English language learning of the students who did not take English as a major, as well as prepare and upgrade the knowledge level of English language both in daily life and for efficient self-development in various dimensions.

## Objectives

The objective of this research is to study and analyze the key features affecting the effectiveness of English language learning among undergraduate students utilizing the data mining techniques between the Decision Tree technique and the Random Forest technique.

## Research Questions

Which data mining techniques between the Decision Tree technique and the Random Forest technique is appropriate to be used to analyze the key features affecting the effectiveness of English language learning among undergraduate students?

What type of features that enable undergraduate students to have good and effective basic English language learning?

## Research Scope

### Scope of Content

This research studied the key features affecting the effectiveness of English language learning among undergraduate students at the Burapha University covering four dimensions namely 1) Grades of basic English class and the number of class missing in the class 2) General information of the students 3) Information of behavior affecting English language learning and 4) Attitude and motivation in English language learning.

### Scope of Population

This research collected data from the sample of 299 undergraduate students, Faculty of Geoinformatics, Burapha University during the academic years 2018-2020 and with the grades of the University's basic English.

### Scope of Methods

This research used the data processing and comparison of the two techniques of Data Mining namely Decision Tree and Random Forest to analyze the key features affecting the effectiveness of English language learning of undergraduate students and measure the effectiveness of the model with the Cross Validation and Confusion Matrix which collected the data with close-ended questionnaire.

### Scope of Time

This research spent six months for the study, data collection, and data processing between January to June 2021.

## Definition of Terms

**Effectiveness in English language learning** means students with very good results or grade A of the basic English language learning at Burapha University.

**Education First (EF) institute** means leading foreign language institute. It is a large education organization that ranks the countries with the ability to use English recognized worldwide.

**Application of the data mining technique** means utilization of the process of the data mining technique by adapting for appropriateness of the undergraduate students with the results of the basic English language learning at Burapha University.

**Key features** mean the data of the specific features or behavior relevant to the dataset to be used to construct the algorithm with the data mining technique.

## Literature Review

### Attitude and Motivation Affecting English Language Learning

Attitude is crucial in English language learning. Visser (2008) stated that the success in language learning did not depend on intelligence or expertise alone but good attitude in learning as well. Similarly, to the research of Gardner (1975) who stated that attitude constituted a major factor in successful foreign language learning similarly to learning of other courses. It must start with good attitude towards the goal to lead to effective learning process and to learners' good behavior. Gardner & Lambert (1972) suggested that the attitude in foreign language learning was divided into two types namely 1) Integrated attitude is the feeling of admiration for a language and the intention to create familiarity as part of the society that used the language and 2) Functional attitude was the intention to use language for ones' utility in developing various dimensions. Apart from attitude, motivation was also crucial to the success in English language learning. Spraat et al. (2005) explained that motivation significantly influenced success or failure in language learning. This was in accordance with Broussard & Garrison (2004) who stated that the learners with high level of motivation in learning English would have higher learning effectiveness. The research of Napat Woothiwongsa (2014) recommended three levels of strategy to motivate English language learning namely 1) Language level such as attitude towards the culture of language owners and own success 2) Learner level such as the desire to succeed and self-confidence and 3) Level of learning situation such as motivation of interesting content of the course, lecturer, and learners. Therefore, the motivation of all forms derives from good attitude and has positive impact on English language learning (Supika, 2018; Deeden, 2013).

### Behavior Affecting English Language Learning

Learning behavior means technique or learning method used by learners to succeed in foreign language learning (Ellis, 1997). This was in line with Pornpot Petchtaveepomdej (2004) who gave the meaning of learning behavior as activities, response, or learning methods of learners to develop knowledge, skills, and attitude to achieve the learning goal by expressing satisfaction and efforts for better development. Once a habit, it will lead to learning success. If learners had behavior or learning technique which was appropriate to themselves, they would increase their learning proficiency. The behavior

or technique would develop and increase the skills in language learning (Oxford, 1990). There were numerous research works in foreign countries on attitude, motivation, and behavior of English language learning. For example, Chen & Huang (2003) found that highly skilled students in language had better and more frequent behavior and learning strategies than the students with lower language skill. This was consistent with the research of Wu (2008) who found that highly skilled students in language in Taiwan had learning strategies such as planning, communication, and more cultural learning of language. Moreover, Broussard & Garrison (2004) studied the relations between motivation and effectiveness in English language learning of primary school pupils in the first and third years. It was found that motivation in learning had positive impact on the effectiveness of English language learning. It could be said that attitude, motivation, and good behavior had positive impact on the success of English language learning.

### Concept of Data Mining

Data mining is a process that uses calculation with big data by bringing out complicated and important data. The objective is to find the model of data, survey big dataset, construct the model that explains key features of data, and forecast the trend of the data (Springer Link, 2013). One of the popular uses of data mining is Classification which is to construct the model that classifies data from the learning dataset already classified in order to classify new data the type of which is not yet known (Surapong, 2018). For example, the classification of the opportunity that a client will cancel services, etc. The Decision tree technique is a type of data mining based on the Classification of data with the model resembling a tree consisting of nodes and links. Each node of the Decision Tree consists of condition using any variable of the data. The decision will start from the Root node of the tree up to Child node and finally to Leaf node , which is the node that will identify the type of the data (Surapong, 2018).

The Random Forest technique is one the techniques that use the Machine learning with the features to classify the data of the tree structure to construct a model and forecast the objective. The Random Forest technique is widely recognized by biomedical and pharmaceutical research due to its highly effective forecast and accuracy. The algorithm of Random Forests is the model that forecasts the trees, each of which will depend on the vector that is randomly picked, independently from each other, with

the same dispersion of the whole tree. Napaporn Sirikulviriya (2011) cited in Wanvisa (2017) who stated that Random Forest was a technique developed and enhanced from the technique of Decision Tree with the use of only one tree to classify the types of desired data to ensure that the model had the highest efficiency in forecast accuracy.

Cross Validation is the method to divide the dataset to construct and test the model by dividing it into the K Disjoint Subsets and each Subsets did not have the same data. Then, it would start with the data of  $k-1$  subsets in developing the model and use the remaining part of 1 subset as the data for the test. Repeat the activity with the number of  $k$  times. Therefore, in developing the model each time, the  $k-1$  subset and the remaining 1 subset would be used. The same data would not be used to assess the effectiveness of the model. The mean of the assessment of the number of  $k$  times would be used. This method was called  $k$ -fold Cross Validation. It could be seen that each data would be used as the data for the test package only one time and would jointly construct the model of  $k-1$  time. In case there is not much data, the  $k = n$  could be determined by while  $n$  was the total data. It means that each time, the data  $n-1$  would be used to construct the model and the remaining data of 1 would develop the model (Surasit, 2015).

The measurement of the efficiency of accuracy in classifying the types consistent with the actual data was conducted through the calculation of the ratio of the number of data that the algorithm made completely correct forecast compared with the entire number of the data. Precision in correct forecast of the classification of the types of data was calculated only the ratio of the data that the algorithm made forecast of what happened with the data that the algorithm forecast as actual. The Recall means the ability of the variable in classifying the types of data and the F-Measure measures the efficiency by combining the calculation of Precision and Recall and the combined average (Surapong, 2018).

## Research Conceptual Framework

Based on the relevant concepts and theories, the research framework could be determined to study and analyze the key features affecting the effectiveness of English language learning among undergraduate students utilizing the data mining technique as in Figure 1.

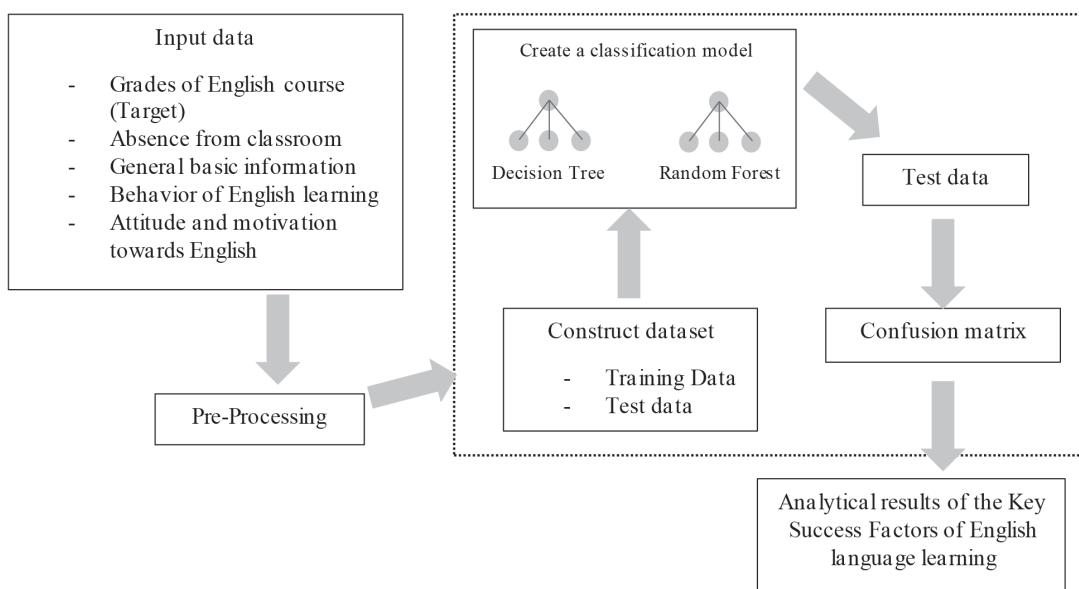


Figure 1: Research Conceptual Framework

## Population and Sample

This research determined the population of 462 students of Faculty of Geoinformatics, Burapha University during the academic years 2018-2020 with the results of basic English of the University (Office of the Registrar, Burapha University as of 4 May 2021). The smallest size of the sample was 210 students according to the concept of Krejcie and Morgan (1970) to reduce the discrepancy from collection of data and for more accurate results. The researchers therefore increased the size of the sample to 299 students.

## Methodology

Based on the study and the analysis of the key features affecting the effectiveness of English language learning among undergraduate students by using the data mining technique, the researchers applied the process of data mining development (CRISP-DM) to serve as the research guideline. The operation was divided into five processes as follows:

### Study and Data Collection

This research was collected through the questionnaire consisting of data on English language learning of the students, basic data of the students, behavior that affected English language learning, attitude and motivation. The data collection aimed to seek the key features which could identify the types of features that were the reasons that the undergraduate students had effective English language learning by using the analytical process of data mining, application of the Binary Classification (Cortez and Silva, 2008). The dataset consisted of 31 Input Attributes and one Target Attribute shown in Table 1. The researchers determined the grades of basic English of students with Binary Classification, classified into the group of students with effective English language learning (Students earning grade A) and the group of students with results of learning of general, basic English (students earning other grades).

### Data Preparation

The inspection of the incompleteness of the data collected from the questionnaire of 299 samples was done using Microsoft Excel program to delete the irrelevant parts and modify the language of all the questions from Thai to English as in Figure 2.

**Table 1:** Dataset Relevant to the Success of English Language Learning for Data Processing

Features	Explanation	Modified Value
GENDER	Gender of the students	{F, M}
AGE	Age of the students	{numeric 18 to 25}
H-COM	Possessed computer and internet for personal use	{yes, no}
LOC	Location of habitation	{urban, rural}
ABSENCE	Number of times of absence from English class	{numeric 1 to 10}
S-ENG	Extra lessons in English	{yes, no}
F-TIME	Free time from class	{very little, little, moderate, high, very high}

Table 1: Dataset Relevant to the Success of English Language Learning for Data Processing (cont.)

Features	Explanation	Modified Value
H-FREQ	Time to go out with friends	{very little, little, moderate, high, very high}
S-STUDY	Free time to practice English by oneself	{very little, little, moderate, high, very high}
A-PROF	Asked lecturers immediately when the students did not understand the content of the lesson	{very little, little, moderate, high, very high}
E-PLAN	Planning of English language learning	{yes, no}
P-SELF	Preparation before attending English language class	{yes, no}
S-FRIEND	Preferred to sit next to the friend who was attentive to learning	{yes, no}
F-FRIEND	Had foreign friend with whom to practice English skills	{yes, no}
I-ENG	Showed interest and attentiveness in English learning during lecture	{very little, little, moderate, high, very high}
T-NOTES	Took notes during lecture	{very little, little, moderate, high, very high}
A-QUE	Answered questions while learning English	{very little, little, moderate, high, very high}
A-SCHOOL	Revised English lessons after class	{very little, little, moderate, high, very high}
E-RES	Conducted additional study and research on English apart from lecture	{very little, little, moderate, high, very high}
C-STUDY	Studied in groups to revise English lessons with friends upon the approach of the examination	{very little, little, moderate, high, very high}
H-EDU	Desired to study at higher level	{very little, little, moderate, high, very high}
F-SUPP	Family support for English language learning	{yes, no}

**Table 1:** Dataset Relevant to the Success of English Language Learning for Data Processing (cont.)

Features	Explanation	Modified Value
E-ENG	Enjoyed learning English	{very little, little, moderate, high, very high}
L-IMPROVE	Interest in learning English for self-development	{very little, little, moderate, high, very high}
L-JOB	Interest in learning English for finding jobs in the future	{very little, little, moderate, high, very high}
L-PAREN	Interest in learning English due to parents' wish	{very little, little, moderate, high, very high}
L-PASS	Interest in learning English to pass the examination	{very little, little, moderate, high, very high}
L-DAILY	Interest in learning English for daily communication	{very little, little, moderate, high, very high}
E-MOV	Joy in reading books and watching films in English	{very little, little, moderate, high, very high}
L-GRADE	Learning English was important due to the wish to have good grades	{very little, little, moderate, high, very high}
L-KNOW	Learning English was important because English enhanced more knowledge	{very little, little, moderate, high, very high}
Grade	University's grades of basic English	(A, B, C, D, F)

Then, the Jupyter program and the Python language were used to convert data for appropriateness prior to entering the process of data mining through the methods of Factorization to replace each dataset with the features in the form of message (Label) or figures (Numerical) as the data was continuously related and not a lot of different data was dispersed. The survey was also conducted of all data with 32 attributes to forge understanding and to be used to consider the statistical trend within the dataset. The ratio of the group of students with effective English language learning totaled 42 students and the group of students with the grades of basic general English totaled 257 persons. The survey revealed that most of the sample were female more than male and almost all students had computer and internet for personal use. At the same time, they did not take extra lessons

in English language. Then, the researchers selected only key features to represent the dataset based on Pearson's Correlation. The researchers selected the attributes with the value of over 0.1 for analysis. The remaining 15 attributes were correlated to the grades of basic English as in Figure 2.

```
In [119]: 1 # Consider correlations only with the target variable
2 cor = df.corr()
3 cor_target = abs(cor['GRADE'])
4 correlated = cor_target[cor_target>0.1]
5 most_correlated = df.loc[:,correlated.index]
6 print(correlated)

GRADE      1.000000
S-STUDY    0.191739
A-PROF     0.119383
S-FRIEND   0.154396
I-ENG      0.212282
A-QUE      0.224614
E-RES      0.103013
G-STUDY    0.140809
H-EDU      0.113585
E-ENG      0.237841
L-IMPROV   0.174530
L-JOB      0.221326
L-PASS     0.105088
L-DAILY    0.159058
E-MOV      0.110849
L-KNOW     0.132827
Name: GRADE, dtype: float64
```

Figure 2: Data of the Features Selected to Construct the Model in the Jupyter Program

### Construct the Model

The Sklearn library of Python was used to determine the ratio of the dataset of 229 samples divided into two parts namely training dataset of 70% for instruction (209 samples) and the test dataset of 30% for testing of model (90 samples) as it determined the basic ratio of the data testing (Alls, Karakurt, and Melli, 2000). Then, the algorithm was chosen with the Decision Tree and the Random Forest techniques for testing and parameter adaptation through the dataset of 15 attributes (Variable X) to determine the grade of the students' basic English as the target attributes (Variable Y) and divide the effectiveness of English language learning.

### Assess the Effectiveness of the Model

The test of effectiveness of the model would be based on the consideration of the most appropriate model between the Decision Tree technique and the Random Forest technique. The researchers used the method of k-fold cross validation by dividing the training dataset and test dataset equally into ten parts. The nine parts would be used for the training dataset and the remaining one part would be used for the test

dataset. Each part derived from random sampling and training and testing would be conducted repeatedly for ten times. The researchers used the Confusion matrix as an instrument to assess the results of the effectiveness of the model divided by types. The effectiveness of the model was conducted based on Accuracy, Precision, Recall, and F1 score in order to find the accuracy of the model with the highest value.

### Utilization

The research results from the analysis revealed the effective features or behavior of undergraduate students in English language learning. The features from the analysis based on the data mining could be used to plan the students' English language learning, which would benefit the enhanced analysis for higher effectiveness of the students' other courses.

## Study Results

### Results of the Comparison of the Model

The results of the construction and the testing of the model based on the Decision Tree technique and the Random Forest technique revealed that the Random Forest technique yielded the forecast accuracy of the effectiveness of the students' English language learning equaled to 85.14% whereas the forecast accuracy of the Decision Tree technique was 78%. These were assessed from the Accuracy Mean which calculated the accuracy from the mean and the standard deviation of all the test results based on the 10-fold cross validation as shown in Table 2.

**Table 2:** Testing Results of the Model Based on the K-fold Cross Validation

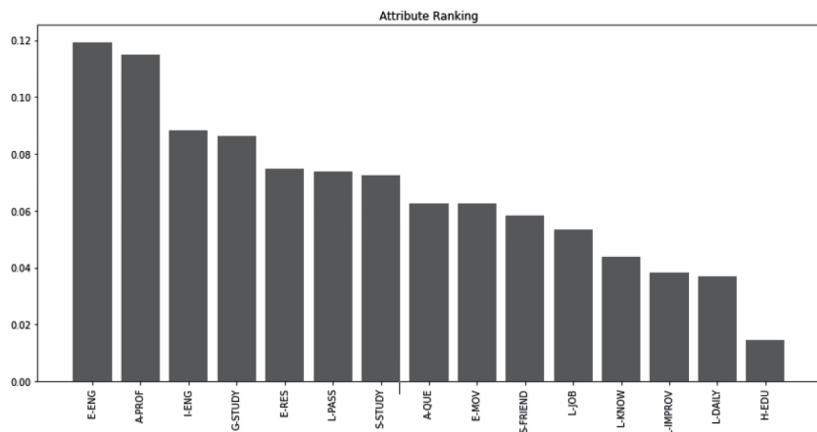
Algorithm	Accuracy Mean	Accuracy STD
Random Forest	85.14	6.26
Decision Tree Classifier	78.00	5.26

Testing was conducted of the accuracy of the model once again with the test method of Confusion Metrix by finding the accuracy from the ratio of the classification of types with Training 70% and Testing 30% to identify the level of accuracy in classifying the types of data. It was calculated from the ratio of the number that the models correctly

classified the types with the total amount of data. It was found that the Random Forest technique still had high accuracy with the value of 0.84 and the accuracy of the Decision Tree technique equaled 0.69. The comparison of the effectiveness of the models revealed that the model developed with the Random Forest technique provided accuracy to analyze the key features affecting the effectiveness of English language learning of undergraduate students more than the model developed with the Decision Tree technique. The researchers chose the model from the Random Forest technique to analyze 15 key features.

#### **Analysis Results of the Key Features Using the Random Forest Technique**

Based on the data processing with the Random Forest technique to analyze the features that identified the effectiveness of the students' English language learning, the sample of the students of Faculty of Geoinformatics, Burapha University were used. They consisted of 299 students with 15 features (Variable X). It was found that the results of the variables of the first five features mostly correlated to the effectiveness of the students included enjoyment of English language learning which had a 0.1194 correlation to the effectiveness of the students' English language learning, and asking questions to lecturer immediately when not understanding the content of learning had a 0.1149 correlation to the effectiveness of the students' English language learning. The interest and attentiveness in English language learning while the lecturer was teaching had a 0.0884 correlation to the effectiveness of the students' English language learning. The study in groups to review English lessons with friends when the examination was approaching had a 0.0864 correlation to the effectiveness of the students' English language learning. The additional study or research on English apart from the lecturers' teaching had a 0.0747 correlation to the effectiveness of the students' English language learning. The graph derived from the analysis using the Random Forest technique was in Figure 3.



**Figure 3:** Graph of the Attribute Ranking Which Identified the Effectiveness of the Students' English Language Learning

Analytical results of the features identifying the effectiveness of the students' English language learning compared the ratio of the group of students with effectiveness of English language learning (grade A of basic English) and the group of students with the grades of the basic general level of English as in Table 3.

**Table 3:** Ratio of Students with the Grade A of Basic English of the First Five Ranks

Features	Level of Frequency (%)				
	Very Little	Little	Moderate	High	Very High
E-ENG	12.5	11.11	6.25	27.08	<b>40.0</b>
A-PROF	15.09	7.14	17.14	<b>27.77</b>	<b>27.27</b>
I-ENG	0	11.11	7.23	27.78	<b>30.43</b>
G-STUDY	<b>21.74</b>	16.28	13.48	10.00	0
E-RES	14.81	11.26	12.76	10.34	<b>43.75</b>

The results of the testing of effectiveness of the model developed with the Random Forest technique using the Confusion Metrix in measuring the effectiveness revealed that the Accuracy Score of the model in classifying the types equaled to 86% and measuring the Precision, Recall, F-Score equaled to 87%, 94%, and 92%, respectively. They demonstrated the perspective of the ability of the model to classify the group of students with the performance of basic general English (determined grades B, C, D, F

of basic English). At the same time, the perspective of the ability of the model to classify the group of students with effectiveness in English language learning (determined grade A of basic English) equaled to 50%, 15%, and 24% respectively. This part demonstrated that for the features identifying the effectiveness of English language learning, the data might be too little.

## Conclusion and Discussions

Data mining contributes to the extraction of interesting knowledge from data and widespread use. Many research studies use data mining to improve the quality of education and increase the effectiveness of instructions. For this study, the test was performed to compare the effectiveness of the models between the Decision Tree technique and the Random Forest technique to select the model appropriate to the analysis of the features affecting the effectiveness of English language learning among undergraduate students. The model was developed by using the data collected from the questionnaire after the experts' testing of precision. The study results revealed that the Random Forest technique was more accurate and effective than the Decision Tree technique. This was in accordance with the research of R (2015) who explained that the Random Forest technique was a group of Decision Tree consisting of numerous Decision Trees. The algorithm would compare and analyze each Decision Tree separately. As a result, the rate of the mistakes of the Random Forest technique was smaller than the Decision Tree technique which rendered the forecast more accurate.

As for the results of the algorithm of ranking the key features in correlation to the effectiveness of English language learning of undergraduate students with the Random Forest technique, the key study results from the analysis of the first five ranking could be summarized as follows:

1) In terms of enjoyment in learning English, the study results revealed that the level of great enjoyment had direct correlation to the students with effectiveness of English language learning. It demonstrated that the group of students with effectiveness of English language learning usually enjoyed learning English. This was consistent with the research of Lucardie (2014) who stated that the motivation and enjoyment in learning any subject would connect outcome, effectiveness, and success in learning the subject. Many factors that could create the positive learning environment to motivate enthusiasm

and enjoyment in learning English. The lecturers could use the results of the study to modify the curriculum in the classroom, pleasurable activities such as English exercise, video games, and social activities to forge friendly atmosphere, and support better English language learning of the students.

2) In terms of asking lecturers immediately when they did not understand the content of the lesson, the study results revealed that the students tending to seek assistance or ask the lecturers when learning English were usually the group of students with the effectiveness of English language learning. This was in accordance with Prathan (1994) who stated that the technique to forge understanding in learning was to prepare in advance and ask questions to acquire real knowledge and understanding. Therefore, the lecturers could specifically allocate time to construct exercise or activity to raise questions. This activity could provide the opportunity for both students and lecturers to ask questions. Moreover, asking questions would ensure the students' success and the lecturers' learning from the students as well.

3) In terms of interest in learning English, the study results revealed that the students with effectiveness of English language learning were interested in learning at a high level compared with the students with normal learning results. This was in accordance with the academic research of Renninger et al. (1992) who explained that students with more interest in learning tended to have better grades than students with low interest in learning. Therefore, the arrangement of appropriate form of instruction and the creation of interesting learning atmosphere could be an instrument that would enhance interest in the English language learning. Lecturers could organize the activities that students might learn English apart from textbooks in general. They would render the English language learning more interesting and enjoyable. There were numerous methods of arranging the classrooms that were more interesting to students such as learning through films and TV programs, etc.

4) Forming groups to revise the English lessons with friends before the examination revealed that the students with effectiveness of the English language learning usually did not form group to review the lessons. This behavior could be analyzed that the students with effectiveness of the English language learning might clearly allocate their time, as well as revise the lessons, and study or research for additional information on English. Therefore,

it was not necessary to revise the lessons before the examination. The academic research showed that the strategy of forming in group had both negative and positive impacts on students' learning and development. It depended on the methods used in the classroom (Chen, Hwang, & Lin, 2019). The review of lessons near the examination date might have both positive and negative impacts. Lecturers could use this information to observe the students' behavior such as from handing in homework, assigning work, or motivating the students to allocate time for examination preparation, etc.

5) Additional study or research on English apart from lecturers' teaching revealed that the students with effectiveness of English language learning were interested in additional study or research on English which constituted an important behavior of learning. The English language learning outside the classroom for additional review of lessons was in accordance with the concept of Maxwell-Jolly (2011). It showed that extra time used for education outside the classroom could improve motivation and participation of students, as well as promote social relationship between students and families. These results could be used to arrange for instruction that might focus on providing additional information sources and necessary instruments through classrooms.

#### **Recommendations for future research**

1. This research was conducted and tested by using the sample from the Faculty of Geoinformatics, Burapha University. Therefore, the results of the development of the sample derived from one group of samples which might not be sufficiently inclusive. Therefore, to acquire the effectiveness in forecasting the model in the future study, the samples may have to be dispersed and added for more inclusive data collection.
2. Measurement of the effectiveness of the English language learning among undergraduate students may have additional factors that can be used to determine the criteria to measure the effectiveness of the students' English language learning better than the grades of individual course such as construction of the model to test the level of English and compare the scores with the grades received from the university, etc.

3. Study should be conducted on other causal variables expected to impact the effectiveness of English language learning in order to compare and plan effective and inclusive learning. There may be other factors that affect the effectiveness of students' English language learning which can be additionally analyzed such as grades of other courses, skills, number of learning hours a day, social factors, and quality of instruction, etc.

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# Recommendations for the Submission of Papers

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- 9) The paper (Word file and PDF) plus a submission form should be submitted via ThaiJO system (Thai Journal Online System) at <http://www.tci-thaijo.org/index.php/NDJ>.
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### Examples of Translated Thai References

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