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Editorial Note

The Interdisciplinary Research Review (IRR) was established with academic cooperation by The Royal Society of Thailand Committee of Interdisciplinary Research and Development, Rajabhat University (Western Group), and Rajamangala University of Technology Rattanakosin. This Issue, Volume 18 Number 6 (November – December 2023). This issue contains of four interesting articles in multidisciplinary fields: (1) Environmental Health Management to Prevent Infectious Diseases and Epidemics in Thailand's Southern Border Provinces , (2)Participatory Multi Criteria Decision Making for Irrigation Management Chiang Rai Province, Thailand, (3) Greenhouse Gas Emission Reduction Guidelines to Promote Green University of Rajabhat Universities in Southern Thailand, (4) Effects of Family Participation Enhancing Program on Health Behaviors of Muslim Elderly with Hypertension in Thung Yang Daeng District, Pattani Province, (5) Herb and Medicinal Properties Information Services with AI and NLP, (6) Gender Identity Construction of Homosexual (Kathoey) Student Teachers in Educational Area.

The Editorial Board of the IRR encourages anyone to submit articles for evaluation and review. The processes of submission, review and publication of articles are described on the journal's website, https://www.tci-thaijo.org/index.php/jtir. The Editorial Board and Committees of the IRR sincerely thank all peer reviewers who have sacrificed their time to help us produce a better journal, and also wish to thank all teachers, researchers and other academicians for submitting their valuable research to this journal. Finally, we thank readers of our journal who help to spread the knowledge and benefits gained to others. With your feedback and suggestions, we will strive to improve the quality and relevance of the IRR.

Yongyudh Vajaradul
Editor
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Environmental Health Management to Prevent Infectious Diseases and Epidemics in Thailand's Southern Border Provinces

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Abstract

The purpose of this research is to study environmental health management amongst hospital staff when handling emerging infectious diseases and epidemics in emergency department of government hospitals in the three southern border provinces. This research is a quantitative study using questionnaires as a research tool. The sample group was 258 staff from the emergency department of governmental hospitals in the three southern border provinces, namely 7 in Pattani, 3 in Yala, and 6 in Narathiwat. Statistics used to analyze the collected data consisted of descriptive statistics, including frequency, percentage, arithmetic mean, and standard deviation (S.D.). Also, inferential statistics were used, including a t-test and one-way analysis of variance (one-way ANOVA).

The results of this research revealed that the staff has high level of environmental health management at ($\bar{x}$ = 4.18, S.D. = 0.07), with high level knowledge and understanding at ($\bar{x}$ = 17.35, S.D. = 2.28), high level awareness at ($\bar{x}$ = 4.28, S.D. = 0.50), high level participation at ($\bar{x}$ = 3.91, S.D. = 0.69), high level confidence at ($\bar{x}$ = 4.03, S.D. = 0.59), high level satisfaction at ($\bar{x}$ = 4.22, S.D. = 0.61), and high level performance behavior at ($\bar{x}$ = 4.44, S.D. = 0.55). Furthermore, a comparison of environmental health management in the prevention and control of emerging infectious diseases and epidemics in the emergency department of governmental hospitals in the three southern border provinces found that gender, province, level of hospital, operational duration, and average monthly income were significantly different at the .05 level.The study found that provinces, job positions, and training experiences on the prevention and control of emerging infectious diseases and epidemics are factors affecting of the environmental health management to handle emerging infectious diseases and epidemics in the emergency department of governmental hospitals in the three southern border provinces with statistical significance at the 0.05 level. These factors can explain the variation in the environmental health management to handle emerging infectious diseases and epidemics in the emergency department of governmental hospitals in the three southern border provinces by 8.2% (R^2 = .082).

Keywords: Environmental Health, Emerging Infectious Diseases, Epidemics, Emergency Department

Article history: Received 21 May 2023, Revised 01 October 2023, Accepted 05 October 2023

1. Introduction

Humans are part of the environment. Therefore, the environment exerts significant influence over human life. Environmental health management is the control of various processes and influences of physical, chemical, and biological factors that act on or may cause adverse effects on the physical, mental, and

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social health of humans, both directly and indirectly. Environmental health management must therefore consider all aspects of economic, social, physical, and biological environmental development, including public health and sustainable development, which are related to each other. Environmental health management principles should be an effective management system. It is accepted, understood, and responsive to the policy very well. The emphasis is placed on prevention rather than correction. There is development, change, and flexibility according to the current situation[1].

Nowadays, epidemics and health hazards are one of the most pressing problems due to the changing global environment and climate. Pathogens spread, and their species change all the time. The outbreak led to public health crisis affecting individuals, society, and the economy at the national and global levels [2]. During past centuries, epidemic of emerging infectious diseases has arisen periodically, including newly discovered infectious diseases with outbreaks in humans, infectious diseases in new regions, and diseases in animals that are likely to infect humans [3]. In 2019, there was the coronavirus 2019 (COVID-19) outbreak. The World Health Organization (WHO) reported in December 2019 about a group of patients with pneumonia for unknown causes in Wuhan, Hubei, People's Republic of China. Later, Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV-2) was reported as the cause of the disease, and it spread to other countries [4]. The outbreak is a crucial national problem affecting health, the economy, and society. Staff were ill and unable to perform their duties as usual. Business organizations closed down their businesses dui 2 the medical supply shortage crisis. Meanwhiie, the utility system was interrupted, which made people panic. All impacts alerted all authorities to respond to the pandemic and be aware of the service provided to people as well as the safety of the staff [2].

The emergency department provides nursing services to the injured person and/or person with physical and mental emergency and crisis illness by evaluating the illness severity stage, making decisions on first aid, using tools, equipment, and medical supplies to rescue the patient, monitoring the changing symptoms to respond to the emergency threatening the patient's life promptly at a crime scene or out-patient department in a hospital, and admitting the patient for observation at the emergency or observation room. The COVID-19 pandemic and the rapid change in the health system allow flexibility in the scope of nursing service for accident and emergency patients and environmental health to react to the changes. The crowded accident and emergency rooms, where the staff and patient have a risk of safety, and the unavailability of a separate room for the infectious patient increase the risk of infection for the staff and service users. For this reason, the development of a service system, physical structure, and management model for current and upcoming emerging infectiousdiseases and epidemics is necessary.Therefore, in the three southern border provincesthat have borders with neighboring countries such as Malaysia, travel between the two countries occurs continuously. This makes it easy to spread the infection of the coronavirus disease 2019 (COVID-19). The first patients found in the area were those who had a history of religious activities in Malaysia. Later, it was found that the number of patients continued to increase. As for the hospitals in the area, there were so many infected staff members at work that the hospital had to close.Consequently, the researcher foresees the necessity to study the environmental health management of the emergency department for the prevention and control of emerging infectious diseases and epidemics by using case studies of governmental hospitals in the three southern border provinces to determine guidelines for environmental health management to handle the current and upcoming emerging infectious diseases and epidemics.

2. Methodology

Quantitative research method was applied to examine environmental health management of staff while handling the current and emerging infectious diseases and epidemics in government hospitals in the three southern border provinces.

Population and Sample Group

The population used in this study was a total of 730 professional nurses and advanced emergency medical technicians (Advanced EMTs) who worked at the emergency department of governmental hospitals in the three southern border provinces, including 13 hospitals in Pattani, 8 hospitals in Yala, and 13 hospitals in Narathiwat. The sample group consisted of a total

of 258 professional nurses and advanced EMTs who worked at the emergency department of governmental hospitals in the three southern border provinces. The determination of the sample group with 95% reliability was done using the Taro Yamane (1967) method. The sample proportion for each province was calculated by comparing the rule of three in arithmetic. Then a simple random sampling method was performed according to the calculated probability of the sample group in each province.

Research Tools

The questionnaire used to collect data from the sample group consisted of personal information, knowledge and understanding of the coronavirus disease 2019 (COVID-19), awareness of environmental health management, participation in environmental health management, confidence in environmental health management, satisfaction with environmental health management, performance behavior in the prevention and control of emerging infectious diseases and epidemics, problems, obstacles, needs, and suggestions for management in the emergency department of governmental hospitals in the three southern border provinces.

Research Tools Validity Test

The questionnairesweretested for content validation by three experts and evaluated for the content validity index (CVI), with the proportion of questions obtained from expert consensus not less than 0.80. Moreover, the pilot study was conducted using 30 participants who were similar to the sample group to determine the reliability of the whole questionnaire by usingCronbach'salpha coefficient formula,and the questions with alpha value of 0.70 or higher were selected.

Research Ethics

The ethical approval to implement the study was obtained from the Pattani Provincial Public Health Office, RECPTN No.006/65. The researcher had declared the study's objective, the right to refuse to answer, the right to withdraw from the study, that their personal information would be kept private, and that the raw data would be immediately terminated after the study finished.

Data Analysis

The descriptive statistics used to analyze the collected data were frequency, percentage, arithmetic mean, and standard deviation (S.D.). The inferential statistics comprising the t-test and one-way ANOVA were used to compare the environmental health management to handle emerging infectious diseases and epidemics in the emergency department of governmental hospitals in the three southern border provinces. Furthermore, multiple regression analysiswas used to study factors that can predict environmental health management to handle emerging infectious diseases and epidemics in the emergency department of governmental hospitals in the three southern border provinces.

3. Results and Discussion

There were 258 professional nurses and advanced EMTs working in the emergency department of governmental hospitals in the three southern border provinces, it was found that 99 respondents (38.37%) lived in Narathiwat, 95 respondents (36.82%) lived in Pattani, and 64 of them (24.81%) lived in Yala. The majority of the respondents worked in medium-sized community hospitals (44.96%). Most of them are female, which accounted for 70.16%, and 29.84% are male. The age ranges are 31-40 years old (58.53%), and they finished a bachelor's degree as the highest education level (90.31%). Most of the respondents are professional nurses (91.86%), and they are advanced EMTs (8.14%). The operational duration of them is 11-15 years, which accounted for 55.04%. The majority of the respondents earned 30,001-40,000 Baht per month (44.19%). The major position of them is in the public health professions (having a professional license), which accounted for 91.86%, as well as another position of the executives and supervisors in the public health profession field (having a professional license), which accounted for 8.14%. The majority of them (59.30%) did not have training on emerging infectious diseases and epidemics prevention and control, while 40.70%of them had been trained.

The results of the environmental health management of the staff in the emergency department of governmental hospitals in the three southern border provinces indicated that their environmental health management was at a high level ($\bar{x}$ = 4.18, S.D. = 0.07). In detail for each aspect, it was found that knowledgeand understanding about the coronavirus disease 2019 (COVID-19) was at a high level ($\bar{x}$ = 17.35, S.D. = 2.28), perception of environmental health management was at a high level ($\bar{x}$ = 4.28, S.D. = 0.50), participation in environmental health management was at a high level ($\bar{x}$ = 3.91, S.D. = 0.69), confidence in environmental health

management was at a high level ($\bar{x}$ = 4.03, S.D.= 0.59), satisfaction in environmental health management was at a high level ($\bar{x}$ = 4.22, S.D. = 0.61), and performance behavior in the prevention and control of emerging infectious diseases and epidemics were at a high level ($\bar{x}$ = 4.44, S.D. = 0.55) because the coronavirus disease 2019 (COVID-19) is a new emerging disease [5]. Moreover, the epidemic situation of COVID-19 is an outbreak that is occurring rapidly around the world. Therefore, press releases are continuously released every day through various channels, including information in the community, the center for COVID-19 situation management (CCSA), or national policy from the Ministry of Public Health, to make people aware of the disease severity, the infection spread, how to prevent infection, risk groups, etc. [6, 7]. These may affect the knowledgeand understanding of the coronavirus disease 2019 (COVID-19) among the staff in the emergency department, self-behavior adjustment, as well as behavioral adjustments for the prevention and control of emerging infectious diseases and epidemics. This is consistent with Rosenstock's belief in health [6], who believes that the key indicator to changing individual behavior is individual perception. In which individuals will show self-satisfied behavior and have a positive effect on themselves. Hence, when a person has knowledge and understanding about COVID-19, they are aware of the risks associated with their work and recognize the severity of the disease, which will act to prevent infection. Similarly, health literacy has a positive correlation with COVID-19 prevention behaviors. As health literacy increases, COVID-19 prevention behaviors will also increase. This may have been the result of the development of skills and self-management abilities that can change behaviors to prevent disease in an appropriate way [8]. In addition, the knowledge and understanding of the staff who are in close contact with the patients and the use of personal protective equipment (PPE) are very important to prevent the spread of infection. The hospitals must be equipped with personnel, health teams, and equipment to be able to care for patients safely and efficiently according to standards [5]. Knowledge and understanding, or perception of environmental health management is one of the factors influencing participation in environmental health management. Due to participation in environmental health management, staff must have knowledge and understanding of environmental health management in hospitals, such as all types of solid waste management, the development of toilets according to Thai public toilet standards (HAS) and sewage management, energy and resource management, environmental management of the hospital, food sanitation management, water management for consumption and supply, and food safety operations in hospitals to be able to manage the environment within the hospital effectively without affecting the community [9]. This finding is further supported by previous study in which knowledge in the implementation of environmental health development can predict the participation in environmental health development of hospital personnel under the Ministry of Public Health, Phetchaburi province [10].Furthermore, it is consistent with the survey of personnel under the department of Medical Services about their confidence in the academic operations and services as a whole towards the policy and management guidelines for the situation of the spread of the coronavirus disease 2019 (COVID-19) being at a high level. There is perception, expectation, and confidence in the management system, such as good management of the treatment situation, clear prevention guidelines, management to prepare the place to be ready to receive services only for patients infected with coronavirus 2019 (COVID-19) and has improved in parts that are not yet ready to be more complete, training to provide knowledge and understanding about coronavirus disease 2019 (COVID-19) for staff, patients, and relatives, dissemination of work to the public to be more informed, current information, and effective policy and practice communication. Also, the quality and expertise of personnel, such as having confidence in the potential of medical personnel and executives attach importance to managing the situation of the spread of the coronavirus disease 2019 [11]. The public health facilities in the three southern border provinces received assistance from the department of Medical Services which is an agency responsible for providing academic services and developing services to support the situation of the spread of coronavirus disease 2019 (COVID-19), helping personnel gain more confidence in their operations and environmental health management. According to the research study on factors related to the new normal lifestyles in the prevention of the COVID–19 pandemic among people in Bangkok, it was found that satisfaction with government management

was positively correlated, which means that this factor will help people in Bangkok practice more self-protection [12]. Consequently, if there is a high level of satisfaction with environmental health management, the work behavior will also be in the same direction.

A comparative study of the environmental health management to handle emerging infectious diseases and epidemics in the emergency department of governmental hospitals in the three southern border provinces demonstrated that gender, province, level of the hospital, operational duration, and average monthly income were significantly different at the .05 level. When considering each item, it was found that males had higher mean scores than females. This may be due to a smaller proportion of male staff than females. Also, males are more flexible in preparation for accepting patients,as they must wear personal protective equipment (PPE) and a powered air purifying respirator (PAPR). Moreover, to accept each patient, especially severely ill patients, it is necessary to observe the symptoms closely, which takes a long time. Therefore, males are more appropriate and have more experience receiving patients, resulting in higher average scores for environmental health management in dealing with emerging infectious diseases and epidemics. This result is contradictory to another study about the successful implementation of the novel coronavirus (COVID-19) in the community of village health volunteers (VHVs) in Thailand [6], which revealed that knowledge and understanding of preventing the spread of COVID-19 were higher among females than males. As a result, females are more successful in implementing COVID-19 disease control in their communities.For the operating provinces, it was found that Yala province had the highest mean score, followed by Narathiwat province and Pattani province, respectively. It may be possible that the first outbreak of coronavirus disease 2019 in the three southern border provinces came from neighboring countries because it is an area bordering Malaysia where there was a severe COVID-19 outbreak during this period. Due to Malaysia's lockdown measures, many Thai workers are forced to return to their country, especially those who smuggle into Thailand through natural channels. The consequences were that they did not pass the screening and quarantine system before entering the country. Hence, the three southern border provinces, especially Yala and Narathiwat, are at high risk of spreading the disease. The management's efforts to support the spread of the coronavirus disease 2019 in the area have received support and priority, as well as being more stringent. Subsequently, staff working in Yala province have better environmental health management to handle emerging infectious diseases and epidemics.It is also supported by similar findings in the study of public health emergency management during the COVID-19 pandemic: recommendations for the national level and the 8 specific contextual areas of Thailand [13], which indicated that 7 main elements of the implementation process of public health emergency management among the 8 specific contextual areas were completed following the WHO's toolkit consisting of 1) management and good governance; 2) the health workforce; 3) medicines, supplies, and health technology; 4) the health information system; 5) the health financial system; 6) the health service system; and 7) community participation, village health volunteers, and people. Thus, any area that is not classified as a risk area should also have strict preparations to prepare for the outbreak situation. The result found that staff with more than 25 years of operational duration and earning more than 50,000 baht were the group with the highest average score. Most of them are senior-level and have high operational experience, resulting in environmental health management that can handle emerging infectious diseases and epidemics well.These findings were consistent with previous study[6] that the working period of village health volunteers (VHVs) was statistically significantly different in the successful implementation of the novel coronavirus (COVID-19) in the community. This may have been due to the reason that the increased time spent working in the role of VHVs has promoted personal experience and hence possess the ability in environmental health management when dealing with emerging infectious diseases and epidemics. Another study also showed that average monthly income affects the performance of biomedical engineers during the COVID-19 pandemic crisis[14]. However, there were no differences in professional fields or positions. This may be due to the coronavirus 2019 disease, which is an emerging infectious disease that has never happened before. Professional nurses or medical emergency workers in different positions, both supervisors and practitioners, have no previous experience

dealing with the COVID-19 outbreak.Nevertheless, a previous study [15] has shown thatadministrative positions held by group leaders, head nurses, and assistant head nurses had opinions on the development of the nursing organization management model in the coronavirus 2019 disease outbreak situation at Samutsakhon hospital and were more effective than those who were assigned special duties. This may have been the result of the fact that the group leaders and the head nurses have had a primary role in managing the COVID-19 epidemic since the beginning of the outbreak. Most of them received online training and skills training from the first generation of infection control nurses. They are also responsible for supervising, following up, and continually evaluating the performance on a weekly basis. As a result, there were opinions that applying the nursing organization management model in the coronavirus 2019 disease outbreak situationwould be more effective than assistant head nurses and assigned special duties.In addition, the positions of assistant head nurses and assigned special duties are not officially appointed administrators in the nursing mission group, and they are assigned by the head nurse to perform occasional supervision duties when the head nurse is engaged in other tasks causing no experience in nursing administration before. The highest education level and training experience in the prevention and control of emerging infectious diseases and epidemics are not different because environmental health management for handling emerging infectious diseases and epidemics is a skill and related performance. Thus, receiving a short training period may not be as effective as on-the-job learning that will help you acquire a skill.The results from this study are further supported by the previous study [16], in which front-line nursing administrators [FLNAs] in the community hospitals located in the five border provinces of southern Thailand with different education levels, management training, and experience of crisis management had no different average scores of crisis management during the COVID-19 pandemic.Despite the results of this study being inconsistent with other studies, there were statistically significant differences in education levels, with the community of village health volunteers (VHVs) having a bachelor's degree or higher, contributing to the access to knowledge on various aspects of COVID-19. As a result, they had more implementation to control the novel coronavirus (COVID-19) in their communities [6]. Additionally, the development of knowledge and skills training for medical personnel appropriate to the prevention and control of coronavirus 2019 disease will result in the efficiency and effectiveness of COVID-19 nursing system management[17].

The study found that provinces, job positions, and training experiences on the prevention and control of emerging infectious diseases and epidemics are factors affecting of the environmental health management to handle emerging infectious diseases and epidemics in the emergency department of governmental hospitals in the three southern border provinces with statistical significance at the 0.05 level. These factors can explain the variation inthe environmental health management to handle emerging infectious diseases and epidemics in the emergency department of governmental hospitals in the three southern border provincesby 8.2% (R^2 = .082). The prediction equation can be written in terms of raw scores as shown in equation 1 as follows:

$$\text{Environmental health management} = 4.676 + (0.112)(\text{Province}) + (-0.298)(\text{Job position}) + (-0.141)(\text{Training experience})$$

In addition, the prediction equation can be written in the standard score formas in equation 2 as follows:

$$Z_{\text{Environmental health management}} = (0.189)(Z_{\text{Province}}) + (-0.159)(Z_{\text{Job position}}) + (-0.135)(Z_{\text{Training experience}})$$

4. Conclusions

Based on the study,this research revealed that the staff had overall environmental health management capability at a high level ($\bar{x}$ = 4.18, S.D. = 0.07).A comparison of environmental health management in the prevention and control of emerging infectious diseases and epidemics in the emergency department of governmental hospitals in the three southern border provinces found that gender, province, level of hospital, operational duration, and average monthly income were significantly different at the .05 level. While there were no statistically significant differences in the professional field, position, training experience in the prevention and control of emerging infectious diseases and epidemics, age, and highest education level.The results of this study can be used as a guideline in preparation for handling emerging infectious diseases and epidemics at present and in the future.The development of environmental health management models for handling emerging infectious diseases and epidemics should be systematically organized by 1) setting policies to monitor, prevent, and control emerging infectious diseases and epidemics in working personnel;2) monitoring, prevention, and control of emerging infectious diseases and epidemics among working personnel; 3) developing anaction plan to prepare in the event of an outbreak and the plan is constantly updated so that it can be carried outaccordingto the desired goals;4) training to working personnel in the prevention of emerging infectious diseases and epidemics; and 5) supervision, monitoring, and evaluation for the effectivenessof environmental health management to deal with emerging infectious diseases and epidemics.

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Participatory Multi Criteria Decision Making for Irrigation Management Chiang Rai Province, Thailand

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Abstract

This study aimed to investigate alternative options for irrigation management in the dry season by participatory multicriteria decision making and to reveal attitudes of relevant stakeholders in irrigation management at the Mae Lao irrigation scheme (MLIS), Chiang Rai province. In the past, the Royal Irrigation Department used the Participatory Irrigation Management (PIM) to collaborate with stakeholder irrigation management. In order to determine the appropriate irrigation during dry season, the Participatory Multi Criteria Decision-Making (PMCDM) tool, based on the analytical hierarchy process (AHP), was applied in this study. All appropriate irrigation management options were assigned scores by the PMCDM procedure through two workshops. In the Workshop, all relevant key stakeholders (11 government officials and 22 water users) participated in a focus group with an expert facilitator using participatory methods. In the PMCDM procedure, relevant multiple criteria (technique, irrigated agriculture, institution and budget criteria) were generated and evaluated in the criterion weighting procedure. Then, relevant solution options of irrigation management were prioritized by these stakeholders. The results show that financial budget criterion has the highest weighted criteria score. Establishing the local irrigation budget and reforming irrigation institution are the first and the second ranking of alternative solution options. Moreover, two criteria (institutional transparency and financial budget) got high sensitivity scores. These criteria influenced attitude of participants who then changed alternative option scores. Participants attitudes toward alternative options for irrigation management showed that their status, roles, responsibilities and irrigation knowledge have influence whether their views become positive or negative towards alternative solution for participatory irrigation management in the study area.

Keywords: Participatory multi-criteria decision making (PMCDM), analytical hierarchy process (AHP), irrigation, participatory method

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1. Introduction

The Left Main Canal scheme (LMC scheme) is a sub-irrigation schemes and managed by the Mae Lao irrigation scheme (MLIS) in Chiang Rai province. Generally, water scarcity is the main problem for paddy rice in the dry season. The problem is not only caused by the over-cultivation and inefficient hydraulic structures [1], but also aggravated by ineffective water conveyance system of the LMC and secondary canals to the irrigation area. So, irrigation management in the LMC scheme needs to determine appropriate alternative options for irrigation management through a suitable decision- making (DM). Such a DM process, two major stakeholders (the government sector and the water user group), who responded to manage irrigation in the LMC scheme, had a play role according to the principle of irrigation management, namely, the Participatory Irrigation Management (PIM), has been promoted by the Thai Royal Irrigation Department (RID) since year 2005 in order to implement a bottom-up approach based on stakeholders' participation in planning and decision making between them [22]. According to the policy, it was stated that the Thai rice-based irrigation system should be changed and adapted irrigation to be effective management in some terms that 1) increasing time of a canal maintenance, 2) changing the management of irrigation supply from continuous flow to rotation flow, 3) decreasing inequitable sharing of water among head-end and tailed-end water users and 4) gaining complaints and disputes from water users [23].

To determine an optimal resolution of irrigation management under the constraints of relevant obstacles in a dry season, relevant obstacles due to the irrigation management in the dry season, the participatory multi-criteria decision-making (PMCDM) based on the analytical hierarchy process (AHP) was used as a tool to increase participation in the DM process. PMCDM was a suitable tool for deal with this obstacle because it was able to handle complex situations in many dimensions, such as, socio-economic, physical, environmental, etc. dimensions, namely, unstruc-

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tured or semi-structured problems in irrigation management [6]. Moreover, characteristics of the DM process in Thai irrigation management were a top-down decision- making. This DM's characteristics will increase uncertainties for the DM process that were characterized in the systematic problems as unstructured and semi-structured problems [10].

The PMCDM process consists of the goal or set of goals of the decision maker or group of decision-makers along with their understanding of related concepts with criteria, a set of evaluation criteria (objectives and/or attributes) based on alternative options, and a set of decision alternatives ([17];[13]; [11];[12], [15]). Moreover, the application of AHP is favorable in the DM process for water resource management. [2] studied the application of participation methods for investigating the perspectives of involved stakeholders for prioritizing irrigation management in Spain, using the decision rule by the AHP. Moreover, [18] reviewed relevant applications of AHP for the scope of water resource management in Thailand from 2009 to 2013, i.e., water resources planning, groundwater management, watershed management, flood management, water quality, irrigation planning, and wetland management. For the literature reviews of AHP for water resources issues [2] studied appropriate irrigation management options by participation methods in Spain, integrated by the AHP method. Moreover, [18] reviewed relevant studies in Thailand from 2009 to 2013 in water resources issues, which used the AHP in these studies, i.e., water resources planning, groundwater management, watershed management, flood management, water quality, irrigation planning, and wetland management.

The objectives of the study were as follows: (1), to identify an optimal alternative-solution for irrigation management by PMCDM based on AHP and (2), to investigate attitude of stakeholders for alternative solutions by the PMCDM process.

1.1 Study Area

The study area is the LMC irrigation area of Mae Lao Irrigation Scheme (MILS) in Chiang Rai.It supplies irrigation for rice paddies in irrigation service area (Fig.1). The LMC irrigation area is divided into five irrigation zones. During the dry season, LMC is able to convey irrigated water into Zone 2 (43 ha), Zone 3 (450 ha), Zone 4 (890 ha), and Zone 5 (537 ha) respectively. The LMC scheme has two major stakeholders, namely, the government sectors and water user groups.

2. Framework methodology

2.1 Methodology

The study methodology of the PMCDM, based on the AHP, composed of 4 stages, namely, (1) Irrigated agriculture system investigation, (2) Participant workshop, (3) Multi criteria decision making (MCDM) process and (4) Attitude towards alternative solutions, was proceeded according to the study methodology. Starting from the first stage (Irrigated agriculture system investigation), it involved investigation of an agricultural system under four domains of irrigated agricultural system (technical, irrigated agricultural, institutional and financial domains) in order to study characteristics of irrigation system in the study area both dry and wet season in the **workshop I**. Next, the second stage (participant workshop) was set to generate the problem statement of irrigation management in the LMC scheme of both dry and wet season. For the third stage (multi criteria decision making (MCDM) process), criterion weighting and alternative option prioritizing process for multicriteria decision making process was generated by problem statement. And the last stage (attitude towards alternative solutions), all prioritized alternative solutions were presented and requested an opinion of an agreement and disagreement by all participants (government sector and water user groups) in the **workshop II**.

Stage 1. Irrigated agriculture system investigation

The purpose of this stage purposed to investigate the characteristics of the study area according to the framework by [16]. Irrigation management context described in four domains as shown in Table 1 and discussed to relevant stake holders. Relevant key stakeholders of irrigation management in the LMC scheme were selected by their status, their roles and their responsibilities of the water user groups. Two major groups of key relevant stake holders (government sector: 11 persons; 2 irrigation engineers and 9 operation staffs and water user groups: 22 persons; 4 head of villagers, 5 irrigation volunteers and 13 general water user members from zone 5 to zone 2) were invited as participants and were interviewed by the facilitator in the morning session meeting in the workshop I. All information investigated to identify irrigation management problems by an interview checklist according to the participatory rural appraisal techniques described by [4].

Stage 2. Participant workshop

After the first stage, relevant problems were framed to define the problem statement in the study area in a focus group meeting, held by an experienced facilitator. Selected issues of irrigational domains were generated in order to the goal of improving irrigation management. All relevant aspects were collected by checklists and semi-structured interview by government sector and water user groups for generating obstacles or concern issues for irrigation management in a whole year (both dry and wet season). And then, more relevant concern issues were gathered and generated in terms of the problem statement in **Workshop I** that "In the wet season, the systematic problems are semi-structured problems, namely the struc-

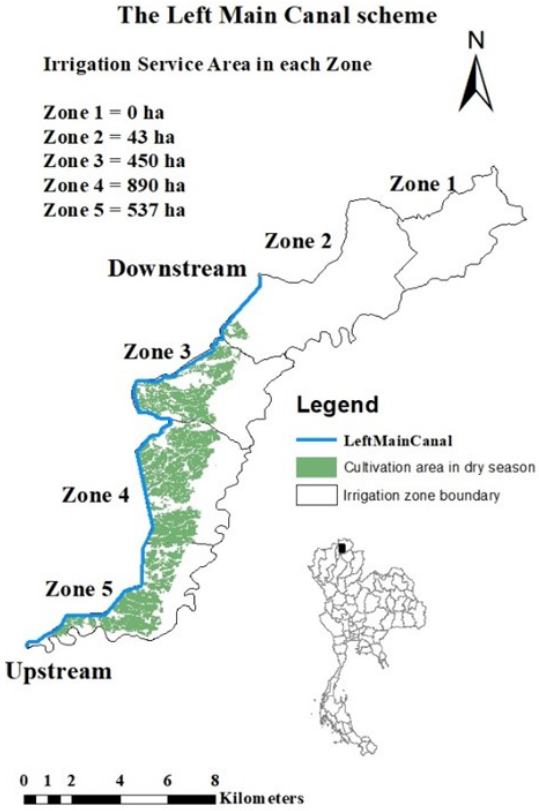

Figure 1: Map of the Left Main Canal scheme in the dry season (sourced by the LMC scheme)

Table 1. Categories of irrigation system in four domains (adapted by [15] and [16])

Domain	Irrigation system characteristics
Technical	Physical conditions (climate, water resource, etc.), physical infrastructure (irrigation canal, etc.) and operation/ maintenance
Irrigated agriculture	Field conveyance system, agricultural system, internal water storage system
Institutional	Water user groups, government sector
Budget	Budget fraction (budget for irrigation management)

tural problem of flooding caused by natural factors and an unsuitably designed main canal system. In the dry season, the unstructured problem of poor irrigation management due to weak institutions is the dominant problem. These causes lead to water scarcity, conflict among water users, breaking the rules of water usage, water theft, etc.

Stage 3. Multi criteria decision making (MCDM) process

The MCDM process was conducted with a focus group in **Workshop II** (afternoon session meeting). This stage involved to develop relevant criteria and alternative options. Criteria was developed by the problem statement in the stage 2 that water scarcity due to poor irrigation management, unsatisfied irrigation conveyance system and limitation of irrigation supply is the main issue for decision making procedure. Each of criteria was set by four domains (technique, irrigated agriculture, institution, and financial budget domains) framework. Firstly, the objective of decision-making was framed on optimization of irrigation management for cultivating paddy rice (dry season) in the LMC scheme. And secondly, relevant information of four domain criteria were determined and linked to generate relevant feasible alternative options for irrigation management in the dry season (Table 2.).

For the PMCDM procedure, all participants were provided and described all relevant objectives for decision making, criteria for achievement for decision making and definition of relevant alternative options for decision making by the experienced facilitator in the workshop II. Criterion weighting was proceeded by all participants in first round meeting and alternative options prioritizing was carried on the second round of meeting. According to the Table 2., six criteria and four alternative options in each four irrigational domains was generated, in which, represented information of all dimension in irrigation management aspects was covered on four domains. And for a set of feasible alternative options for irrigation management was grouped and defined the definition as below:

1. Improving field irrigation conveyance system:

Table 2. Criteria and alternative options in each irrigational domain

Domain	Criteria	Alternative options
Technique	1 Irrigation network performance	1 Improving field irrigation conveyance system
Irrigated agriculture	2 Irrigation practice	2 Improving the irrigation plan saving water according to the PIM policy
Institution	3 Employee	3 Reforming institution by the PIM policy
	4 Participatory water allocation	
	5 Institutional transparencies	
Budget	6 Financial budgets	4 Establishing a local irrigation budget

This irrigation management solution will be focused on rehabilitating the canal network, such as lining the canal, installing hydraulic structure to control the water level, and maintaining the canal before and after the irrigational season to increase water distribution efficiency.

2. Establishing the local irrigation budget: This alternative solution will refer to the water user group establishing the local irrigation budget, collected water service, and penalty fees.

3. Reforming the institution by the PIM: This alternative solution will refer to reforming a major water user group from non-legal organization to an irrigation water user group.

4. Improving irrigation plan and saving water according to the PIM policy: This alternative solution will be focused on water-saving strategies to relieve the water scarcity situation due to irrigation consumption in the dry season.

For the MCDM analysis, starting the analysis process, criteria were scored by participants for weighting a score of each criterion. Each of criterion score was prioritized by the analytic hierarchy process (AHP), which was developed by [14]. This procedure was called as the criterion weighting. And next procedure was the alternative option prioritizing in equation (1), which overall score in each appropriate alternative options for irrigation management were calculated summation scores by participants for prioritizing alternative options from the best to the worst according to alternative option scores. In AHP method, consistency ratio (CR) value (less than 0.1) and consistency index (CI) value.

$$R_i = \sum_k w_k r_{ik} \tag{1}$$

where w_k is the vector of priorities associated with the k-th element of the criterion, r_{ik} is the vector of priorities comparing alternatives for each criterion, and R_i is the overall score for the i^{th} alternative. Sensitivity analysis, which was adopted by [19], will be applied to search for critical criterion values.

Stage 4. Attitude towards alternative solutions

The last stage was discussed by all alternative solutions. These solutions were presented to all participants by the facilitator to extract information regarding agreement and disagreement with solutions in practice. Effective factors, impacted on attitude toward alternative solutions, were analysed by status, role and responsibility of all participants. All attitude of participants were analysed in order to search relationship of agreement and disagreement in each sub groups according to their status, roles and responsibility of all participants.

3. Results

The first objective of this study is to find appropriate alternative solutions for irrigation management via the PMCDM process. Two main processes (criterion weighting and alternative options prioritizing) were conducted by the facilitator through relevant stake holders. Before alternative options prioritizing, criterion weighting process was scored by stakeholders. Moreover, the criterion sensitivity score was measured by changeable value for each criterion; if any criterion has a high sensitivity score, it has a high likelihood to change prioritized alternative solutions.

3.1 Criterion weighting

In the Figure 2., six criteria were weighted by all participants (government sector and water user groups). Importance of each criterion referred to score of participants' opinions, considering, in which, any criterion was more important than other criterion in decision making process. In the Figure 2, six criteria in four domains were weighted by all participants. There were classified two level groups of weighting scores. The first group had scores greater than 0.1 and the second group was less than 0.1. For the first group of criteria, the financial budget criterion was the highest score (0.35) in the financial budget domain, the employee criterion in the institutional domain was the second score (0.26), and the irrigation network performance criterion in the technical domain was the third score (0.15). And the second group, in which, weighting score had less than 0.1, the participatory water allocation in the irrigated agricultural domain was the

highest score (0.09), the institution transparency in the institutional domain and irrigation practice in the irrigated domain were scored as 0.08 and 0.06 respectively.

3.2 Alternative solution prioritizing

In the Figure 3., the x-axis shown six criteria (bar chart) and four alternative options (lined point) in each criterion. The left y-axis and right y-axis were criterion weighting scores and scores of alternative options respectively. In this graph, scores of alternative options were prioritized by ranking scores as (1) establishing the local irrigation budget (0.41), (2) reforming the institution by the PIM (0.32), (3) improving field irrigation conveyance (0.16) and (4) improving irrigation plan and saving water according to the PIM (0.11) respectively.

3.3 Sensitivity analysis of criteria

In Figure 3., slope of lined points was the sensitivity of the changeable score for each criterion. Two highly sensitive criteria occurred in the financial budget and the institutional transparency due to higher weighted criterion scores than other weighted criterion scores. High slope of lined points which was represented as high sensitivity of changeable scores occurred among four criteria, so called, (1) financial budget, (2) employee, (3) irrigation network performance and (4) participatory water allocation. Especially, pairwise criteria (financial budget criterion and employee criterion; irrigation network performance and participatory water allocation) were highly sensitive for alternative option scores as 133.98%. and 116.74% respectively.

3.4 Attitude toward alternative solutions for irrigation management

Table 3. shown attitudes toward alternative options for irrigation management as discussed by two major groups of participants (water user group members (22 persons) and the government sector (11 persons). Discussion reflects relevant participants' perception of a certain solution for irrigation management. Two alternative options (establishing a local irrigation budget and reforming the institution by the PIM) received the widest agreement among two major groups (government sector and water user groups). However, another alternative solution (improving field irrigation conveyance and improving the irrigation plan and saving water according to the PIM policy) were quite opposite between the two major groups. Particularly, improving the irrigation plan and saving water according to the PIM policy was strongly disagreed by the water user group.

4. Discussion and conclusion

4.1 Discussion

Participatory Multi Criteria Decision Making (PMCDM)

The PMCDM process was chosen in this study because it was suitable for handling the solution of unstructured problems or semi-structured problems in irrigation management [8]. In this study, three main steps for participatory procedures were applied in the study methodology, namely, first step, the problem statement was generated by key relevant stake holders, the second step, all relevant stakeholders were also addressed to weight in criterion weighting and alternative options prioritizing for irrigation management, and the third step, attitudes toward alternative options for irrigation management by two participants were investigated for positive and negative point of view on positive and negative attitudes of all alternative solution for irrigation management.

Relevant criteria and alternative options for irrigation management were developed by the concept of irrigation system in four domains [16] through the framework for defining the set of criteria [7]. It covered on settled dimensional system (technic, irrigated agricultural, institutional and financial domains) for the DM process.

For participants selection, relevant key stakeholder of irrigation management in two sections (government sector and water user group) were introduced in the meeting. Government sector, consisted of two irrigation engineer staffs and nine operation staffs, had their responsibilities for management irrigation in the main canal level. And water user group, consisted of four head of villagers, four irrigation volunteers and one the head of irrigation volunteer, had their responsibilities for management irrigation from the secondary canal to field distribution canal level. These key relevant stake holders were a key of decision in irrigation management, co-operated among government sectors and water user group through irrigation schedule plan, operation of hydraulic structures in the conveyance system, operation and maintenance process, etc.

For reducing in decision traps and the cognitive biases [9], the facilitator was selected by the level of experiences (expert facilitator by the RID) to hold the focus group meeting (team group or coalition group). Moreover, a focus group, held by a facilitator was selected in the meeting pattern because it was suitable for deal with competitive interaction contexts, caused by different attitudes of stakeholders. Other relevant responsibilities of the facilitator could control relevant decision-making issues through discourage information sharing, mediation and negotiation in decision-making process. These intended outcomes were to help mitigate or resolve stakeholder disagreements and conflicts, for instances, semi-structured or unstructured problems [20].

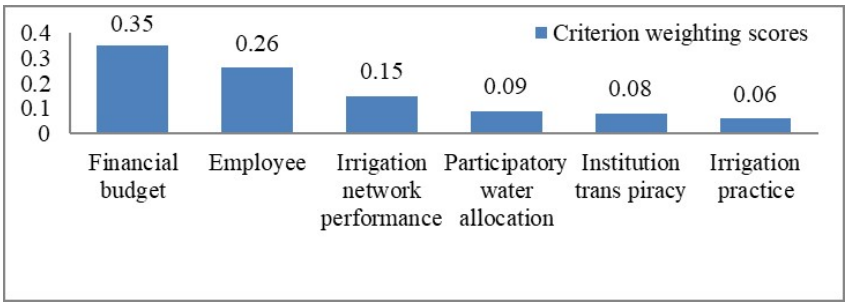

Figure 2: Criterion weighting scores

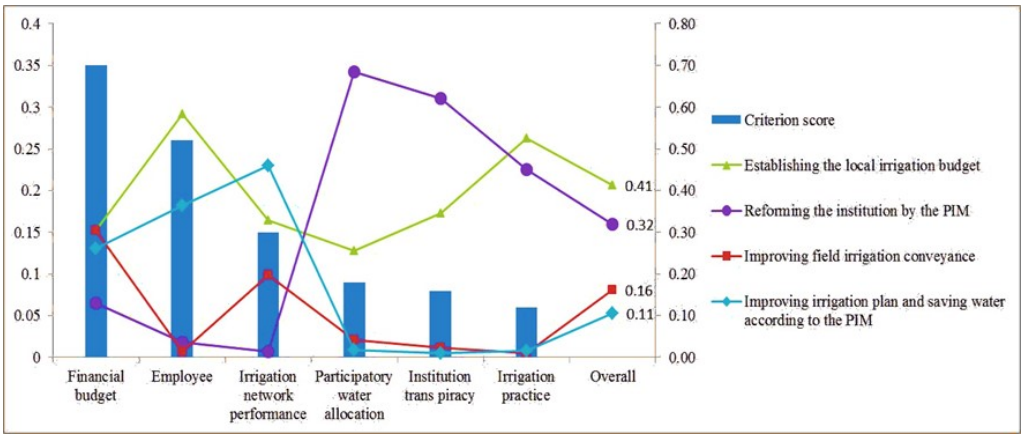

Figure 3: Prioritized criteria and criteria weighting scores

Table 1. Attitude of participants to alternative options in the dry season

Alternative Solutions	Actor Groups: Integrated Water User Group (IWUG) of the LMC scheme	
	The government sector	**Water user members**
1. Establishing a local irrigation budget	**Good:** Expenditure for irrigation management: canal maintenance, board salary, annual meeting, etc.	**Good/ Moderate:** Question for verifying the budget and not ensuring reliable water in the tail canal when paying the fees
2. Reforming the institution using the PIM policy	**Good/Moderate:** Cleary the structural organization for improving irrigation management efficiency but the not strong concept of role and law of water user groups	**Good/Moderate:** Same as the government sector
3. Improving field irrigation conveyance	**Moderate** Decrease water lost during water sending Concerning the expenditures for system upgrade Hard to operate and maintain some controllable infrastructure	**Good** Decrease water lost during water sending Fair divided water in the field conveyance system
4. Improving the irrigation plan and saving water according to the PIM policy	**Moderate** Irrigation practices (micro-sprinkler, drip water) is a good choice for water savings Alternate Wetting and Drying in paddy rice is not suitable No market for sale of products by growing plants with less water	**Bad** Irrigation practice (micro-sprinkler, drip water) for water savings is not suitable due to high expense Alternate Wetting and Drying in paddy rice is not suitable Crop calendar adjustment for water savings is hard to practice

Alternative options for irrigation management

Results of the study were discussed in two results (weighed criteria and alternative options for irrigation management). For weighted criterion, two criteria (institutional transparency and financial budget) in two domains (institutional and budget domains) have highly sensitive scores due to high weighted scores in these criteria, since these criteria have more effective for changing scores and probably affect to change priorities of alternative options scores by relevant key stakeholders. And favourite alternative options for irrigation management (establishing a local irrigation budget and reforming the institution using the PIM policy) were more important than other solutions because these alternatives focused on the improvement of the institutional domain that support the strength of the water user organization and the efficacy of the irrigation budget through the financial budget and institutional domains. This was why these options are the first choice for stakeholders' opinions.

Attitude of participants towards alternative options for irrigation management

Improving the irrigation plan and saving water according to the PIM policy was the first choice of alternative options for irrigation management in the PMCDM. This option was different attitudes among government sector and water user groups due to the status, roles and knowledge toward to agree and disagree alternative solutions. The government sector (11 persons; 2 irrigation engineers and 9 operation staffs) quite agreed on two alternative solutions (establishing a local irrigation budget and reforming the institution using the PIM policy) because these solutions involved to their roles and responsibilities for support the strength of water user depend on the PIM policy. While, the water user groups (22 persons; 4 head of villagers, 5 irrigation volunteer staffs and 13 general water user members), who responded to manage irrigation conveyance section from secondary canal to paddy rice field, insisted to disagree on some alternative solution (improving the irrigation plan and saving water according to the PIM policy), particularly, water saving issues by water saving technology (micro sprinkler, drip irrigation) was not suitable due to high expense and alternate wetting and drying technique for water saving in paddy rice was also not suitable due to hard operation in practice.

These results will be expected to contribute effective participatory process policy that allow water users and government sectors for decision-making from irrigation planning to irrigation supply operation through the participatory or collaborative approach. Learning is a social act; communication between individuals and collective learning [21]. Moreover, stakeholders can share their concerns and perspectives, develop skills on joint problem solving [8]. And all results of this study were also expected to extend relevant details in these option for application in irrigation management under the PIM policy framework. Such two top ranking scores of alternative solutions (establishing a local irrigation budget and reforming the institution by the PIM policy), these options involved in two domains (financial budget and institutional domains). In the establishing a local irrigation budget reforming option, the local irrigation budget should be established and reformed according to the PIM approach, in order to be extensions for operation and maintenance from secondary to field distribution level, handled by relevant key water user group (local irrigation staff, local irrigation volunteers, hiring irrigation staff for watching water theft, etc.); moreover, it also used in relevant local irrigation management through irrigational activities according to the steps of PIM approach. Consequence from the first option, reforming the institution by the PIM policy option should be practiced through institutional transition from the Integrated Water User Groups (IWUGs) to be the Joint Irrigation Management for Irrigation Committee (JMC) under the PIM approach because the JMC will allow to establish a formal organization, guarantee a status of law enforcement, increase a role of financial management through driven forces of relevant water user groups and government sector in the LMC scheme in order to achieve the option's task.

However, stakeholder involvement was considered in the framework. Various groups are those where participation occurs amongst stakeholder with divergent interests and perceptions of the problem [1]; [3]. Obstacles in meeting appointment because convenient attention in the meeting had different appointed time depending on each individual participant. Suggestion in this study can be developed through activities in specific skills and knowledge in order to increase level of participatory from the participatory model level to the collaborative model level. So, expectation of the PCDM application for irrigation management was suitable for handle to semi or un structured problems in irrigation through coordination, collaboration and joint action of government sectors, who organizing team is responsible for the design and guidance of the participatory and collaborative modelling process.

4.2 Conclusion

The PMCDM process in this study was applied in the study area (LMC scheme), which is operated by the Mae Lao Irrigation project in Chiang Rai province, Thailand. appropriate participatory techniques were applied to collect information to generate relevant criteria and alternative solutions by participants (the government sector and water user members). For a decision rule, the AHP was used as a decision rule that dealt with a qualitative variable in terms of conflict in decision making for judgment in criterion weighting and alternative solution ranking processes.

Based on the results of criteria weighting and prioritized alternative solutions, it can be concluded

that six criteria (financial budget, employee, irrigation network performance, participatory water allocation, institution transparency, and irrigation practice) are weighted for prioritizing with the values 0.35, 0.26, 0.15, 0.09, 0.08, and 0.06, respectively. It meant the financial budget criteria had the most important criterion for prioritizing appropriate alternative option for irrigation management. Moreover, two criteria (institutional transparency and financial budget) in two domains (institutional and budget domains) were critical criterion value due to high sensitivity. It meant that these criteria (institutional transparency and financial budget) had the most changeable important when criterion weight scores was small change by participants' decision. The prioritized values for the four alternative solutions (establishing a local irrigation budget, institution reform using the PIM, improving field irrigation conveyance, and improving the irrigation plan and water-saving with the PIM) are prioritized in that order with the performance values 0.41, 0.32, 0.16, and 0.11, respectively.

The participants' attitudes toward alternative solutions show that relevant status, roles, their responsibilities and their knowledge can affect point of views thus making attitudes positive or negative towards alternative solution for participatory irrigation management in the study area.

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Greenhouse Gas Emission Reduction Guidelines to Promote Green University of Rajabhat Universities in Southern Thailand

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Abstract

This research aims to develop a guideline to reduce greenhouse gas emissions from the organization's operations to promote the green university status of the 5 Rajabhat Universities, namely, Surat Thani Rajabhat University, Phuket Rajabhat University, Nakhon Si Thammarat Rajabhat University, Songkhla Rajabhat University, and Yala Rajabhat University. Data were collected from an in-depth interviews with open-ended questions. The sample selected by purposive sampling consisted of experts from 5 Southern Rajabhat Universities. Experts from Rajabhat University in Southern Thailand were recommended as qualified interviewees (Gatekeeper) in conjunction with snowball sampling to reach the desired study group who can provide information on the subject study in-depth. The results of development of greenhouse gas emission reduction guidelines to promote green university of Rajabhat Universities in Southern Thailand comprised 3 steps. Policy formulation process consists of 1) policy formulation and action plan, and 2) roles, duties, and participation of personnel and students. Policy implementation process consists of 1) establishing the structural system and facilities that infrastructure, information technology, carbon footprint for organization, and carbon offset, and 2) implementation of energy and environmental management standards, including energy management and environmental management, transportation, water management, and waste management, and 3) communicate and create a network of cooperation both within and outside the organization. Policy evaluation process consists of 1) university assessment, and 2) external assessment.

Keywords: greenhouse gas emission, greenhouse gas emission reduction, green university, Rajabhat University

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1. Introduction

Greenhouse gases are a significant contributor to global warming and climate changes that pose many risks to human beings and all other forms of life on earth, such as higher temperatures, more severe storms, increased drought, loss of species, and more health risks [1]. Thailand is under the Nationally Determined Contribution (NDC) with GHG emissions reduction target of achieving net-zero GHG emissions by 2065 and carbon neutrality by 2050. This matter was included in the 20-year national strategy [2], which is the core strategy for national development, and was conveyed to practice at the provincial and local levels. The strategies includes developing GHG reduction capabilities and setting GHG reduction goals from all sectors, namely government, private sector, including education sector. Education can contributes to GHG emissions, at the same time it is a source of knowledge, cultivate awareness of natural resources and environmental conservation in students, which will be a significant force in transmitting the concept of reducing GHG emissions to society in the future. Additionally, students can be a resource for knowledgeable personnel in designing various forms and innovations to reduce GHG emissions within the university and be a role model for other agencies. Rajabhat Universities in Southern Thailand, as educational institutions, has also responded to the country's net-zero emissions policy and assigned the issue in "developing the university to be a green university or actions to promote the university to be a green university" in the master plan of each university [3]. However, there is no concrete plan to find ways to reduce GHGs. In addition, considering Section 7 of the Rajabhat University Act B.E. 2547 that "the University is a higher education institution for local development" [4], and the strong network of Rajabhat Universities, it is necessary to set guideline to promote green university in Southern Rajabhat Universities to be a role model for the locality in developing organizations in energy and environmental management, creating a low-carbon society according to national plans and policies, and leading society and local communities.

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2. Materials and Methods

The tool used to collect data through an in-dept interviews was "open-ended questions" for the draft GHG reduction guideline designed by the researcher based on the data obtained from the carbon footprint assessment and study on guidelines for reducing GHG emissions from the past activities to promote green universities of Rajabhat Universities in Southern Thailand [3]. The resulting guidelines were verified by 12 experts, selected by purposive sampling in conjunction with Snowball Sampling. Experts from Rajabhat University in Southern Thailand were recommended as qualified interviewees (Gatekeeper) by selecting interviewees who can provide information on the subject study. They consisted of 12 people as follows: 1) executives in charge of the green university Promotion Project, 2) experts in environmental management and sustainable development, 3) experts in greenhouse gas management, 4) executives or people with experience in the development of higher education institutions to recommend recommendations, and 5) those who have the knowledge and assigned by the university to take any action in GHG emission reduction. In-depth interviews were conducted on individual subjects one by one to obtain complete and in-depth information and facilitate systematic data collection until all issues completely answered the research objectives.

The data obtained from the interviews were opinions and suggestions for the draft guideline to reduce GHG emissions. The researchers used the analytic induction technique by analyzing data obtained from transcripts from interviews and interpreting data with common characteristics to create common conclusions. After that the researchers made adjustments according to the opinions of experts, and took the "messages" obtained from the interviews as references to obtain a complete GHG reduction guideline that is suitable for the 5 Southern Rajabhat Universities and report the study results in the form of descriptive analysis [5].

3. Result and Discussion

Greenhouse gas emission reduction guidelines to promote green universities of Rajabhat University in Southern Thailand consisted of 3 steps: policy formulation, implementation, and evaluation as follows:

3.1 Policy Formulation

3.1.1 Policy Formulation and Action Plan

The GHG reduction policy to promote green university is divided into 4 aspects. 1) Curriculum and educational management were divided into 2 levels: subject level and curriculum level. 2) Research consisted of 4 issues that must be continuously implemented: internal research funding, research issues, academic services, individual indicators for conducting research, and provision of external research funding related to GHG reduction, energy and environmental conservation, and other management that promotes green university. 3) For energy, a long-term energy management plan in the university must be formulated specifically taking into account the energy potential in the university based on the principle and giving importance to the following issues: use of highly efficient and energy-saving tools and equipment, repair and maintenance of equipment and electrical appliances, alternative energy supply, planning and controlling energy usage for maximum efficiency and benefit, and recycle. 4) According to environment, a specific long-term campus environmental management plan must be developed by giving importance to 3 main areas, namely, transportation, water management, and waste management. The policy formulation for environmental management in all 3 areas is based on the principles and gives importance to the following issues. First, traffic management consists of fleet management and travel routes management. Second, water management consists of tools and equipment management, and water administration and management. Third, waste management consists of a waste database, reducing the amount of waste with the 3Rs, and separation of waste. The policy in each area must 1) designate the host or the core person responsible for the operation who will have a management role to be the central point in planning, driving, and coordinating work with stakeholders; 2) set goals and desired results that are measurable and concrete; 3) determine methods for enforcing policies, such as requesting and applying technology to change behavior and enforcement by regulations or laws; 4) set guidelines for operations; and 5) set guidelines for supervising various activities within the university to be clear and cover all activities within the university.

In formulation of policies and action plans, existing policies should be synthesized to develop new ones or improve existing ones by adhering to the following principles and actions. They are 1) specifying details that show the connection between that activity and environmental management to reduce GHG emissions and the linkage of the policy to the goals of the national development plan provincial development plan and the development plan of Rajabhat Universities; 2) pushing for the policy to reduce GHG emissions at a strategic level to receive budget support for the implementation of projects and activities; 3) establishing personnel and departments to implement the GHG reduction policy and action plan for general adherence including to be used as a basis for approval of projects or activities within the university by the priority of the principle that "support projects that are more compliant with university policies and are more sustainable". The review and improvement period should not exceed 10 years due to the rapid and ever-changing climate, the effects may vary, planning to deal with

such impacts, therefore, needs to be reviewed regularly and promptly; 4) encouraging participation and support from relevant individuals and organizations from the beginning of the formulation of the policy and action plan to reduce GHG emissions mirror as well as analysis of stakeholders, find funding sources, and cooperate with external organizations to get support in terms of budget, tools, equipment and people with expertise. It also publicizes the university's operations to create awareness among external agencies; and 5) assessing the carbon footprint of the organization and analyze the university's GHG data and forecast the future from the base case to assess the status of GHG emissions present and future trends to serve as a database for policy formulation and action plans to reduce GHG emissions to promote a green university in the future.

3.1.2 Specification of Roles and Responsibilities and Participation of Personnel and Students

It was divided into 2 parts: 1) establishing a specific agency with primary responsibility for driving such policies; and 2) determining the roles, duties, and participation of personnel and students. Since the development of the university is everyone's business, this is to create cooperation in implementing the university's GHG reduction measures together in an integrated manner according to roles, duties, expertise, and the ability of each population group.

3.2 Policy Implementation

3.2.1 Organization of Structures and Facilities

Infrastructure, consisting of:

1) Physical structure (infrastructure) includes buildings, roads, electrical and water systems, and wastewater treatment system. Infrastructure should operate in a multi-function manner to increase the efficiency of resource utilization. It should be built, improved, or maintained to ensure a perfect, ready-to-use and complete manner, as well as increasing green areas by planting trees. 2) The master plan for building and construction management, including general control measures, should be used as a guideline for the development, utilization, conservation, and long-term maintenance of buildings and facilities in the university area in line with the conditions of being a green university. 3) For responsible agency, a core unit and person responsible should be established for driving policies and implementing activities that will help the university achieve its goal of reducing GHG emissions, and delegate authority and decision-making in management to ensure unity and flexibility in administration. 4) For legislation, rules, regulations, or announcements related to GHG reduction, energy, and environmental management should be made to specify details related to the duties of the agency or operator's scope of work and penalties to support management following the university's policy.

Information Technology

A central database system that contains complete information to support the university's GHG reduction operations should be established for effective access, operation tracking, and control. An information system should be developed using innovation and technology to manage the existing infrastructure and services in various areas of the university in a way that is easily accessible, fast and comprehensive. The system should cover all kinds of activities and services within the university that reduce the use of paper, reduce travel, reduce pollution and environmental impact. Moreover, new digital platforms should be created to support specific actions related to reducing GHG emissions, including the development of various management systems that can support carbon offsets. Because access to detailed and high-quality data is key to the integrity of carbon footprint assessment results.

Carbon Footprint of the Organization

The organization's carbon footprint should be assessed to know the amount of GHG emissions from all activities within the university and the data should be publicized to individuals or external organizations about the university's intention to contribute to GHG emission reduction and responds to the policy of the country. The assessment should adhere to 3 principles: 1) assess annually, 2) assess every activity of the university, and 3) assess accurate and quality data in order to be used as information for finding Guidelines for effective and precise management of GHG reduction in universities.

Carbon Offsetting

Participation and approaches can be divided into 2 levels: individual and department level. Universities can 1) determine individual indicators by having students and staff record their daily activities to calculate the amount of individual GHG emissions; and 2) carry out activities that contribute to offsetting all the carbon emitted by the university, e.g., the beautiful garden project to increase green space, mangrove planting, and restoration of watershed forests and wetlands to increase the absorption and storage potential of GHG within the university area. The purchase of carbon credits that have been registered by the GHG Management Organization (Public Organization) is another measure that universities can driving Thailand's carbon market and supporting the reduction of GHG emissions in the country.

3.2.2 Implementation of Energy and Environmental Management Standards

The results of the organizational carbon footprint assessment of the Southern Rajabhat Universities found that activities type 2 electricity consumption have high levels of GHG emissions, compared to other activities. This led to the determination of management 2 measures: energy management and environmental management, as follows:

Energy Management

Universities must consider the cost of operating versus the potential benefits, taking into account the energy potential on of university. This includes measures for energy management, meanwhile maintaining efficiency in teaching and learning and conducting various activities within the university, and emphasizing on the use of technology to help save energy. The guidelines for energy management should be established using principles of energy conservation. There are 5 methods, namely, use of highly efficient and energy-saving tools and equipment, repair and maintenance of equipment and electrical appliances, alternative energy supply, reusing, and planning and controlling energy usage with maximum efficiency and benefit.

Environmental Management

It was divided into 3 aspects. 1) Transportation management determine how to manage the traffic environment according to the characteristics of the area, buildings, way of life, and vehicle use into vehicle management and management of travel routes. 2) For water management, Southern Rajabhat Universities has used both tap water and use water from natural sources. Some places are not equipped with meters for measuring water consumption. Some places do not have a wastewater treatment system on campus. Water management is considered based on the information obtained from the study along with legal requirements, as well as conservation concepts that focus on the cost-effective use of resources and the principle of maximizing water use and reducing wastewater as much as possible. Therefore, the method of water management is determined as management of tools and equipment and water administration and management. 3) Waste management gives importance to waste reduction with good integrated waste management. It starts at the source and try to manage the least amount of waste by applying the 3Rs (reduce, reuse, recycle) principle. Along the way, it is important to sorting waste according to the correct type. Moreover, the place where the waste has been disposed should be suitable for the type of waste and maximize benefits. The waste management guidelines were divided into waste database creation, waste reduction through 3Rs, and waste segregation.

3.2.3 Communication and Networking for Cooperation both Inside and Outside the Organization

Communication goals should be set to raise awareness to people broadly and deeply because it has the most sustainable influence in controlling GHG reduction behavior. Coupled with collaboration with individuals and agencies both inside and outside the university including raising awareness about the policies and activities, the universities should be implemented through the strategies of 1) communication and 2) networking cooperation with the quality of the media and communication for delivering messages. Focusing on communication issues is divided into 2 parts: 1) communicating to educate and raise awareness of the importance of GHG reduction and environmental conservation, and 2) communicating about the policies and activities that have been implemented to become a green university.

3.3 Policy Evaluation

3.3.1 University Assessment

It is a follow-up and evaluation by the university in order to acknowledge the information and apply it for the benefit of reviewing, improving and developing the university. It consists of 1) assessment methods should base on real-time evaluation from efficient systems and information, reducing time and paper with emphasis on the participation of all people both inside and outside the university at any time. The form of evaluation focuses on transforming existing data into information for decision making of executives or decision-makers to review, improve and further develop such information for public relations and corporate communication. 2) Assessment criteria should adhere to the principle of reducing the use of resources but not the quality of life. In other words, it should improve the quality of life without reducing or compromising the quality of work or services. The standard of the work must be as good as before or even better. 3) Evaluation form consists of an assessment of the process, results obtained from the operation, and the impact of operations.

3.3.2 External Assessment

Many agencies have developed measures, projects, and mechanisms to reduce greenhouse gases in the country. For example, the Department of Environmental Quality Promotion (DEQP), which implemented through the Green Office measure, Thailand Greenhouse Gas Management Organization (Public Organization), developed a method to reduce GHG based on the principles of the Clean Development Mechanism through Thailand Voluntary Emission Reduction (T-VER) and the development of a system for reducing GHG emissions, Measure Reporting and Verification (MRV). For abroad, agencies that have standardized and international ranking internationally recognized, and have conditions or indicators to take any action to reduce GHGs include UI Green Metric World University and Times Higher Education Impact (SDGs). Universities can work with external agencies that specialize in reducing GHG emissions or energy and environmental management to obtain an assessment. In addition, haring knowledge to increase efficiency in GHG emissions reduction from experts can also guarantee performance through standard certificates that demonstrates the university's potential and contribution to driving Thailand towards its goal of becoming

carbon neutral by 2050 and achieving net zero GHG emissions by 2065.

Setting the policy-making process as an important starting point for success in reducing GHG emissions corresponds to the research results of K. H. Hussein, et al. (2022) [6], which shows that the University of Babylon participated in UI rankings in 2017 to 2020 and the result is a continuous improvement. This success is due to the University's strategic plans, policies, and operating procedures related to the provision of a clean and green environment in line with the United Nations Sustainable Development Goals and environmental friendliness. However, the country has had economic and domestic security problems, including the spread of Covid-2019. In addition, the research results of Abdul-Azeez, I. A., and Ho, C. S. (2015) [7], which studied Realizing Low Carbon Emission in the University Campus towards energy sustainability, suggested that sustainable environmental and energy planning should be a continuous process in the form of a policy, passed goal acceptance, research analysis, planning, and determining policy outcomes. It is instrumental in directing the achievement of a low-carbon and sustainable university. Moreover, the roles and responsibilities and participation of personnel and students should be determined, consistent with the findings of L. G. Perdamaian, et al. (2021) [8], who studied implementation and impacts of education for sustainable development. As a result, the Education for Sustainable Development (ESD) program to raise awareness of sustainable development and encourage everyone participating in the program to respond and participate in activities has been held annually since 2016. Tthere has been an immediate and noticeable change in cognition and behavior toward a sustainable lifestyle. Sustainable development is a long-term vision and requires participation from everyone. Similarly, Tohmoh, S., et al. (2020) [9] studied the perception and participation of personnel and students of Yala Rajabhat University towards environmental management to become green university. Implementing an environmental management policy toward the development of a green university is essential to create understanding, awareness, and cooperation from personnel in the organization.

For policy implementation process, action steps in terms of structures and facilities, including physical structure (infrastructure) and information technology systems, the implementation of the specified measures is possible smoothly as well as preparing supporting information for assessment, analysis, finding trends and guidelines for reducing GHG emissions, namely, carbon footprint assessment and carbon offset. This is consistent with the research results of S. M. Abtahi (2021) [10], Towards a Green Campus Energy, Climate and Sustainable Development Initiatives at Isfahan University of Technology (IUT). It was found that the university has followed the basic steps in the implementation green management in infrastructures such as providing green buildings, building an energy efficiency management system, designing and constructing wastewater treatment and improvement of irrigation systems, using vehicle management software to organize fuel consumption, etc. The implementation of such measures resulted in reduced consumption of water, energy, and pollution from switching to clean energy as well as cost savings and the university's budget. Similarly, the research results of D. Chalil, and R. Barus (2021) [11], studied opportunities from the COVID-19 pandemic: being greener through online and e-learning methods. It was found that the university recognizes the importance of reducing the amount of paper through the use of online and e-learning methods. As a result, efforts are now being made to improve internet facilities and e-learning accessibility. The process that requires an assessment of the carbon footprint of the organization is consistent with several studies. It shows the number of GHGs emitted from the organization's operations, which is an important tool in determining management guidelines to effectively reduce GHG emissions both at the agency, organization, and national level. As a result, Mangkang, R. (2015) [12] studied the carbon footprint and carbon offset of Kasetsart University to manage GHGs and promote green university and found that it support plans and policies formulation for energy and environmental management as well as management for the goal of GHG emission reduction at Kasetsart University. As a result of the carbon footprint assessment, managing both energy and environmental management, e.g., water, waste, and transportation important role in reducing GHG emissions, is consistent with Janangkakan, B., et al. (2012) [13], who studied the carbon footprint of educational organizations. A case study from the Department of Environmental Engineering, Chulalongkorn University, shows that a good and sustainable measure to reduce GHG emissions is the use of energy conservation principles in buildings, not only being able to reduce electricity costs but also reducing GHG emissions effectively. Furthermore, M. A. Budihardjo, et al. (2022) [14] studied the improvement of water conservation at Diponegoro University, Indonesia. The study found that the university has a water management approach based on water conservation principles by reusing treated water. Wastewater Treatment Plans (WWTPs) are in place and water efficiency is prioritized. The research results of Pandiyarajan, V., et al. (2022) [15], who studied the concept of 3Rs in waste management for a sustainable environment, found that the use of the 3Rs concept in waste management is the most appropriate solution for managing environmental problems within the university. In terms of communication and networking for cooperation both inside and outside the organization, the goal in communicating to raise awareness to people in a wide and deep sense has

the most sustainable influence in controlling greenhouse gas reduction behavior. It includes collaboration with individuals and agencies both inside and outside the university as well as raising awareness about the policies and activities that the university is working on with the quality of the media as an intermediary in delivering that message. This is consistent with the findings of C. B. Milanes, et al. (2022) [16], who studied innovations in education and research management at the Universidad de la Costa, Colombia in the epidemic era. The study noted that Universidad De La Costa increased international cooperation during the coronavirus pandemic in research, academic publications, and academic and scientific cooperation networks, including participation in the UI Green Metrics project. At the same time, it shows the strength of networks and good inter-agency collaboration within the university which facilitate data collection, present results, and disseminate knowledge related to the university's sustainable development.

Finally, the evaluation is the process of reviewing and analyzing the results of the implementation of the GHG reduction policy from the beginning, which is the policy formulation and the resulting end point from performing the procedure. Assessment forms were used to evaluate the whole process, the results obtained from the operation, and the impact of operations. The evaluation results corresponds to the research results of Sitthipitak, M., et al. (2021) [17], studying the success factors of a sustainable green university. It was found that one of the success factors of the operation to become a sustainable green university is to determine indicators, goals, monitoring, and evaluation of projects and activities using quality processes (PDCA) for continuous improvement.

4. Conclusions

Based on the study, the Greenhouse Gas Emission Reduction Guidelines to Promote Green Universities of Southern Rajabhat Universities were defined according to a systematic work process based on management principles throughout the organization. It consisted of 3 steps: policy formulation, implementation, and evaluation. Setting a policy at the first step in the implementation likes a compass for the operation. All activities of all departments must be consistent with university's policy along with personnel participation and acceptance in terms of policy formulation, goals, plans, outcomes, and joint actions according to their duties. The next step is the implementation process, an active process that focuses on setting up necessary infrastructures and enabling individuals to comply with standards to reduce GHG emissions. The last step is the evaluation process by the university and external agencies with specific expertise to improve, develop, and be accepted by the evaluation results from standardized external agencies. This systematic approach to reducing GHG emissions will cause management throughout the organization covering all positions, individuals, and agencies, making operations to reduce GHG sustainable towards becoming a green university.

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Effects of Family Participation Enhancing Program on Health Behaviors of Muslim Elderly with Hypertension in Thung Yang Daeng District, Pattani Province

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Abstract

The quasi-experimental research aimed to compare health behavior scores and blood pressure values of Muslim older adults with hypertension in the experimental group before and after receiving the program and between those receiving the program and those receiving formal nursing care. Develop a program based on Cohen and Uphoff's contribution concept. The sample group were elderly Muslims with high blood pressure who received outpatient ward, Thung Yang Daeng Hospital, and 60 people, selected by a specific method, divided into a control group and an experimental group of 30 people each. The control group received only formal medical care for eight weeks. The research tools were the Health Behavior Questionnaire and the Family Participation Promotion Program on Health Behaviors of Muslim Elderly with Hypertension, developed by the researcher, three qualified people. The reliability of the Health Behavior Questionnaire was Cronbach's alpha coefficient of .78. The data were analyzed using descriptive statistics and t-Test.

The study found that after receiving a program to promote family participation, the experimental group had mean scores of health behaviors (Mean=127.07, S.D.=4.77) than before receiving the program (Mean=62.6, S.D.=3.43) and significantly more than the comparison group (Mean=78.5, S.D.=4.31) <0.001 (p-value <.000). Mean systolic blood pressure and mean diastolic blood pressure after the trial were significantly lower than those before and significantly lower than the comparison group <0.001 (p-value <.000).The results obtained from using the program allow family members who are primary caregivers to be more involved in monitoring and evaluating the changing health behaviors of Muslim Elders with high blood pressure and support them in self-management in changing health behaviors and controlling blood pressure continuously, correctly and appropriately.

Keywords: Participation, Promotion, Program, Health Behavior, Hypertension, Caregiver

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1. Introduction

Hypertension is a common chronic disease and a crucial public health problem in all countries around the world. A global health survey found that the number of patients with hypertension who die from premature complications from hypertension tends to increase [1], is the most common in the Thai elderly [2], which is related to the circulatory system in the body, measured based on systolic blood pressure levels and diastolic blood pressure levels which is the blood pressure when pumping blood acting on the vascular surface. Caused by increased age, causing the deterioration of the body in various aspects that affect blood pressure levels, and blood vessels that have decreased flexibility and hardening of the arteries increased [3]; therefore, most elderly patients are unable to take care of themselves to have appropriate health behaviors.

Pattani Province has a Muslim population of 75.66% [4]. Statistically, patients with hypertension in Pattani province found the most among seniors. Public Health Statistics for the year 2016-2020 of Pattani Province, the prevalence of hypertension for the elderly was as follows: between 60-69 years old found 49%, between 70-79 years old found 54.2% and older than or equal to 80 years old 60.8%, respectively, which is consistent with the statistics of hypertension in the lower southern provinces. reported that the elderly had the highest incidence of hypertension accounted for 68% [5].Thai Muslims believe that illness is a test from God whether or not it will disappear depending on God [6]. Elderly Muslims with high blood pressure need to know the cause, how to prevent and control disease and can face high blood pressure by taking care of appropriate health behaviors based on awareness of health behaviors in the Muslim context with self-management on health behaviors in terms of taking medicines dining manage stress and exercise

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correctly and appropriately according to the treatment plan.

From working in Thung Yang Daeng District Pattani Province, 99.00 percent of the population were Muslims and believed in practicing health behaviors according to religious principles according to their understanding. As a result, the practice of health behaviors for disease prevention in the area was ineffective, not understanding and cannot be put into practice. Including the collection of data on the adherence to treatment of hypertension in terms of drug use among Muslim elderly in the area, 39 percent of the elderly with high blood pressure did not meet the doctor according to the treatment plan, resulting in each year, patients with paralysis in the area increased and in 2018, 7 cases of paralysis complications were found due to high blood pressure and in 2019, an increase of 12 cases. Part of the reason why elderly Muslims change their health habits irregularly and intermittently is because they forgot to take medicine and thought that they had recovered from the disease and therefore did not receive further treatment. There are side effects of drug use. Therefore, they reduced the dose by themselves or did not want to burden their relatives in taking them to hospital to pick up the medicine, resulted in lack of continuity in the treatment.

Registered Nurse at Non-Communicable Disease Clinic, Thung Yang Daeng Hospital, is aware that the health problems of elderly Muslims with high blood pressure in the area is one of the problems that the service system needs to improve. Although currently, professional nurses organize activities according to quality NCD clinics (non-communicable disease) or quality non-communicable disease clinics, the policy of the Ministry of Public Health. However, it is an activity that provides a limited prescription and some aspects are still not covered. Moreover, it is also a treatment that is available to patients only. The main caregivers have not yet been involved in the activities of the patient care process. Therefore, researchers saw the importance of integrating the concept of participation proposed by Cohen Uphoff (1980) [7] with the principle of faith in God into the program this time.

2. Materials and Methods

This study was a quasi-experimental Research with a two-group pretest and posttest design, divided into two groups; a control group and an experimental group, to compare health behavior scores and blood pressure values of Muslim elderly with hypertension in the experimental group before and after receiving the program, and between the programmed group and the formal nursing group.

The sample consisted of both male and female elderly who were diagnosed with hypertension, selected according to the inclusion criteria, that is, the systolic pressure level was in the range of 150-179 mmHg. and diastolic pressure levels in the range of 90-109 mm Hg for three consecutive times and without concomitant diseases that affect the cardiovascular system, such as heart disease, stroke, as well as being of good consciousness. No hearing problems and can be reached by phone. The exclusion criteria is not to participate in all activities according to the program. Required hospitalization at the time of the trial and had comorbidities detected during the trial, including heart disease, kidney disease, and stroke. Calculate the sample using Cohen's formula. The total sample size was 60 people, divided into two groups, 30 people in each group, 30 people in the control group received formal medical care, and the other 30 people were in an experimental group that received a family participation promotion program along with regular medical care.

2.1 Research Instrument

2.1.1 Instrument used to collect information

1) Personal information questionnaire of Muslim elderly with hypertension consisting of 2 parts; Part 1 was Personal Information, twelve questions were gender, age, marital status, education level, occupation, income, adequacy of income, cohabitant, doctor's appointment, pill organizer, escort, and service place satisfaction. Part 2 was Health information, seven questions: body weight, height, body mass index, blood pressure level, period of disease, use of other drugs in combination with treatment, history of smoking or tobacco leaves, history of alcohol use, exercise, stress, self-care knowledge resources which, was created by the researcher from the review of relevant literature.

2) A personal information questionnaire of family members who are primary caregivers with nine questions: gender, age, religion, marital status, education level, occupation, income, period of care for elderly patients with hypertension, experience taking care of other patients, was created by the researcher from the review of relevant literature.

3) Health behaviors of Muslim elderly with hypertension questionnaire, created from a review of the literature and adapted from the self-care behavior questionnaire of hypertension patients ChonlakarnChaikul (2014) [8], 37 questions covering four health behaviors, namely, eating behavior, fifteen questions, exercise behavior, nine questions, stress management, seven questions, and drug taking behavior, six questions, a question to choose from, and negative questions on a 4-point scale.

The questionnaire contains both positive and negative questions. The scoring criteria for each item are as follows:

- Respondents perform activities on that item at least five times in 1 week, giving 4 points.

- Respondents perform activities on that item at least 3-4 times in a week, giving 3 points.

- Respondents perform activities on that item 1-2 times in a week, giving 2 points.

- Respondents did not perform any activity at all, giving 1 point.

Develop criteria for assessing health behaviors using the stratification principle, define the score range into three levels and interpret the results as follows:

- A score of 37.00-74.00 means health behavior is low

- A score of 74.01-111.00 means health behavior is at a moderate level

- A score of 111.01-148.00 means a health behavior is at a high level

Content validity checked by three experts who reviewed the correctness of the text as follows: one doctor specializing in chronic disease care, one nurse practitioner specializing in family and community nursing, and one advanced practice nurse in family and community practice. After a qualified person has already examined the equipment Suggestions have been taken to improve and verify the validity of the content of the tool again, the content validity index (CVI) was obtained for CVI = 0.81. The health behavior questionnaire was then used to check its validity, applied to the actual experiment with a sample group with the same qualifications as the sample group of 20 people and the score obtained was analyzed for reliability, equal to 0.78.

2.1.2 Instrument used in the experiment

1) Guidelines for using the program is the practice of the program user, consisting of instructions for using the program, introductory, description of the program about the background and magnitude of the problem, program objectives, Target group and program users, program duration, and locations for organizing activities according to the program.

2) A plan to promote family participation in the health behaviors of elderly Muslims with hypertension, divided into participation process of primary caregiver family members according to the process of participation of each individual divided into four steps: Participation in decision-making, participation in activities, Participation in receiving benefits arising from operations, and 4) Participation in the evaluation.

3) Self-management manual on health behavior modification, produced in the form of a book containing content about illness, truth of the disease recovery and commitment (both the patient and the family member who is the primary caregiver), and behavior modification advice, attached a health behavior record form for tracking each week as well by communicating in Thai and Malay (Arabic) characters that are clear and suitable for Muslim patients.

2.2 Sample Rights Assurance

The research project was approved for human research ethics by the Research Ethics Review Board, Pattani Provincial Public Health Office Approval number 005/65 dated January 31, 2022. The sample group decided to participate in the research by themselves after knowing the purposes and procedures for collecting data, and received the opportunity to withdraw from the research at any time, and will still receive regular medical treatment if they want to know the results of the experiment, the researcher will inform them as a whole.

2.3 Research Methodology

The duration of the research was eight weeks.

Experimental group received the family participation promotion program. The experiment was conducted in 3 phases as follows:

*2.3.1 **Phase 1: Preparation,** 1st time, 1st week, details are as follows:*

1) Introduce yourself, build relationships, clarify research objectives and ask for cooperation in conducting research

2) Assess health status by measuring blood pressure, weight, height, waist circumference and BMI calculation for the first time.

3) Collect general information and have the patient complete the 1st Health Behavior Questionnaire before joining the program.

*2.3.2 **Phase 2: Promote family participation,** consisting of*

1) Participation in decision-making activities "Force of Faith wisdom in making decisions"

- Build relationships and explain participation in activities according to the steps in the experimental program.

- Educate about the meaning of the disease. Ready to show examples of realistic food models

- Watch the real video through the screen. "Acute ischemic heart disease, silent death"

- Provide an opportunity to find out the causes of worse behavior related to managing past health behaviors as well as participating in planning decisions, finding alternatives to doing things together, and creating a common commitment.

- Encourage self-reflection in order to motivate and make decisions in the practice of changing health behaviors.

2) Participation in the implementation of the activity "Join together, help each other Create Niamat"

- Set self-management goals for behavior change individually and jointly formulate self-management guidelines for health behavior change with family members who are primary caregivers.

- Provide an opportunity to find out the causes of worse behavior related to managing past health behaviors as well as participate in planning decisions, and look for ways to choose a way of doing things together, and forming a common commitment.

- Clarify the follow-up phone call and evaluation in the 2nd, 4th week, the home visit for the 6th week, and

the program evaluation for the 8th week, and schedule the next appointment.

*2.3.3 **Phase 3: Monitoring and Evaluation of Performance***

1) Participation in the benefits

Activities "work together, benefit together, make a phone call, visit a house for Allah", 3rd and 4th (2nd and 4th weeks) by telephone and 5th (6th week) by individual home visits.

2) Participation in the evaluation

Patients and families shared their results over the past eight weeks, measuring blood pressure and assessing health behaviors No. 2

Control group, 1st time (1st week) blood pressure measurement, health behavior assessment 1st time, nursing as usual, namely, questioning symptoms, advice, providing information about individual blood pressure control practices according to the problem condition, and making an appointment to see a doctor. Week 2-7, the sample group self-cares at home. Week 8, 2nd time blood pressure measurement and health behavior assessment, 2nd time.

2.4 Data Analysis

Comparing the difference between mean health behavior scores and mean systolic blood pressure and diastolic blood pressure within the experimental group a paired t-Test. Comparing the difference between mean health behavior scores and mean systolic blood pressure and diastolic blood pressure between the experimental group and the control group, independent t-test was used for 2-group t-test.

3. Result and Discussion

Compare the mean scores of overall health behaviors of the experimental groups before and after the experiment using Paired t-Test after receiving the program to promote family participation. The experimental group had a higher mean score on health behaviors than before receiving the family participation promotion program, statistical significance at the .001 level as shown in Table 1.

Compare the mean scores of overall health behaviors before and after the experiment using independent t-Test statistics. The experimental group and the control group had overall health behavior scores, statistically significant difference at the .001 level and after receiving the program, the experimental group had an overall mean score of health behaviors significantly higher than the formal nursing group at the .001 level as shown in Table 2

Comparing the mean systolic blood pressure and diastolic blood pressure of the experimental group before and after the experiment using paired t-test statistics, after receiving the program to promote family participation, the experimental group had mean systolic blood pressure and diastolic blood pressure statistically significantly lower than before programmed at the .001 level as shown in Table 3

Comparing the difference in mean systolic blood pressure and diastolic blood pressure before and after the experiment using independent t-test before receiving the family participation promotion program, the mean systolic blood pressure and diastolic blood pressure were not significantly different between the experimental group and the control group. But after receiving a program to promote family participation, the experimental group had mean systolic blood pressure and blood pressure. Diastolic was significantly lower than the formal nursing group at the .001 level as shown in Table 4

After receiving a program to promote family participation in the health behaviors of Muslim elderly with hypertension, the experimental group had a statistically significant mean score for health behaviors before receiving the program at the .001 level, a statistically significant mean score of health behaviors than the control group at the <.001 level, the family engagement program uses the Cohen and Uphoff concept of engagement Effects on health behaviors in Muslim elderly with hypertension, shows that the concept of family involvement has four participatory processes: 1) Participation in decision-making, 2) Participation in operations, 3) Participation in receiving the benefits that arise, and 4) Participation in outcome evaluation. The study results are consistent with the study of ChinkornDankasai, SupawanYodprong, KanitthaKaewdoo, Chaiwat Inchaiya, and Charoenchai Muenhor (2022) [9], the mean scores of health behaviors of the experimental group after the experimental group was higher than before and higher than the formal nursing group statistically significant at p<.001, consistent with the study of NapapornChansri, KanokpornNateethanasombat, and TaweesakKasiphol (2020) [10], self-management in patients with depression Uncontrolled hypertension in the experimental group. Their mean health behavior scores were higher than the comparison group, and their mean blood pressure was significantly lower than the comparison group, p<.001.

After receiving a program to promote family participation in the health behaviors of Muslim elderly with hypertension, the experimental group had mean systolic blood pressure, and diastolic blood pressure was a statistically significant difference at the .001 level. After the experiment, the experimental group had significantly lower mean systolic blood pressure and diastolic blood pressure than the control group, with statistical significance at the <.001 level, which explains the Program to Promote Family Participation in Health Behaviors of Muslim Elderly with Hypertension Effect on the mean blood pressure in Muslim Elders with hypertension. Therefore, after receiving the experi-

Table 1. Comparison of the mean overall health behaviors of the experimental group before and after receiving the family participation promotion program using Paired t-Test.

Experimental Group	Overall Health Behavior Score		t-Test	p-value
	$\bar{x}$	S.D.		
Before Trial	62.6	3.43	-57.09	<0.001
After Trial	127.07	4.77		

Table 2. Compare the average overall health behavior between the control group and the experimental group before and after the experiment using independent t-Test.

Experimental Group	Overall Health Behavior Score				t-Test	p-value
	Control Group		Experimental Group			
	$\bar{x}$	S.D.	$\bar{x}$	S.D.		
Before Trial	78.4	4.45	62.6	3.43	15.41	<0.001
After Trial	78.5	4.31	127.07	4.77	-41.40	<0.001

Table 3. Compare the mean systolic blood pressure. Diastolic blood pressure of the experimental group before and after receiving the Family Participation Promotion Program using Paired t-Test.

Experimental Group	Before Trial		After Trial		t-Test	p-value
	$\bar{x}$	S.D.	$\bar{x}$	S.D.		
Systolic Blood Pressure	159.47	6.15	129.77	5.94	-23.55	<0.001
Diastolic Blood Pressure	95.93	3.22	79.13	7.25	12.04	<0.001

Table 4. Comparison of mean systolic and diastolic blood pressure between the control group and the experimental group before and after the experiment using independent t-Test.

Experimental Group	Control Group		Experimental Group		t-Test	p-value
	$\bar{x}$	S.D.	$\bar{x}$	S.D.		
Systolic Blood Pressure						
-Before Trial	157.63	5.03	159.47	6.15	-1.26	.21
-After Trial	154.73	3.53	129.77	5.94	19.79	<0.001
Diastolic Blood Pressure						
-Before Trial	95.93	3.22	96.17	3.45	-0.27	.79
-After Trial	92.60	4.58	79.13	7.25	8.60	<0.001

mental group program, the mean blood pressure decreased. The family participation promotion program has a process that helps the experimental group manage to change their health behaviors better. Using the participation strategies of family members who are the core caregivers to encourage the experimental group to change health behaviors appropriately. The experimental group was able to control their blood pressure levels.

Behavioral modification to have appropriate health behaviors is the elementary practice for all Muslim elderly with hypertension, increasing the effectiveness of drug treatment, resulting in lower blood pressure levels, consistent with a study by NantikarnWangji (2015) [11] which found that drug treatment adherence scores in week 8 increased compared to drug treatment adherence scores in week one and the end at the 4th week, statistically significant p<.05, and the BP at the 8th week decreased compared with the BP at the 1st week and at the end of the 4th week, significantly p<.05

4. Conclusions

Based on the study, The mean scores of health behaviors of Muslim elderly with hypertension after joining the program were higher than those before the program and higher than those receiving formal nursing care, statistically significant (p<.001). Mean systolic and diastolic blood pressure of Muslim elderly with hypertension after joining the program were low, statistically significantly lower than Muslim older adults with hypertension before joining the program, and lower than those receiving formal care (p<.001). This research shows that the Family Participation Promotion Program on Health Behavior of Muslim Elders with Hypertension that involves family members as primary caregivers can promote and support Muslim elderly with high blood pressure, change health behaviors continuously, and help control blood pressure better.

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Herb and Medicinal Properties Information Services with AI and NLP

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Abstract

The objectives of this research are: 1) to gather information on the properties of herb plants from the herb garden of Plak Mai Lai Temple, located in Tung Kwang subdistrict, Kamphaeng Saen District, Nakhon Pathom, and 2) to develop and evaluate the efficiency of an information system for herb and medicinal properties. The system utilized artificial intelligence (AI) based on natural language processing (NLP) concepts. The research methodology comprises the development of research tools, an experiment tool, and subsequent analysis and evaluation. The experiment tool is an information system designed according to system development life cycle, and hosted on the Apache web server. The user interface was created using HTML5, CSS and Bootstrap, with data management handled by jQuery and AJAX. The responsive web application is linked to a MySQL database through PHP scripts. Data collection tools include a system performance evaluation form and a user satisfaction form, both of which successfully passed an assessment conducted from two panel of five experts.

The findings of the research are as follows. Through the survey and data collection of herb and their components properties from 508 herb plants found in the Plak Mai Lai Temple herb garden spanning within an area of 92 rai, 1 ngan, 97 square wa (approximately 156,800 square meters), along with the analysis of 373 cases containing sentences describing symptoms, the accuracy of NLP concepts was determined to be 82.35 percent. Regarding the performance evaluation of the information system for herb and medicinal properties utilizing AI based on NLP concepts: 1) the overall performance was rated at the highest level ($\bar{X}$ = 4.68, $S.D.$ = 0.47), and 2) the overall satisfaction also scored at the highest level ($\bar{X}$ = 4.70, $S.D.$ = 0.50).

Keywords: information service, herb, medicinal property, artificial intelligence, natural language processing, AI

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1. Introduction

According to the national strategic plan for Thai wisdom development, Thai-style healthcare, issue 3, and the national master plan for Thai herb development, issue 1 (B.E. 2560-2565), Thai traditional medicine, folk medicine, and alternative medicines were designated as primary services running paralleled to modern medicine in creating wellness. Moreover, the benefits of Thai herbal products and services were widely promoted to enhance competitiveness in both Thai and international markets. As people trust and recognize the advantages of herbal usage, the wisdom of Thai herbal medicines will be safeguarded and preserved [1][2].

During the COVID-19 pandemic, there has been a notable surge in the popularity of herbal medicines, particularly for alleviating basic symptoms and providing fundamental treatments. Nevertheless, the lack of knowledge on the usage of herbal medicines can potentially lead to harmful or side effects. Therefore, it is crucial to exercise caution when selecting herbal remedies, ensuring that the chosen herbs are suitable for addressing specific symptoms [3].

Nowadays, AI is becoming increasingly integrated into information services, facilitating effective user communication. NLP stands out as one of the most widely used AI technologies for enabling interactive communication. Through machine learning, AI is trained to comprehend conversations and frequently asked questions, enabling it to automatically and efficiently provide users with the most relevant information. Consequently, this leads to the generation of faster and more convenient services.

Hence, the researchers conceived the idea of developing an information system for herb and medicinal properties, utilizing AI based on NLP concepts. The goal is to facilitate the transfer of knowledge on various herbs, including their properties, benefits, and potential risks of misuse. For this purpose, we incorporated information from the Plak Mai Lai Temple herb garden in Nakhon Pathom, along with insights from experts and traditional healers well-versed in medical plants, as documented in the daily use memos.

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Accessible through the Internet, this platform allows people to conveniently explore and inquire about this information. Not only does it serve as a source of knowledge and understanding of their significance, but it also empowers users to make informed decisions about the use of herbs.

2. Materials and Methods

2.1 Objectives

2.1.1 Collecting property information for herb plants located in the herb garden of the Plak Mai Lai Temple, Tung Kwang Subdistrict, Kamphaeng Saen District, Nakhon Pathom, Thailand.

2.1.2 Developing and assessing the efficiency of an information system for herb and medicinal properties, employing AI based on NLP concepts.

2.2 Reviews of literature and related works

2.2.1 Natural language processing (NLP) facilitates computer comprehension of human languages by converting communication languages into interpretable structures that can be processed. The five key stages of NLP are as follows: 1) Morphological analysis: This involves analyzing words based on their constituent meaningful parts. 2) Syntactic analysis: Here, the structure of the given sentences is identified, determining whether they function as subjects, verbs, objects, or phases to convey logical meaning. 3) Semantic analysis: This process entails extracting meaning from texts that might have correct syntax but could be ambiguous, nonsensical, or impossible. 4) Discourse integration: Considered within the broader context of nearby sentences, this stage examines how some texts relate to previous or subsequent sentences. 5) Pragmatic analysis: This phase involves reinterpreting the true meaning of sentences [4] [5] [6]. NLP is closely linked to text analytics, which entails classification and categorization to automatically extract meaning and identify structures with in large volumes of data. Text analysis is a technique used to explore data sets in text format, defining new and previously unseen variables from the data.

2.2.2 The Thai text structure theory emphasizes the elements of consonants, vowels, tone marks, and their associated meanings. Thai sentences adhere to a distinct language rule where words are arranged in the order of subject, verb, and object. Texts commonly comprise a series of multiple sentences. Grammatical relations in Thai for forming sentences include: 1) Word order relationship: This refers to the arrangement of words to form phrases or sentences according to language rules, creating meaningful sentence structures. Word order follows syntax rules based on word categories, such as subject (actor), verb, and object (undergoer). 2) Grouping relationship or hierarchical relationship: This involves organizing words in interconnected sentences and segmenting words into related subgroups to construct a cohesive grammatical structure [7].

2.2.3 During model testing and performance evaluation, a test set was utilized to assess algorithm efficiency. The results were presented in the form of a confusion matrix table, outlining a positive class pertaining to the interested class and a negative class representing the non-interested class. Accuracy is expressed as a percentage of correct predictions compared to the entire predicted data set [8], calculated using equation (1).

$$\text{Accuracy} = \frac{TP + TN}{TP + FP + TN + FN} \tag{1}$$

In the evaluation of data classification performance, various standard criteria are incorporated for accurate measurement and assessment. This included the True Positive Rate, also known as Recall which is determined by the number of true positives divided by the sum of true positives and false negatives, as depicted in equation (2).

$$\text{Recall} = \frac{TP}{FN + TP} \tag{2}$$

The True Negative Rate, also referred to as Specificity, is the ratio of genuinely negative samples that yield negative results. It is determined by dividing true negatives by the sum of false positives and true negatives, as illustrated in equation (3).

$$\text{TNR (True Negative Rate)} = \frac{TN}{FP + TN} \tag{3}$$

Precision refers to the closeness of measurements to each other, or the ratio of correct positive predictions out of all positive predictions made as shown in equation (4), where precision equals true positive divided by the sum of true positives and false positives.

$$\text{Precision} = \frac{TP}{TP + FP} \tag{4}$$

When True Positive (TP) is the number of cases correctly identified positive. The model predicts positive and it is actually positive.

True Negative (TN) is the number of cases correctly identified negative. The model predicts negative and it is actually negative.

False Positive (FP)is the number of cases incorrectly identified positive. The model predicts positive, but it is actually negative.

False Negative (FN) is the number of cases incorrectly identified negative. The model predicts negative, but it is actually positive.

2.2.4 Related works

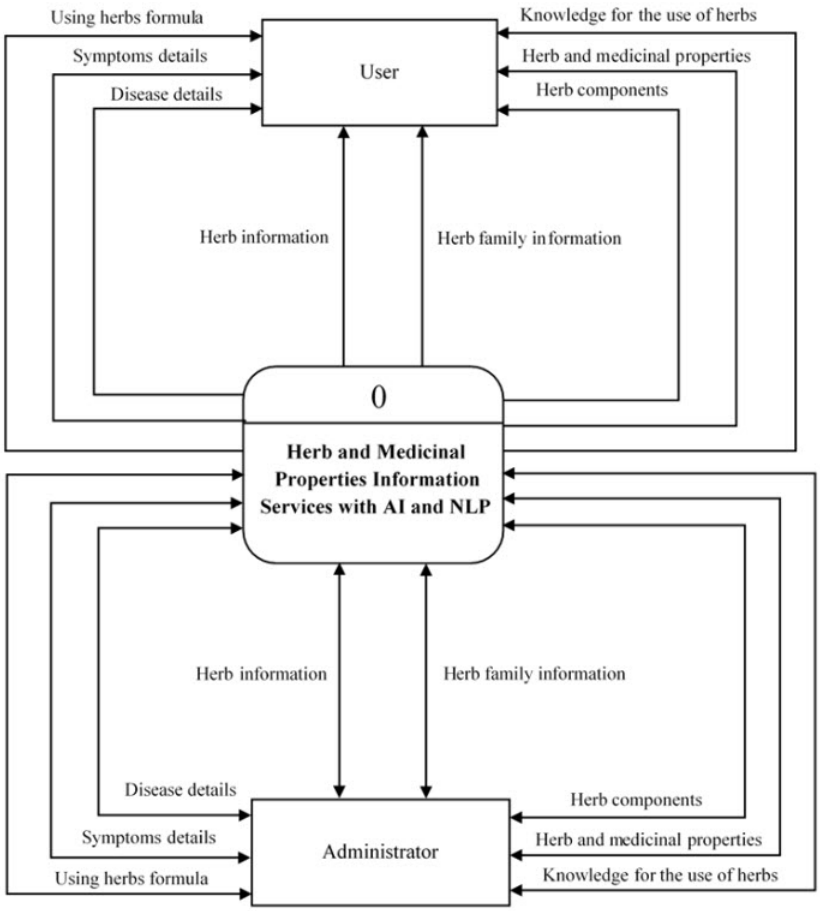

Figure 1: Data Flow Diagram

1) Research on the collection of herbs and their properties has revealed their utilization as both food and treatments for various symptoms, contributing to health nourishment [9]. The influential factors guiding the use of herbs in healthcare include access to herbs, media literacy concerning herbs, knowledge and comprehension of herbs, communication skills in selecting herbs, decision-making skills in choosing appropriate herbs, self-management in herb selection [10], attitudes, perceptions, access to health services, and the realization of the advantages of herbs in fundamental healthcare, thereby reducing reliance on the costs associated with modern medicines [11]. However, only a small fraction of the population possessed knowledge about the use of herbs. Thus, the dissemination of herbal knowledge in healthcare can empower individuals to make informed choices in their self-healing journey [12].

2) Research focusing on the development of information service systems using AI has highlighted the creation of a management system for medicinal plants and their properties. This was achieved by implementing concepts from the system development life cycle and conducting system performance evaluations [13]. Furthermore, automatic Thai text classification using machine learning, coupled with NLP, involved the extraction of extensive data from the Internet, followed by thorough data analysis and computer processing. However, the complexity of Thai language processing, owing to intricate sentence structures and syntax, necessitates the analysis of its language structure, the implementation of Thai text classification, and the storage of machine learning data for future applications [14]. Configuring variables and operations in the NLP model has been instrumental in enhancing accuracy [15]. Thai sentence examination by NLP techniques is swiftly validated by subjecting sentences or texts to a pre-processing phase. This involves word tokenization, the removal of duplicate words and gaps, and the identification of nouns and classifiers to ensure precise information retrieval [16]. The process of tokenizing words from main sentences involves grouping alphabets, vowels and tone marks to form words, which are then compared to keywords in databases [17]. Following the extraction of meanings through NLP, the system can present data in textual, pictorial and video formats alongside providing links to related resources [18] [19]. NLP finds practical application in the healthcare domain by establishing connections between symptom data and corresponding treatment data [20] [21].

From the literature review, it can be indicated that

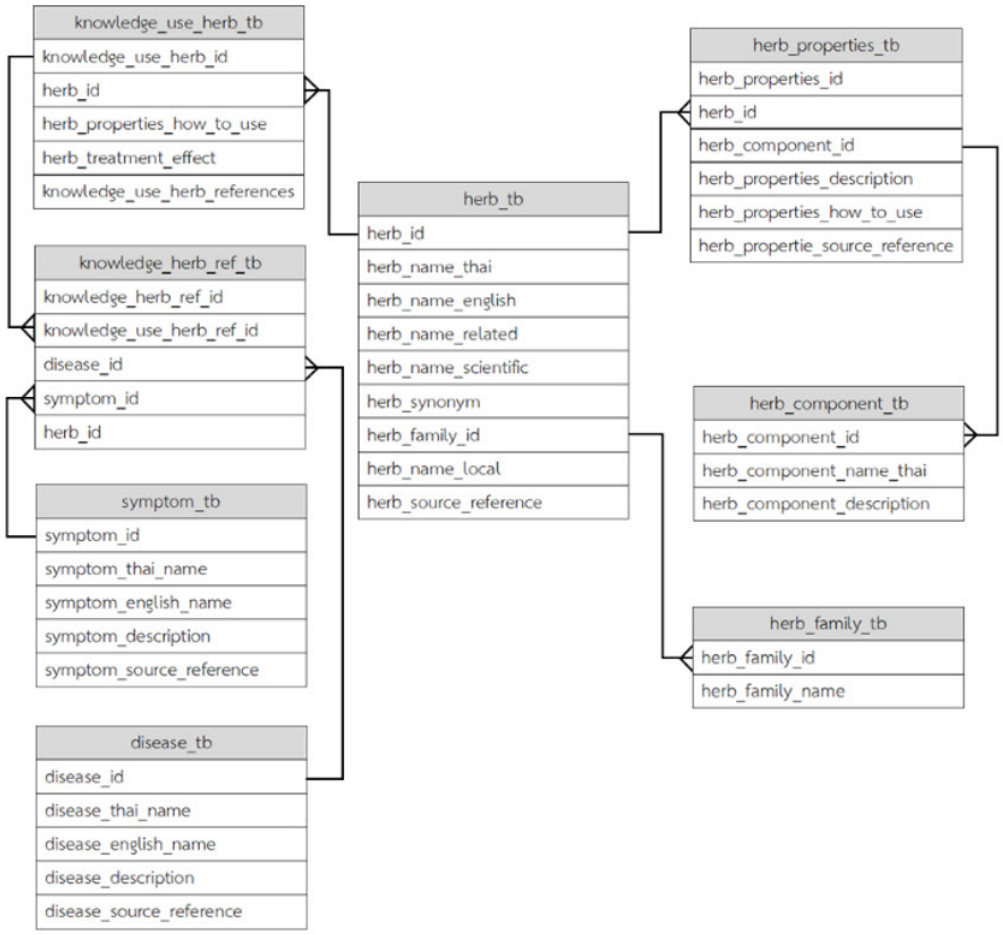

Figure 2: Data Flow Diagram

Thais widely use herbal remedies for self-care. Providing information services about herbal plants and their medicinal properties is crucial, and it has been observed that the use of AI can effectively facilitate human communication and automated services. Furthermore, Thai people use Thai language as their primary means of communication. The application of Thai language in the context of herbal plant information and medicinal properties is still relatively limited. Consequently, researchers propose the integration of AI based on NLP concepts to provide information services on herbal plants and their medicinal properties, aiming to meet the growing demand for such information services in the future.

3. Research Methodology

3.1 Research tool

The research tool is an information system for herb and medicinal properties, employing AI based on NLP concepts. It has been developed using PHP, jQuery, JavaScript, HTML, CSS, Bootstrap, and Ajax, and integrated with a MySQL database. The data collection tools comprised a system performance evaluation form and a user satisfaction form.

3.2 System development

The proposed system was developed according to five steps of System Development Life Cycle (SDLC).

1) Investigation and collection of medicinal plants from the Plak Mai Lai Temple herb garden, Tung Kwang subdistrict, Kamphaeng Saen District, Nakhon Pathom were conducted to gather information about their medicinal properties. The requirement definition was identified, which included herb data, parts of herb with their medicinal properties, and medicinal properties with their related treatment power. Information was gathered from various reliable documentation and online sources [22].

2) Analysis and design of the information system for herb and medicinal properties were conducted using AI based on NLP concepts as depicted in the data flow diagram (DFD) and Entity Relationship (ER) diagram in Figure 1 and Figure 2.

3) Development of the proposed information system.

3.1) Development Tools were as follows:

3.1.1) The information system development tool was Sublime Text 3.

3.1.2) The web server service was Apache server.

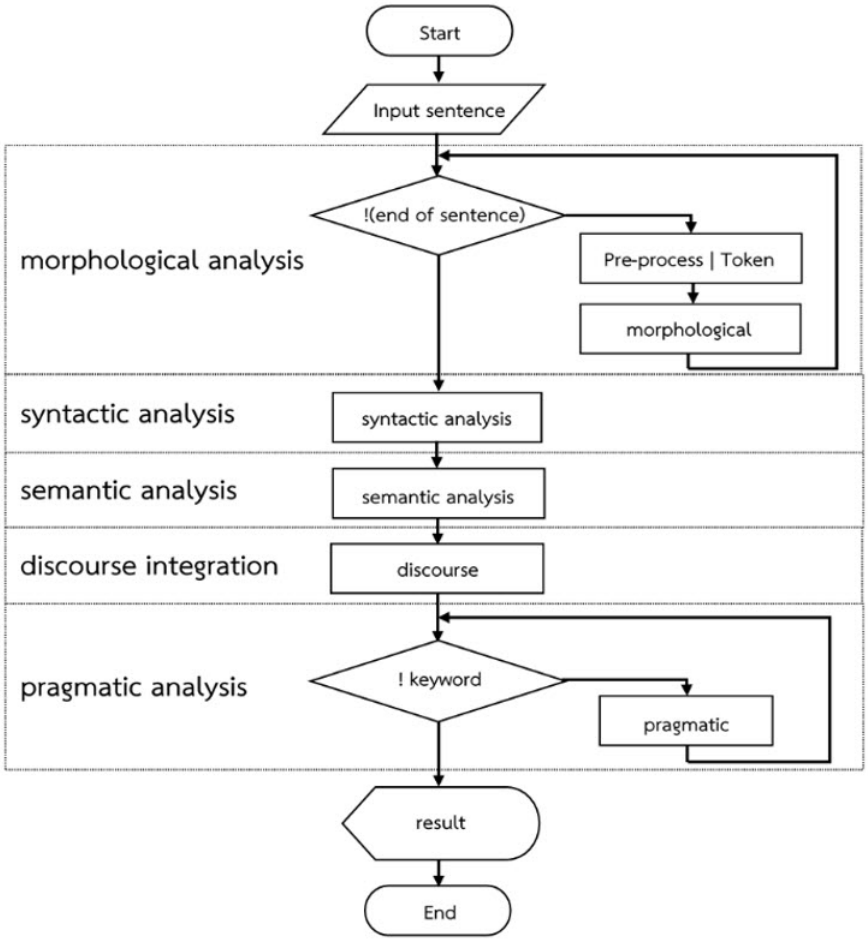

Figure 3: NLP concept

Table 1. System testing results

System testing	Result
Administrator identification to access the system	passed
Medicinal plant properties data management through database operation including insertion, updating, deletion, and viewing data	passed
Frequently asked questions and answers of herbs and their medicinal properties data management through database operation including insertion, updating, deletion, and viewing data	passed
Medicinal properties of herb search using web applications connected to the Internet	passed
Question and answer services on web applications, using AI for herb medicinal properties, connected to the Internet	passed
The processing of herb and medicinal properties information service, based on AI, enables the retrieval of medicinal plant properties according to users' needs	passed

Table 2. Examples of herb medicinal properties

Herb	Components of Herb	Properties
Acacia tomentosa	Root	Snake venoms counteracting
Indian gooseberry	Fruit	Diuretic and phlegm-expelling
Naringi crenulata	Leave	Epilepsy healing
	Root	Intestinal disease healing
Crinum	Tuber	Laxative
	Seed	Menstruation healing
Soap Pod	Root	Anti-inflammatory
	Flower	Tendon deformation
Chebulic	Overripe fruit	Cough and vomit healing
	Crust	Heart nourishment
Mulberry	Leave	Cough and sedative healing
	Fruit	Kidney caring and throat soothing

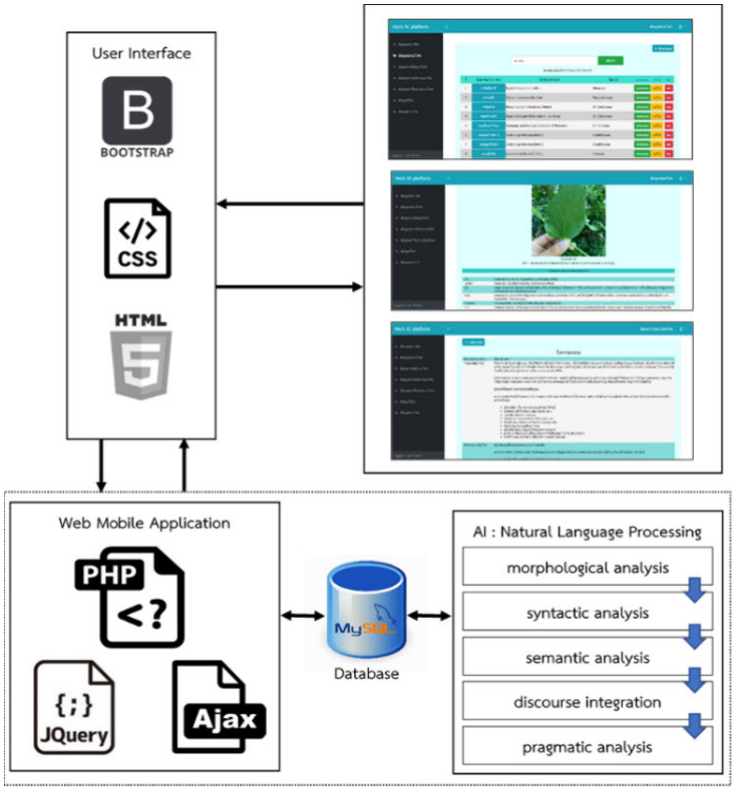

Figure 4: System architecture of the information system

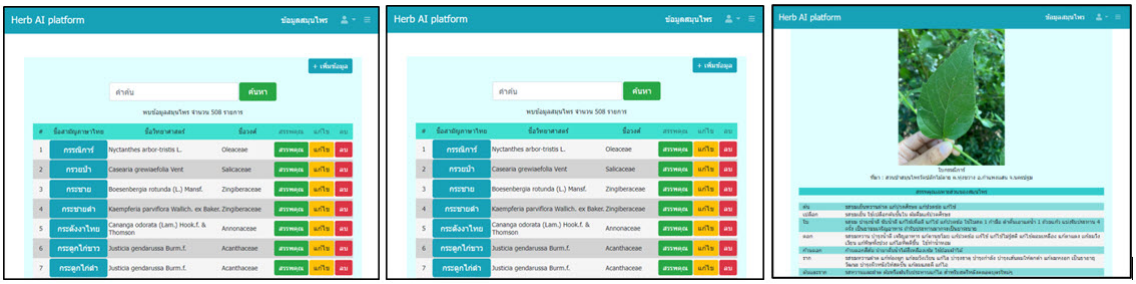

Figure 5: Results from the development of the proposed information system

3.1.3) The database management tool was phpMyAdmin, providing access to MySQL database.

3.1.4) The system development languages and techniques included PHP, Bootstrap, jQuery, Ajax, CSS, and HTML5.

3.2) System development process

3.2.1) Install and configure the web server.

3.2.2) Install and create the database, and define users' rights and authentication.

3.2.3) Utilize HTML5, CSS, and Bootstrap to design and develop the user interfaces.

3.2.4) Use PHP to develop the web application that connects to the database.

3.2.5) Utilize jQuery along with Ajax to develop parts that automatically reload data.

3.2.6) Convert herbs and their properties data into the digital form and import them into the information system for medicinal plant and medicinal properties information services using AI based on NLP concepts.

The system architecture of the information system depicted in Figure 4 illustrates that the herb data, along with reference data, was imported to the system via the user interface developed using HTML5, CSS, and Bootstrap. The web application, constructed using PHP, jQuery, and Ajax, facilitated the connection to the database. Furthermore, data retrieved from the database could be visualized on the geographic map by integrating the system with the Google Map API.

The NLP concept utilized in this research involves five fundamental steps, including morphological analysis, syntactic analysis, semantic analysis, discourse integration, and pragmatic analysis, as illustrated in Figure 3.

The system architecture, depicted in Figure 4, showcases the information system of herb and medic-

Table 3. Results of the System Performance Evaluation

	Performance issues	$\bar{x}$	S.D.
1	**Functional requirement**	**4.72**	**0.40**
1.1	Ability to access the database system	5.00	0.00
1.2	Ability to insert data	4.80	0.45
1.3	Ability to update data	4.40	0.55
1.4	Ability to present data	4.60	0.55
1.5	Correctness of database	4.80	0.45
2	**Functional accuracy**	**4.72**	**0.49**
2.1	Accuracy on data classification	4.60	0.55
2.2	Completeness on insert data	4.80	0.45
2.3	Completeness on update data	4.80	0.45
2.4	Completeness on present data	4.60	0.55
2.5	Overall completeness	4.80	0.45
3	**Usability**	**4.68**	**0.51**
3.1	Convenient to use	4.80	0.45
3.2	Appropriateness of screen design	4.60	0.55
3.3	Clarity of text on screen	4.60	0.55
3.4	Ease of understanding data	4.80	0.45
3.5	Overall usability	4.60	0.55
4	**Performance**	**4.64**	**0.51**
4.1	Web link loading speed	4.80	0.45
4.2	Database connection speed	4.60	0.55
4.3	Storing or updating data speed	4.40	0.55
4.4	Presenting data speed	4.80	0.45
4.5	Overall speed	4.60	0.55
5	**Security**	**4.63**	**0.46**
5.1	Right and permission	4.80	0.45
5.2	Network security	4.80	0.45
5.3	Data access security	4.80	0.45
5.4	Accuracy of user right control	4.60	0.55
5.5	User right and permission verification	4.20	0.45
5.6	Virus and intruder protection	4.20	0.45
5.7	Supporting requirement and application	4.80	0.45
5.8	Consulting and problem esolution	4.80	0.45
	Overall performance	**4.68**	**0.47**

Table 4. Evaluation results of the model

Diagnostic	Value
Sensitivity	77.47%
Specificity	83.91%
Accuracy	**82.53%**

Table 5. User general information

General Information	Quantity (persons)	Percentage
Gender		
Male	28	52.83
Female	25	47.17
Total	**53**	**100.00**
User type		
People	12	22.64
Student	38	71.70
Teacher/Professor/ Academic officer	3	5.66
Total	**53**	**100.00**
Age		
Less than 20 years	29	54.72
20 - 29 years	19	35.85
30 - 39 years	3	5.66
40 years or upper	2	3.77
Total	**53**	**100.00**
Education level		
Lower than bachelor degree	37	69.81
Bachelor degree	11	20.75
Master degree	2	3.77
Higher than master degree	3	5.67
Total	**53**	**100.00**

inal properties. It employed AI based on NLP concepts. This architecture illustrates that user input sentences are imported from a user interface that has been developed by HTML5, CSS, and Bootstrap. These sentences were then connected to the database in a web mobile application format, which has been created using PHP, jQuery, and Ajax. These sentences were further analyzed by the system based on the NLP concept.

4) System testing involves evaluating the information system to provide herbal and medicinal information services through AI, based on NLP principles. The testing was divided into two parts: subsystem testing and integrated system testing. The system testing was considered ”passed” when the subsystem testing was able to function as specified. The test results and system usage testing results are presented in Table 1.

5) Implementing and maintaining the information system of herb and medicinal properties information services using AI in line with testers' recommendations, and launching the system via the Internet.

3.3 Analysis and Evaluation

Likert's five-level rating scale was utilized for the evaluation of system performance and user satisfaction. Mean ($\bar{x}$) and standard deviation (S.D.) are were calculated and the results are were interpreted based on the specified levels [23].

Table 6. Results of users' satisfaction

	Satisfaction issues	$\bar{x}$	S.D.
1	**Information system usage**	**4.75**	**0.43**
1.1	Usability, uncomplicated	4.81	0.39
1.2	Correctness of information	4.79	0.41
1.3	Information system corresponds to user requirements	4.57	0.53
1.4	Appropriateness of data volume on each page	4.79	0.41
1.5	Correctness and completeness of text, picture, table	4.81	0.44
2	**Information system administration and performance**	**4.71**	**0.47**
2.1	Correctness of administration and fast processing	4.81	0.39
2.2	Correctness, completeness and reliability of data	4.47	0.74
2.3	Benefits to users	4.70	0.46
2.4	Speed of data retrieval	4.62	0.48
2.5	Performance and readiness to serve	4.77	0.42
2.6	Up-to-date information	4.79	0.41
2.7	Convenience and usability for use	4.75	0.43
2.8	Overall satisfaction of usage	4.77	0.42
3	**Information system usage**	**4.62**	**0.59**
3.1	Usability to access the system	4.72	0.49
3.2	Network security	4.64	0.52
3.3	User identification before using the system, such as username and password	4.53	0.77
3.4	Privacy	4.66	0.55
3.5	Safety upon logging out after usage	4.55	0.63
Overall users' satisfaction		**4.70**	**0.50**

4. Results and Discussions

1) The survey and data collection of herbs and the properties of their components were conducted on 508 herb plants found in the 92 rai, 1 ngan, 97 square wa (equivalent to 156,800 square meters) of the Plak Mai Lai Temple herb garden. The survey included mapping the medicinal properties of herb components, for example, leaves, flowers, roots, crusts, and seeds, to herbs and their properties, as examples identified on Table 2.

2) The information system of herb and medicinal properties employing AI based on NLP concepts was developed in web application format as illustrated in Figure 5.

3) Based on the performance evaluation of the information system for herb and medicinal properties, utilizing AI based on NLP concepts, the results can be summarized as follows:

3.1) The information system's performance evaluation form and the user satisfaction form passed the IOC assessment conducted by a panel of five experts, including three information system development experts, one plant and agriculture expert, and one herbal expert. Subsequently, the system performance was evaluated by another group of five experts, three information system development experts, one plant and agriculture expert, and one herbal expert. The results of the evaluation presented in Table 3.

The results of the evaluation of the processing model for providing information on herbal plants and medicinal properties using AI based on NLP concepts were obtained from a sample group of sentences used for testing, consisting of general terms combined with terms indicating symptoms of diseases, totaling 373 cases. The Split Test evaluation technique was used, dividing the group into a learning data set of 60% and a testing data set of 40%. It was found that the sensitivity value was 77.47%, the specificity value was 83.91%, and the accuracy value was 82.53%. The evaluation results are presented in Table 4.

3.2) Users of the information system of herb and medicinal properties, utilizing AI based on NLP concepts, amounted to 53 individuals. User general information is presented in Table 5.

The results of users' satisfaction are presented in Table 6.

5. Conclusions

The results indicate that, from the survey and data collection of herb medicinal properties associated with 508 medicinal plants discovered in the Plak Mai Lai Temple herb garden, along with the medicinal properties of herb components when applied in conjunction with sentences containing words describing symptoms, in a split test technique comprising 60% learning data and 40% testing data, the accuracy of NLP concepts is 82.53%. This could be incorporated into the information system for herb and medicinal properties information services, utilizing AI based on NLP concepts.

During the development of the information system of herb and medicinal properties, leveraging AI based on NLP concepts, a responsive web application format was adopted, connected to an online database. This setup enables users to conveniently access the system

from various devices, such as computers, tablets, and smartphones, providing flexibility in usage from any location at any time.

According to the performance evaluation of the information system for herb and medicinal properties, using AI based on NLP concepts, the overall performance is at the highest level ($\bar{X}$ = 4.68, $S.D.$ = 0.47). Specifically, the system exhibited the following performance levels: 1) Functional requirement: highest level ($\bar{X}$ = 4.72, $S.D.$ = 0.40) 2) Functional accuracy: highest level ($\bar{X}$ = 4.72, $S.D.$ = 0.49)

According to the results of users' satisfaction, the overall satisfaction level is also at the highest level ($\bar{X}$ = 4.70, $S.D.$ = 0.50). Specifically, users are highly satisfied with information system usage: highest level ($\bar{X}$ = 4.75, $S.D.$ = 0.43).

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Gender Identity Construction of Homosexual (Kathoey) Student Teachers in Educational Area

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Abstract

The term "kathoey" is used in Thailand to refer to individuals who are homosexual expressing their gender identity in a different way rather than traditional male gender role. This study aims to analyze the identity construction of kathoey or bisexual student teachers in the educational area. This qualitative research uses descriptive analysis to describe the research findings. The samples in this research were the kathoey student teachers that purposively selected using snowball sampling method, from three schools in Thailand.

The selection of schools was chosen from a complaint document about Kathoey student teachers at educational institutions who were unfairly treated based due to their gender identity. The case was referred to the Committee on the Determination of the Unfair Gender Discrimination (DUGD) of the Department of Women's Affairs and Family, Ministry of Social Development and Human Security, during the years 2016 to 2019. The selection involved a purposive sampling of three individuals-the 1st sample from the Faculty of Education, Kamphaeng Phet Rajabhat University, the 2nd sample from the Faculty of Industrial Technology, King Mongkut's University of Technology North Bangkok, and the 3rd sample fromFaculty of Education, Chulalongkorn University.The study found that Kathoey student teachers, who do not conform to their assigned gender at birth and exhibit feminine characteristics or undergo physical changes to become female, faced discrimination within the educational system, particularly in dress codes. This led to unequal treatment based on gender, prompting transgender students to fight against this inequality. They sought advice from experienced individuals, such as the Thai Transgender Alliance (ThaiTGA) and the Rainbow Sky Association of Thailand, using the Gender Equality Act of 2015 as a tool to assert their identity. This included filing complaints with the Committee on the Determination of the Unfair Gender Discrimination (DUGD) of the Department of Women's Affairs and Family, Ministry of Social Development and Human Security. During the investigation, various testimonies and discussions occurred between the complainants and the accused parties. The outcome of the investigation for all three individuals was the same: they had experienced discrimination based on gender identity. As a result of their efforts, they successfully challenged the educational system's discriminatory practices. They also initiated changes to dress code regulations within the educational institutions to better accommodate their gender identities. Additionally, efforts were made to enhance communication and understanding of Kathoey student teachers' needs and rights among faculty and staff within the educational institutions.

Keywords: Practicing; Identity Construction; Kathoey Student Teachers; Educational Area

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1. Introduction

Teachers are the mold of good practices for future generations. It is their responsibility to teach the students morality, ethics, and knowledge. So, the students could become qualified adults who, later, contribute goodness to society and the nation. According to a speech of Her Royal Highness Princess Maha Chakri Sirinthorn that kindly gave to graduates of teachers' colleges on May 18, 1983 (morning session) as follows.

"...Teacher is the most important occupation for the development of the country. Before developing the country, the teacher has to develop the people of the nation. Because the youth is the future of the nation..." [1]

The Faculty of Education in both public and private universities are the educational institutes that nurture these future teachers. [2] One of the most obvious good practices of the teacher is how to dress appropriately. According to the Teachers and Educational Personnel Regulation Act 2004 and the Prime Minister's Office Rules 2010, the dress of civil servants' uniforms for males and females was mentioned. In this sense, the regulations divide people into two genders-male and female. [3]Also, the social norm is one of the important factors that shape society in terms of gender,

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seniority, family, occupation, assets, power, social status, etc. Moreover, these norms are related to rules of laws, regulations, culture, as well as practices in society too. [4]In other words, practices and daily life of people whether good/ appropriate or bad/inappropriate are defined by these norms. So, the practice and actions that do not match one's gender are considered bad practice that doesn't go along with social norms. [5]

As mentioned above, social norms are one of the reasons that extremely relate to the educational structure and regulations such as the Ministerial regulations, regulations of teacher schools (KHURUSAPHA), and university regulations. These are tools to control the behavior of the members of the organization. So, the students could be well-behaved and act in the same way. However, gender diversity cannot be limited to this multicultural society including educational institutes. Kathoey Student Teachers in educational institutes are subject to gender diversity, particularly to those who dress, act, or transform to be women. In the studyof the identity of bisexual students: a case study of a high school in Chiang Mai [6], Kathoey students define themselves as kathoey which differs from straight male or female. There is an inner feeling of not accepting the role of males as defined by society. These factors caused kathoey students to feel uncomfortable with the dressing norm. Coupled with the profession, teachers have relatively high expectations from society. As teachers, they are expected to be noble, honorable, and reliable. [7] Kathoey[8], a word originally used to denote hermaphrodites is used today to describe a male-to-female transsexual. Moreover, the term "Kathoey" [9] is a commonly used but also contested term for a broad spectrum of transgender persons whose sex is assigned as male at birth but who have a feminine gender identity and/or expression. Changing the gender of kathoey students is something different from social norms and university regulations, for example, the way they dress. As a result, kathoey students are often discriminated against by society because bisexuals are not classified as mainstream genders- men and women. In some cases, they are not accepted and included in society.[10] Some studies showed that kathoey teacher students are often discriminated against, treated unequally, and suppressed by the institute's regulations. For example, they could not follow the university's regulations on dressing because the regulations are specified only for males and females. Below is a sample of kathoey teacher students who could not follow the university's regulations and caused discrimination and abusive gender identity.

"When I was a sophomore, I put on a hairpiece. The other day, one of a senior went to the professor and tell him that I had an inappropriate hairstyle. The male professor then called me to meet and he made me remove the hairpiece that was attached to my head. I was very angry and felt like my right was limited. That professor also told me to sign a document that if I do it again, I have to resign from the university. I was shocked and he called my mother to pay a visit. He then reported this to my mother. When my mother knew, she was very upset and afraid that I might be expelled from the school. She cried. So I decided to stand up and fight."

(Interviewed on November 28, 2020)

According to the interview, gender-unequal discrimination against kathoey student teachers is caused by the educational structure. However, such discrimination is contrary to the Gender Equality Act 2015, which states that "any act or non-act that discriminates, deprives, or restricts any direct or indirect benefit, without legitimacy, because the person is male or female, or has an expression different from the innate sex" [11] According to a sample interview, kathoey student teachers questioned gender inequality: *"I think the university is against the Gender Equality Act. If I don't get up and fight, I could not be the way I am, and I'll have to dress like a male until my graduation"* The situation has resulted in kathoey student teachers having an identity-building operation in the education environment. They tried to negotiate gender inequalities that arise in educational structures that suppress the identities of kathoey student teachers. The complaint was informed to the Committee on the Determination of the Unfair Gender Discrimination (DUGD), the Department of Women's Affairs and Family Development, the Ministry of Social Development, and Human Security. It is the central agency to promote gender equality and determine which actions are discrimination or against gender equality.

The researchers were therefore interested in the issue of identity formation of bisexual or kathoey student teachers, as this is very limited and could help gain a better understanding of educational structures and social structures among kathoey student teachers. The concept of Anthony Giddens' Structuration Theory was applied as it is believed that the relation between actors and structures created practice and inseparable structure agency reflect. [12] This study aims to analyze the identity construction of kathoeystudent teachers focusing on their the practice in the professional identity construction-social values, norms and gender role in the education area. Also, attitude of professors who teach the kathoey student teachers in the educational school under the context of time and space are also focused.

1.1 Objective

To analyze the identity construction of kathoey student teachers focusing on the practice in the professional identity construction-social values, norms, and gender role in the education area.

1.2 Scope of the study

Population scope

The research populations were three kathoey teacher students in the study area, namely the Faculty of Education, Kamphaeng Phet Rajabhat University, the Faculty of Education, Chulalongkorn University, and the Faculty of Home Economics Technology, Rajamangala University of Technology Krungthep who sent the complaint to the Committee on the Determination of the Unfair Gender Discrimination (DUGD), the Department of Women's Affairs and the Family Development, the Ministry of Social Development, and Human Security.

Content scope

This research scope focuses on the practices that establish the identity of kathoey teacher students in the educational space by analyzing the factors affecting the identity-building practices of kathoey teacher students, social norms, social values, the Gender Equality Act B.E. 2558 (2015) and educational structures such as university regulations, teacher professional standards, and teacher professional ethics.

1.3 Definition of Terms

Kathoey student teacher is a term for students who study in the Faculty of Education, the Faculty of Education, and the faculties involved in the teaching profession who define themselves as "kathoey" and behave in a feminine manner or transform their physical appearance to female.

Practicing in professional identity construction refers to a method to obtain an identity through a process of compromising or demanding gender equality that results from discrimination, including identity suppression derived from educational structure and regulations.

The term educational area refers to organizations and institutions that are involved in the production and training of teachers. This includes faculties of education, faculties of education sciences, the Teachers' Council, the Ministry of Education, and the Ministry of Higher Education, Science, Research, and Innovation.These organizations and institutions are responsible for teacher training and education in Thailand.

1.4 Conceptual Framework

Figure 1 illustrates the conceptual framework used in the research, which focused on the practice of establishing the identity of kathoey teacher students in the educational area. According to the structuration theory, the action of agency relates to the structure which is reflected back and forth. The kathoey student teachers were suppressed by the regulations of the universities. They were discriminated against and treated unequally. Therefore, they would like to stand up and fight for their identities which results in the changes in education structure, regulations, and identity of kathoey teacher students in the educational space.

2. Methodology

This qualitative research aims to analyze the self-identity formation practices of Kathoey student teachers within the educational context. The inclusion criteria for selecting participants in this study are 1) Students must be enrolled in the Faculty of Education or Faculty of Education Sciences 2) Students must be in their first to fifth academic years 3) Students must self-identify as "" (Kathoey student teacher) and 4) Students must have filed complaints with the educational institution regarding unequal treatment based on their gender identity. On the other hand, the exclusion criteria include students who feel uncomfortable during data collection or are unable to provide complete information during interviews or the research process.

Population and Sample

The research population and sample selection process involve purposive sampling from a complaint document from Kathoey student teachers at educational institutions who were unfairly treated based on their gender identity. The case was referred to the Committee on the Determination of the Unfair Gender Discrimination (DUGD) of the Department of Women's Affairs and Family, Ministry of Social Development and Human Security, during the years 2016 to 2019. Three Kathoey student teachers from different faculties were selected based on the specified criteria: one from the Faculty of Education at Kamphaeng Phet Rajabhat University, one from the Faculty of Industrial Technology at King Mongkut's University of Technology North Bangkok, and one from the Faculty of Education at Chulalongkorn University. Additionally, six teachers were also selected for the study.

Random sampling

To recruit participants, the researcher employed a snowball sampling technique, wherein individuals with relevant experience in the field were initially selected, such as those associated with the Thai Transgender Alliance (ThaiTGA) and the Rainbow Sky Association of Thailand. These initial participants then recommended others who had similar experiences or backgrounds. Purposive sampling was used to select individuals based on the specific criteria required for the research.

Data Collection The interview form was done as a research tool for data collection in order to investigate the primary information of the samples. The questions were ensured to cover the objectives of the research including - Part 1: General background information, Part 2: Personal information of the samples such as gender identity of kathoey status, Part 3: Information of Teacher Professions focusing on attitude and opinion of the professors towards kathoey student teachers and Part 4: Operations and Identity Formation focusing on how to create the identity of kathoey teacher students in the educational area. The conversations and exchange of experience

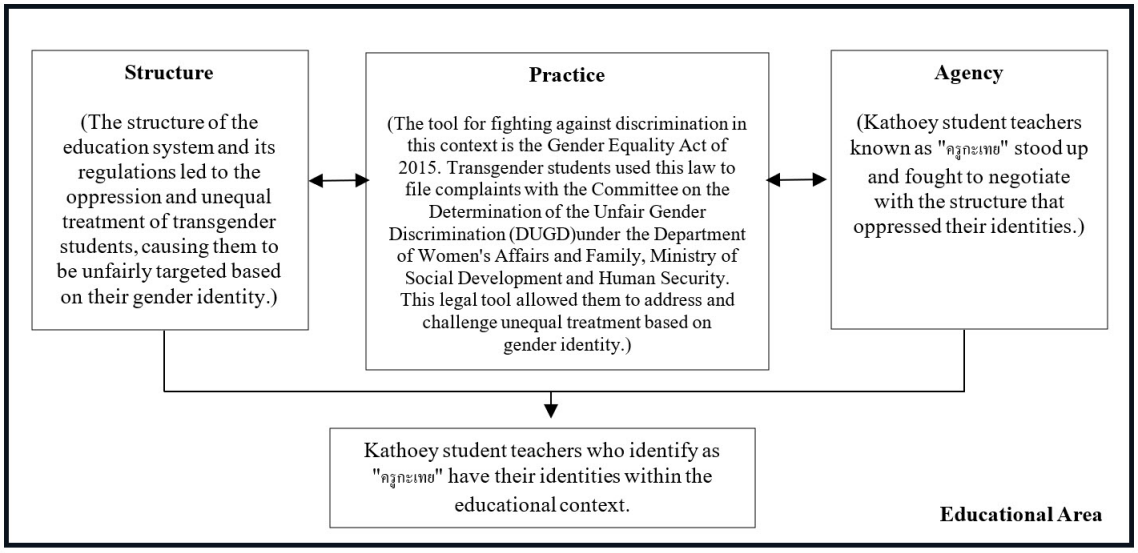

Figure 1: The conceptual framework used in the research.

and ideas between the researcher and samples were extremely focused so that the researcher could understand verbal and nonverbal communication. Some related questions that were not in the questionnaires were asked by the researcher in order to gain more trust. So, the informants would be more comfortable providing more information or revealing their true feelings. For the secondary information, the data was collected from the relevant documents obtained from sources such as 1. The regulation of the university that suppresses the identity of kathoey student teachers or causes discrimination and gender inequality 2. The request form of kathoey's student teachers provides ideas and needs for their identity claim 3. The Gender Equality Act 2015 4. The document related to the teaching profession 5. The diagnostic results are from the Gender Unfair Discrimination Diagnostic Committee and the Department of Women's Affairs and Family Development, the Ministry of Social Development, and Human Security.

Data Analysis

Data analysis was analyzed based on Anthony Giddens' Structuration Theory, in which the relation between actors and structures created practice and inseparable structure agency reflect. The identity-building practices of kathoey student teachers in the form of claims of gender inequality from discrimination and identity suppression from regulatory university structures that result from social values and norms, especially for roles of males and females, were analyzed. Also, the attitude of the instructor towards bisexual students in the context of time and space, which occurs during the 1st year to the 5th year in the study area was observed. The outcome of the operation between the actors and the structure could create more or fewer results according to the ability to negotiate the agency in the operation. After that, the results and conclusion were presented in descriptive analysis.

3. Results

The data analysis phase of the study was informed by Anthony Giddens' Structuration Theory, which posits a reciprocal relationship between actors and structures, resulting in the creation of practices that reflect the inseparability of structure and agency. The research centered on the identity-building practices of kathoey student teachers, particularly their efforts to address gender inequality stemming from discriminatory practices and identity suppression embedded within university regulations. These regulatory structures are influenced by prevailing social values and norms, particularly those pertaining to gender roles. Furthermore, the study examined the attitudes of instructors toward bisexual students within the temporal and spatial context of their academic progression, spanning from the first to the fifth year of study.

Outcomes resulting from the interplay between actors and structures were contingent upon the agency's negotiation capacity within these interactions. The study subsequently presented its findings and conclusions via descriptive analysis.The study on Practicing in Professional Identity Construction of Kathoey Student Teachers in Educational Area aims to analyze the identity-building practices of kathoey teacher students in the educational school in Thailand, namely, the Faculty of Education, Kamphaeng Phet Rajabhat University, the Faculty of Education, Chulalongkorn University, and the Faculty of Technology, the Rajamangala University of Technology Krungthep. Three kathoey teacher students from the above-mentioned institutes, who were discriminated and treated unequally by the structure of the university's regulations were the informants. Anthony Giddens's Structuration Theory

was applied. The findings reveal that the gender identity of kathoey student teachers was suppressed by the structure of the university's regulations, especially in terms of dressing. There is gender inequality and discrimination in the educational space. As a result, kathoey student teachers have compromised their identities against the structure of the university's regulations through the central agency. So, they could help the kathoey student teachers to promote gender equality and establish an identity in the educational space.

Educational institutes are the place where future teachers are educated and groomed. Being a teacher is an honorable and respectful occupation. Thus, the concept of being a teacher in Thailand is quite strict and lies with traditional concepts specifically for gender identity. Nowadays, student teachers are diverse and it is not limited to only males or females. In this study, the samples are the bisexual student teacher or kathoey student teachers who have acted and dressed as females. In this regard, they were discriminated against and suppressed by the structure of the university's regulations because their sexual identities do not match their genders. Therefore, they could not dress according to the university's regulations which limit only male and female's dress codes for example, the announcement of the uniform/the student's dress code, the examination guidelines of dress code for admission, Rules and regulations of dress code of teacher practitioners, Teacher Professional Experience Training Guideline: The Announcements of dress code for graduation, graduation certificates, and photographs used in educational documents. According to those regulations, male students are required to dress according to their genders and have a short haircut that their hair is long no more than the collar line. The ears must be seen, and the front hair must not be too long to cover the faces. overgrown. The male student teachers must wear a white shirt with short or long sleeves. The shirts must not be too tight or slim fit and must be put in the trousers at all times. The trousers should be modern and polite with a black belt and black cut shoes. The overall look must be polite, clean, and appropriate. *"For a male student, if you cannot put a bottle of drinking water into your trouser. It is against the regulation. Also, wearing too tight trousers is against the regulation too."* (Interview of the administrators of the Faculty of Education, December 15, 2020). Changing physical appearance would not be considered to be a student teacher because the children could copy the behavior of the bisexual student teachers.

The above negative attitudes are all derived from the values and social norms underlying the educational structure. Since social norms are considered part of the social culture, this educational structure will not tolerate either inappropriate sexual behavior or sexual orientation.[13] As well as social values, people in society will have a fixed mindset and tend to attach to traditional values such as the teacher should dress politely and appropriately whether at school or in the public area. This idea is in line with the interview of a professor from the Faculty of Education who:

"Teachers' careers lie on cultural traditions. We will not be respected by the student's parents if we wear high heels, shorts, or small T-shirts outside the house. Women teachers are usually viewed in a bad way if their dresses don't follow the ethics of education."

(Interviewed on December 15, 2020)

The second lecturer in the same faculty stated about accepting the conditions of the educational structure based on social values and norms as follows:

"To me, I've been a teacher since I finished my bachelor's degree. I was also in a family in which my uncle or relatives were soldiers, and my grandfather was gender sensitive. I didn't have the opportunity to dress inappropriately or show any inappropriate signs that were against my gender since I was a child. I was told to be a good role model. So, I try to do everything that is in line with the tradition and social norms."
(Interviewed on December 15, 2020)

The regulations of the educational institutes are like a structural concept that all students and teachers in the field of education must follow because they are in line with culture, tradition, and social norms that are agreed upon by the majority of people in society. On the other hand, the power of these structures could create identity suppression and lead to discrimination against a particular person. In this study, kathoey student teachers were suppressed by these regulations just because they could not follow the traditional concept of dressing. Those who dress or act or transform their physical appearance to a female look would be judged and excluded by society. Applied from Section 3 of the Gender Equality Act 2015, they were forced to stop dressing like a female student teacher and, instead of that, dress as a male student teacher. Their gender identities were insulted in class and could lead to the forcing resignation in the end.

"I got a complaint from the professor in front of my classmates in the course of instruction. He spoke with a microphone like he wanted to expel me. I was insulted that I should make a lot of merits, so I wouldn't be born bisexual again. My mother and aunt were summoned to complain about raising me as kathoey and now become a kathoey student teacher"

(Interviewed on March 27, 2021)

Another example of the suppression of sexual identity is that:

"There was one time when we were forced to dress like men again. That was because the teacher didn't allow me to enter the exam room if my dress didn't match my gender. I tried to dress like a male student teacher, but it wasn't me at all. The teacher complained to me about using a female toilet. I was not allowed to use the female toilet and I could be punished if I was caught using a female toilet. So, I use a restroom for handicapped people. Then I complained again. The teachers always complain about bisexual students and hate speech towards the bisexuals all the time."

(Interviewed on March 29, 2021)

Gender inequality actions and discrimination result from the regulation of educational structure. Kathoey student teachers have to compromise their gender identities with faculty. However, this was not accepted. So, they chose to seek other ways by using legislation under the Gender Equality Act 2015 as a tool to claim their sexual identity and address issues related to gender identity suppression. They used the internet to search for information and created a central agency, the Bisexual Friends Network Foundation for Human Rights, to support and mentor them. Then a series of laws such as the Gender Equality Act B.E. 2558, the Constitution of the Kingdom of Thailand 2017, and The Yogyakarta Principles on the application of international human rights law on issues of sexual orientation and gender identity were applied. The Bisexual Friends For Human Rights Network Foundation also helps collect relevant documents and coordinates with the Committee on the Determination of Unfair Gender Discrimination (the 'DUGD Committee'), the Department of Women's Affairs and Family development, the Ministry of social development and human security, which is the central agency to coordinate operations on promoting equality between the sexes as well as to determine which actions constitute unfair discrimination between the sexes.

The fact that kathoey student teachers have utilized legal avenues to address gender discrimination within educational institutions has resulted in formal complaints being lodged with the Committee on the Determination of Unfair Gender Discrimination (the 'DUGD Committee'). Kathoey student teachers have been required to apprise the committees of the unequal treatment they have experienced and provide suggestions and solutions for both committees and the educational institutions to rectify this issue. This process entails the submission of request forms, the provision of information, and attendance at meetings, among other steps.

Any actions of the regulation of the education structure that against bisexual students are contrary to the Constitution of the Kingdom of Thailand, 2017, Article 4, "Human Dignity". The human rights, freedoms, and equality of persons. Are protected under Section 27 that persons are equal in law. They have rights and freedoms, and they are equally protected by law. Unfair discrimination against individuals regardless of the difference in origin. race, language, gender, age, physical disability or health condition, a person's status, socio-economic status, religious beliefs, education, training, or political opinions are not contrary to the provisions of the Constitution, or any other cause shall be unconstitutional. In other words, the result of such a structure is unfair sexual discrimination according to section 3 of the Gender Equality Act 2015 and the University Regulations on Student Dress Code, which defines only female and male students. As a result, the university's regulations are inconsistent with the Gender Equality Act 2015, Section 3, "Unfair Discrimination Between the Sexes," the notion that any act or non-act that discriminates, deprives, excludes, or restricts any benefit, directly or indirectly, without justification because the person is male or female or has an expression that differs by means of sex. As same as Section 17 the formulation of policies, rules, regulations, measures, programs, or practices of any government agency, document organization, or person in a manner that constitutes unfair discrimination between the sexes shall not be committed.

The findings of the three samples, based on the diagnosis of the Group of Judges of Unfair Discrimination between the Sexes, revealed the same result that the structure of the university in terms of regulations was changed according to the constructing practice of professional identity of kathoey student teachers. Consequently, the regulations based on the educational structure must be changed appropriately to gender diversity and gender identity of the student teachers in the educational area. Students whose gender differences are from their birth gender should be allowed to dress and have haircuts according to their gender identity during their studies. In addition, the university has to create a way to communicate about gender identity and gender diversity as well as allow the kathoey students to dress like female student teachers during their studies until their graduation. Also, professors and staff in the university must be encouraged to understand and respect the gender identity of the kathoey student teachers.

Kathoey student teachers were suppressed by the regulations according to the educational structure. So, they were treated unequally and discriminated against. As a result, kathoey student teachers have to compromise with such structures by sending complaints to the authorities that be able to declare unfair sexual discrimination which is against the Gender Equal-

ity Act 2015. In this way. kathoey student teachers have successfully created identity-building operations in the educational area. For instance, the educational educationalstructure also needs to be changed according to the current circumstance in terms of sexual diversity and the sexual identity of students.

4. Conclusion and Discussion

Conclusion

The educational institutes are the places where future teachers are educated and groomed. It has a strict regulatory structure, such as mannerisms, good behavior, etc. So, the students could be well behaved, have knowledge and ability to be a role models in the future. These social values and norms are things that people in society agree as the right thing to do. However, the sexual identity of students in these educational institutes is not limited to only males and females. Kathoey student teacher who has feminine manners and behaviors, or changes their physical condition to a woman, is considered wrong since it is against the social norms. As a result, kathoey or bisexual students are subjected to self-oppression and discrimination without gender equality. They were treated unequally and led to other sexual unfairness in terms of sexism, exclusionary, degrading human dignity and limiting direct privileges. Kathoey student teachers then find ways to negotiate with the structure by conducting internet searches involving legal datasets, as well as networks that will provide assistance and guidance in this operation. They used the Gender Equality Act 2015 as a tool to file a complaint to the Committee to determine unfair discrimination between the sexes, the Department of Women's Affairs and Family Development, the Ministry of social development and human security, which is the central agency to coordinate operations on promoting gender equality, as well as to determine which actions constitute unfair discrimination between the sexes. Referring to the Gender Equality Act 2015, it resulted in restructuring the university's regulations that suited the sexual identity of kathoey student teachers. The university should change its practice, such as the university amending and etc. Students whose gender differs from their birth gender are allowed to dress and have haircuts according to their gender identity during their studies. In addition, the university has to create a way to communicate with people in the organization to understand the composition of students based on their gender of origin. Also, the universities have to create measures to encourage teachers and staff in the organization to respect and awareness of sexual diversity without discrimination among students whose gender does not match their gender of origin.

Discussion

The findings are consistent with Anthony Giddens's theory of structuration Theory that the construction of structures was created by the relationships between the doers/ actor or individual and structure through some practice as the structure agency reflects because they are inextricably related. [12] It was found that kathoey teacher students were subjected to self-restraint from the structure of the university's regulatory studies on dress code because they exhibited sexual behaviors that differed from the university's social norms and regulations, namely, the mannerisms and behaviors of women, or the change ofbody towomen. Therefore, they suffered from gender-unequal discrimination in the educational area.Being suppressed as kathoey teacher students lead bisexual student teachers to compromise their representation as an agency, to claim their identity against the structure by sending the complaint to the Board of Directors to determine unfair discrimination between the sexes, the Department of Women's Affairs and Family Development, the Ministry of Social Development and Human Security, which is the central agency to promote gender equality and determine which unfair discrimination actions are against the constitution. The findings consistent with the structuration theory that the educational structure on regulations and kathoey student teachers represented the agencies that their relationship cannot be separable. The structure changes according to the result of the agent's actions.Through practice, some structures reflect in the context of time and space, which occur during years 1- 5 in the study area.

It is also consistent with other studies regarding self-meaning [14] that causes bisexual teachers to be stigmatized and socially discriminated against in schools. Meaning influences stigma and discrimination, and in situations of discrimination against bisexual teachers. Bisexual teachers give themselves four meanings: 1. Be a male teacher who expresses masculine demeanor and behavior; 2. Be a male teacher who expresses behavior as a gay man and acts like a female 3. Be a male teacher who has preferences in a gay manner, and 4. Be a female teacher in a school with only the prefix "Mr."[15]. According to Guidelines for ensuring the right to gender identity in Thailand through the perspective of foreign law, it found that, under international human rights principles, states has a duty to ensure legal status based on the gender identity endorsed by law. It prohibits imposing conditions that are in violation of human rights in other matters in order to obtain legal status. Currently, Thailand only has to guarantee the legal status of individuals classified as male and female. As a result, individuals with diverse gender identities have become targeted by widespread unfair discrimination in public spaces. Therefore, it is appropriate to have a law to set the rules, conditions, and legal consequences of certifying their gender identity in accordance with the will. Moreover, the principles of international human rights under international obligations should be created in

Thailand. Another approach on Human rights regarding sexual orientation and gender identity in the Thai legal system [16]suggested that the diversity in sexual orientation and gender identity leads to the queerness of individuals who do not necessarily conform to society's norms or rules. The United Nations has established guidelines to protect and certify human rights in matters relating to LGBTQ people that cover several important rights and freedoms while requiring member states to ensure protection from discrimination on the grounds of sexual orientation and gender identity. Moreover, bisexual concepts have had a significant influence on the legal system in terms of gender classification and the establishment of family institutions [17]. However, since the end of the 20th century, changes have occurred in the legal system to accommodate the status of gender-diverse individuals in both international law and the internal legal system of each country. International law has increasingly recognized the identities of gender-diverse individuals on the principles of equality and non-discrimination due to gender differences. While internal law has undergone significant changes in two areas: the legal acceptance of transgenderism and the acceptance of the dual life of individuals of various genders, this change has resulted in the legal system being expanded to a more multi-gender legal system.

Suggestions

1. There was a limited number of studies in this kind of research. Therefore, more studies in this area should be conducted to provide information and knowledge of gender identity and the sexual diversity of people.

2. The research findings can be used as guidelines for adjusting the educational institution's structure, including various regulations, to make it more inclusive and supportive of individuals with diverse gender identities.

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