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Objective

As mentioned above the aim of this journal is to provide a platform and a means for disseminating and exchanging of knowledge and experience pertaining to academic advancement and research findings which may be beneficial for academy and society as a whole.

Deadline - Period of Publication

The UBRU INTERNATIONAL JOURNAL is a four-month academic journal (4 months per issue or 3 issues per year); the first issue is from January-April; the second from May-August; and the third from September-December.

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EDITORIAL

Dear Valued Readers:

As we step into the year 2024, I am delighted to extend my heartfelt greetings to all. May this new year shower you with abundant blessings, woven with hope, safety, success, vibrant health, strength, prosperity, and empowerment. Time, as we all know, moves swiftly. Though a year may seem long, it often slips away unnoticed.

Throughout 2023, we have dedicated ourselves to serving our readers and contributors by curating and publishing high-quality papers and articles to enrich our online journals. Our aim has been to elevate our academic platform, offering you enriching and insightful opportunities for reading and research. We hope that our academic articles and studies have sparked your intellectual curiosity and positively influenced your perceptions, experiences, attitudes, interests, vision, and worldview.

As we release Vol. 4 No. 2 (May - August 2024) of our journal, we once again extend a warm invitation to our readers and contributors to submit their scholarly articles and studies for publication. For submissions and more information, please visit the ThaiJo system at https://so04.tci-thaijo.org/index.php/ubruij.

We sincerely hope that you find our online journal not only meaningful and engaging but also relevant and applicable to your academic and professional endeavors. We deeply appreciate and eagerly anticipate your continued cooperation and contributions.

Asst. Prof. Dr. Pimook Somchob

Editor

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Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things for the advancement of modern farmers

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Abstract

The objectives of this study are: 1. to develop an Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things, 2. to compare the performance of the Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things with commonly used irrigation control systems in the market, and 3. to demonstrate and transfer knowledge on the development of the Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things to a group of farmers. The sample group used in the research consists of 30 tomato farmers from the Agricultural Production Efficiency Learning Center (ALC) in the Muang Sri Kai Subdistrict Network, Warin Chamrap District , Ubon Ratchathani Province The population was obtained by purposive sampling . The research tools used include: A questionnaire to evaluate the performance of the Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet, employing Black Box Testing methods conducted by 5 experts who assessed the system's effectiveness and A questionnaire to evaluate farmers' satisfaction with the training. Statistical analysis involved calculating the mean and standard deviation.

The research findings are:

1. The development of the irrigation control system using an Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things, controlled by the NodeMCU ESP8266 microcontroller, which manages sensors to detect temperature, humidity, water flow, and water usage, and can report environmental conditions of the greenhouse and handle error cases where no water is flowing through a developed web application, showed overall system performance at the very high level.

2. A comparison of the performance of the Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things with commonly used irrigation control systems revealed that the developed system offers additional functions: 1) a notification system via LINE to alert users when there is no water flow, 2) an automatic shutdown of the water pump if no water is flowing, 3) the ability to set the daily water rate, 4) a display of electricity usage, and 5) a report on daily and cycle water usage.

3. The results of the training demonstration and knowledge transfer on the development of an Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things show that the farmers' overall satisfaction with the training across all aspects is at a very high level.

Keywords: Drip Irrigation System, Internet of Things, Automatic Adapted, Tomato Plat, Modern farmers

Introduction

Tomatoes are economically and industrially important vegetables in Thailand. The majority of the cultivation areas are located in the northeastern and northern regions. Tomatoes are crops that are often affected by water shortages, especially during the growth and fruiting stages, resulting in low yield and quality. Farmers, therefore, prefer to cultivate tomatoes under a drip irrigation system, which is part of a Precision Agricultural System and Smart Farm that utilizes Internet of Things (IoT) technology. IoT involves devices around us that can communicate and connect through the Internet, enabling Machine-to-Machine (M2M) communication, which is a widely used communication technology today. It has been applied to household appliances, industrial equipment, and agricultural devices, allowing users to control various equipment through the Internet from anywhere with an Internet connection (Jiamklin et al., 2021). This technology is used to address the aforementioned issues. Precision agriculture is a modern agricultural approach that uses production inputs in precise amounts necessary for plant growth (Low-External Input Agricultural: LEA) or maximizes the efficiency of production inputs. This approach involves monitoring various factors in the cultivation fields and rapidly transmitting data to processing systems for decision-making to control equipment in the fields. Therefore, various measuring devices, including computer programs for data transmission, display, and control of necessary cultivation factors, will assist in monitoring and managing the optimal cultivation conditions. This reduces the risk of crop damage and inconsistency in yields, leading to lower production costs due to reduced input usage while increasing yields, preserving the environment, and enabling the monitoring of plant growth.The primary importance of cultivation under drought conditions is an accurate and efficient irrigation system, especially for large-scale crop fields, where the yield is directly related to the soil moisture level. Therefore, controlling soil moisture levels

within the beneficial moisture range for plants (Available Moisture Capacity: AMCA) is a challenging task for farmers. An automatic irrigation control system with accuracy and precision is necessary for large-scale crop cultivation with limited water sources. Proper water management, including the amount and accuracy of water applied to the required areas, will help maintain sufficient and appropriate soil moisture levels for plant growth, resulting in higher yield and quality. Moisture measurement and control can be achieved by applying locally available electronic devices to develop a soil moisture measurement kit. The moisture readings from the fields are processed by a microcontroller, which then controls the water valves to open or close water supply to specific areas with precision. The main components of this system include soil moisture sensors, a microcontroller, and an automatic water control system. The various components work together systematically and continuously. The system can display real-time soil moisture levels in the cultivation fields and the status of the valves on a monitor, and all data is stored in a database. The database includes temperature, humidity, and water usage data throughout the cultivation season. This data can be analyzed alongside other cultivation factors measured by the sensors and used to forecast future yields. All data from each cultivation season is stored as a database for planning future cultivation. This research focuses on studying how to implement an automatic drip irrigation system To ensure that tomatoes have suitable yields and are beneficial for both existing and modern farmers.

Objective

1. To develop an Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things.
2. To compare the performance of the Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things with commonly used irrigation control systems available in the market.
3. To demonstrate and disseminate knowledge on the development of an Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things to a group of farmers.

Literature Review

This development project has developed an Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things. The following documents were studied and Related Research.

1. Critical Soil Moisture Levels

Soil moisture can be categorized into several types, each with distinct properties. Therefore, utilizing soil moisture effectively requires considering different moisture levels, which are classified into five types as follows:

1.1 Saturation Point or Water Saturation: This is the condition where all the pore spaces between soil particles are filled with water. There might be a small amount of air in the tiny pore spaces, but it is minimal. If the soil has good drainage capacity, the water in the larger pore spaces will move downward due to gravity in a short period.

1.2 Field Capacity: This is the amount of moisture left in the soil after the free-draining water has been removed from the larger pore spaces. It represents the maximum amount of water the soil can retain against gravitational pull. In this condition, the small pores are fully saturated, but the large pores contain air. Field capacity is typically observed 2-3 days after heavy rainfall or irrigation ceases. Generally, the moisture tension at this point is about 1/3 atmosphere, although this value varies with soil texture. For example, coarse soils have a moisture tension of around 1/10 atmosphere, while clayey or sticky soils have about 0.6 atmosphere. Field capacity is considered the upper limit of soil moisture beneficial to plants, meaning plants can absorb moisture at this level, and it remains available long enough for plant uptake. Moisture levels higher than this, such as free water, are less useful to plants because they drain away quickly from the root zone. (Sutthiboribarn et al., 2011)

2. Internet of Things

The Internet of Things (IoT) is a network of objects, devices, or things embedded with electronic equipment, software, sensors, and connectivity that can be connected. It enables the collection and exchange of data between these entities. IoT allows these objects to be monitored and controlled remotely through existing networks, creating opportunities for integration between everyday objects and computer systems. This integration can enhance efficiency, accuracy, and economic benefits. Each object in IoT has a unique identifier and can be recognized through embedded devices, allowing them to interact over existing networks such as LAN, Wi-Fi, 3G, and 4G. Experts predict that by 2020, there will be approximately 50 billion IoT devices (Saaid M.F. et al, 2013). Using IoT in agriculture can address various problems faced by farmers, leading to highly precise and plant or animal-specific farming. Furthermore, farmers can use available resources more efficiently and appropriately for their

farming area. Additionally, they can monitor and manage their operations closely via computer devices, with data transmitted through accessible networks. This will ensure that the yield meets the farmers' needs as they can control and adjust variables according to their requirements.

3. Microcontroller Board

The Arduino microcontroller board is an open-source project developed from another open-source project called “Wiring.” The original “Wiring” project used the ATmega128 AVR microcontroller, which has a large amount of memory and input/output capabilities, and importantly, the ATmega128 is an SMD chip, making it challenging for beginners to build their own boards and circuits. Additionally, the board is relatively large, which might seem excessive for beginners, leading to less popularity. However, after Arduino adapted the “Wiring” code to work with smaller AVR microcontrollers like the Mega8 and Mega168, it became easier to create and use circuits and significantly reduced the cost of building the boards. This adaptation led to Arduino gaining widespread popularity in a short time (Nishimura, et al., 2016). The Arduino Esp8266 microcontroller board uses the ATmega328 chip with a 16 MHz clock, 32 KB flash memory, and 2 KB RAM. The board operates on a power supply of 7 to 12 V, with operating voltage and signal pins at 5 V (TTL). It includes 14 Digital Input/Output pins, 6 Analog Input pins, 1 Serial UART, 1 I2C, and 1 SPI For programming Arduino, the C++ language is used, which is a variant of the C language with a structure similar to standard ANSI-C. However, it has been simplified to reduce complexity, making it easier and more convenient for users to write programs compared to using standard C directly. In reality, Arduino programming can utilize commands that conform to the ANSI-C standard, and the programming style and command usage can be referenced directly from ANSI-C textbooks for NodeMCU is an open-source IoT platform. Consisting of hardware in the form of a system on a chip (SOC) Wi-Fi microchip from ESP8266 made by Espressif System as well as firmware used using the Lua scripting programming language. Node MCU itself refers to the firmware used in the hardware development kit. Node MCU is just like Arduino, but the difference is the MCU. The Node ESP 8266 module is equipped with WIFI, so it can be used for internet-based or IoT hardware requirements. (Firmansyah et al., 2019)

In this research, the NodeMCU ESP8266 is a popular device used in Internet of Things (IoT) applications. The research team chose the NodeMCU ESP8266 due to its compact size and sufficient number of input and output pins for general-purpose use. This device is utilized to control various equipment, such as light bulbs, solenoid valves, and irrigation valves. It is also used for tasks such as opening and closing irrigation valves based on water flow detection and monitoring humidity levels in cultivation areas.

4. Firebase

Firebase is a real-time database and also acts as a Backend-as-a-Service(BaaS). It allows to store a list of objects. Google Firebase is Google-backed application development software which allows developers to develop applications for Android, iOS, and Web apps. Firebase is a grouping of Google's many services in the cloud, including instant messaging, user authentication, real-time database, storage, hosting, etc. (Li et al., 2018)

In this research, Firebase is a schemaless database platform that enables backend management and operates faster than structured databases. The research team chose Firebase for controlling irrigation systems, scheduling, and setting water quantities. It acts as an intermediary between the web application and the ESP8266 board, facilitating communication between them.

5. MySQL

MySQL is the most widely used open-source database software in the world, with more than 100 million users worldwide. MySQL has become the preferred database for many software and application developers on both online and desktop platforms due to its dependability, speed, and ease of use. Individuals and small businesses aren't the only ones that use MySQL; Yahoo!, Alcatel-Lucent, Google, Nokia, YouTube, WordPress, and Facebook are all MySQL users (Michael & Andreas, 2023).

In this research, MySQL is a structured database system that organizes data into tables. The research team chose MySQL for storing data on water usage rates and electricity consumption rates. This allows PHP and JavaScript to retrieve the data and create statistical graphs.

6. No Structure Query Language

Boonrom (2023) discussed unstructured databases, noting that they were first used in 1998 with the rapid expansion of the internet, driven by the increasing popularity of databases for websites. This was due to the need for a data management system capable of handling massive amounts of data. In unstructured databases, Structured Query Language (SQL) is not used to manage data. Generally, unstructured databases are used to handle large volumes of data, also known as Big Data, which have schemas and metadata. Data is accessed using reference principles that allow for quick retrieval, efficient recovery and recording, and synchronized operations for multiple users, along with indexing and high database security. NoSQL databases have become very popular, especially for developing applications to manage large data structures due to their rapid data access and the variety of data management formats. Applications of unstructured databases include the Internet of Things (IoT), hardware control in smart farms, and intelligent human agent systems. The characteristics of unstructured or NoSQL databases are as follows: 1) They do not use a relational database model. 2) They focus on distributed processing. 3) There are no requirements for schema or data structure. 4) Replication and backup are easy to perform. 5) Data access is achieved through an API: Application Program Interface. Unstructured databases are commonly used in formats similar to JSON and BSON data exchange. From an application development perspective, unstructured databases are often used in conjunction with JSON and BSON data exchange.

In this research, the research team utilized an unstructured database or NoSQL Database with Key-Value Store and Document Store capabilities for controlling the system through the developed web application. This was used to manage drip irrigation commands, where commands were stored in NoSQL Database using Firebase Realtime Database. Temperature, humidity, and water usage data for each irrigation event were temporarily stored in Firebase Firestore, a cloud-based database, before being recorded in the MySQL relational database management system at 11:00 PM each day. After the data was recorded, it was then deleted from Firebase Firestore. This process is executed daily following the use of the control system.

7. Related Research

7.1 Mohanad et al. (2020) developed research on designing an automated irrigation system to control water quantity using the Arduino Uno R3 microcontroller and soil moisture sensors. The system controls irrigation and schedules water delivery based on the type of plant, aiming to reduce costs such as water and labor expenses while increasing agricultural productivity. This proposed system is a sustainable solution for enhancing water use efficiency in agricultural areas according to plant needs. The system operates using a drip irrigation method, with the irrigation sensors connected to the Arduino Uno R3, allowing real-time monitoring via a computer. It also allows selection of plant types according to the system's program based on soil conditions and root zone moisture. The automatic irrigation system for

farmers helps determine the required water quantity at scheduled times, reports the water status for each agricultural plot, and allows tracking of soil moisture levels and pump operation. It includes a database on plants and displays suitable water quantities for different plant types.

7.2 Rossy et al. (2020) developed research on the design and implementation of an automated tomato irrigation system using IoT with the ESP8266 microcontroller. The system considers factors such as the required soil moisture, air conditions, and temperature necessary for growing tomatoes, which should be between 60% and 80% humidity and temperatures between 24°C and 28°C. The research team utilized IoT technology to develop an innovative agricultural technology solution to address issues and enhance irrigation precision based on soil moisture levels and air temperature. The system, which includes ESP8266, soil moisture sensors, and DHT11, can be controlled remotely via an internet connection. The program is integrated with the Telegram Messenger application to receive data from the sensors and automate tomato watering. Experimental results showed that the soil moisture sensors functioned well, accurately reading soil moisture levels, and the temperature sensors provided suitable air temperature readings. Users receive all sensor data through the Telegram Bot, which sends notifications, allowing farmers to easily monitor and control tomato irrigation remotely. The system also manages and tracks the condition of tomato cultivation.

Research Methodology

The development of an Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things was conducted by the researcher following the steps of the SDLC model, which includes the following stages:

1. Planning Requirements

1.1 Studying the Problem: Due to the large amount of agricultural land in Thailand, farmers need to use a significant amount of water for their crops. This requires them to spend a lot of time watering their plants, and they are also unable to accurately monitor the amount of water being used. To help farmers work more efficiently, it is necessary to apply technological and innovative solutions to reduce the workload of cultivating field crops and garden plants.

1.2 Studying the Hardware Tools

1.2.1 Studying the Working Principles of NodeMCU ESP8266: NodeMCU ESP8266 is a small, low-cost Wi-Fi enabled microcontroller that is widely used in Internet of Things and smart home devices. It is unique in that it can be programmed to perform various tasks.

1.2.2 Studying the YF-S201 Water Flow Sensor Module: This sensor module is utilized to measure the flow rate of water. Generally, its operation is based on detecting and measuring the flow of water using the principles of pressure change or water flow within a pipe. Equipped with a fan, the sensor module measures the water pressure passing through it. It must be installed on a water pipe and measures the flow of water through the pipe by detecting changes in water pressure.

1.2.3 Studying the operational principles of a relay: relay is an electrical control device with a crucial component known as a coil. It functions similarly to a switch, utilizing electrical voltage to open and close the electrical current, thereby controlling various electrical devices. Relays are essential components in automated control circuits.

1.2.4 Studying the Solenoid Valve: A solenoid valve has the ability to control the flow of water or other substances using electrical energy as the medium for operation. It utilizes

electrical energy to either open or close the flow of water, allowing for efficient control over the fluid's movement.

1.2.5 Studying the Temperature and Humidity Sensor (SHT31): The SHT31 module combines both temperature and humidity measurement capabilities while being water-resistant. It is capable of measuring temperatures ranging from -40 to 125°C with high accuracy and can measure humidity levels from 0 to 100% RH. The sensor operates with an electrical voltage of 3.3V or 5V and connects using the I2C communication protocol. Additionally, it features a water-resistant design for added durability.

1.3 Studying the Software Tools

1.3.1 Studying the operation of the Arduino IDE involves understanding the programming aspect of controlling Arduino boards. Programming for Arduino boards is done using the C language, and the entire process is open source, allowing users to work with it without incurring any costs. The Arduino IDE enables users to write programs that control the functions of Arduino boards, making it a versatile and cost-free solution.

1.3.2 Studying the operational principles of Firebase Firebase Realtime Database is a NoSQL cloud database that stores data in JSON format. It enables real-time synchronization across all connected devices, offering faster performance compared to relational or structured databases (Boonrom, 2023). It supports offline functionality by storing data locally until the device reconnects to the internet, at which point it automatically synchronizes the data. Additionally, it includes Security Rules, allowing the configuration of access conditions for both reading and writing data. The database is compatible with Android, iOS, and web applications, as well as the ESP8266 board used in this research

1.3.3 Studying the principles of relational databases relational database stores data in the form of two-dimensional tables, where information is presented in rows and columns. Each row is referred to as a record, while each column is called a field or attribute (Boonrom, 2023). The research team will use a relational database to store daily drip irrigation data, including moisture levels, temperature, and water usage. The data will then be compiled into statistical graphs for reporting to users

2. Analysis System

2.1 Steps of Analysis

The research team has gathered data to study the Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things. This process involves the following steps:

Analyzing the Automatic Adapted Drip Irrigation Systemfor Tomato Plat Using Internet of Things

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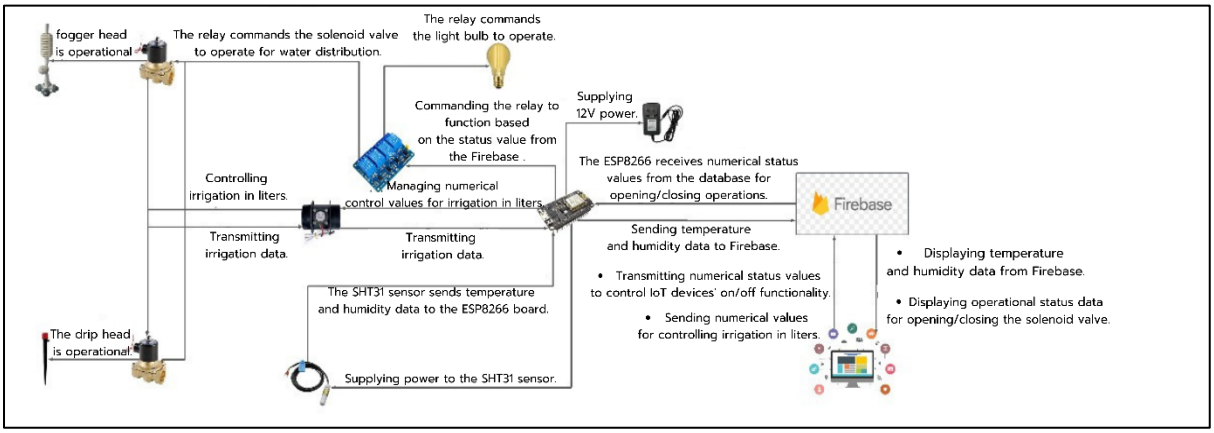

Figure 1: Analyzing the Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things.

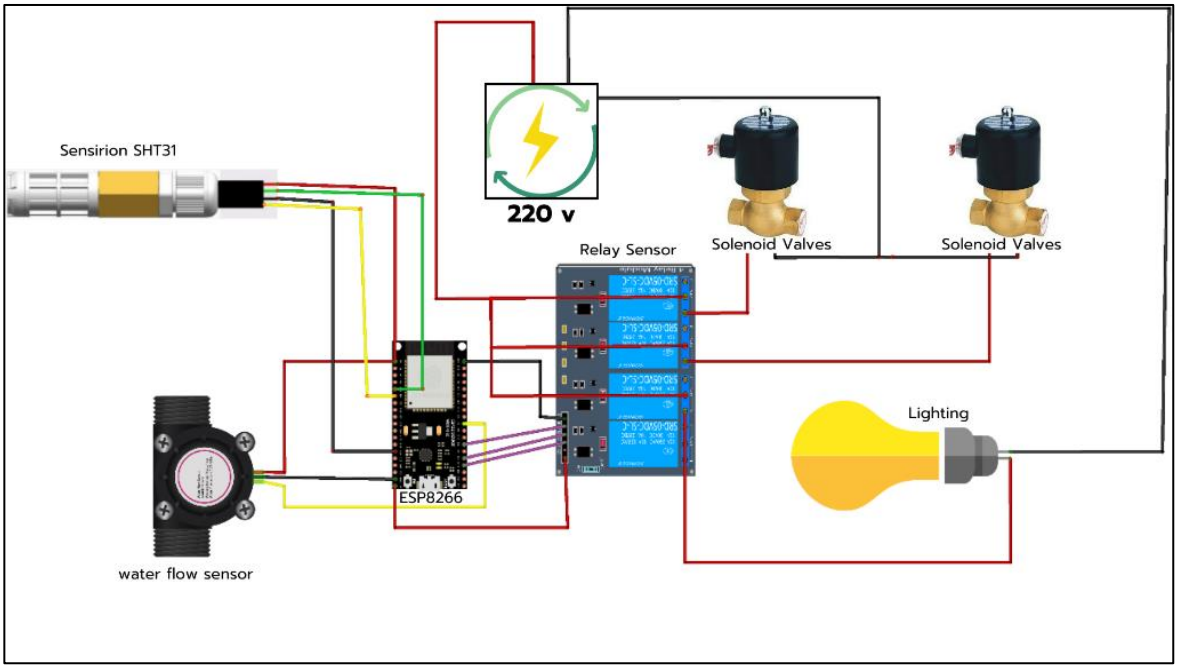

Figure 2: Circuit Analysis

Figure 1 and 2 depict the analysis of the Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things. Users interact with the system through a web application to issue commands. The web application then sends status values as numerical data to Firebase, and the ESP8266 board retrieves these status values from the Firebase database. The ESP8266 board acts as a control unit, sending commands to the relay to activate or deactivate devices. The devices include light bulbs and solenoid valves. Moreover, the ESP8266 board transmits temperature and humidity data obtained from the SHT31 sensor to Firebase, allowing the web application to display sensor readings. This feature informs users about temperature and humidity levels in the cultivation area. Additionally, users can remotely control the irrigation

schedule through the web application, utilizing the YF-S 201 Water Flow sensor module to measure the water flow rate in liters. When the specified water quantity is reached, the solenoid valve stops the water supply, effectively halting the irrigation process in the cultivation area.

2.2 Design System

Based on the study of the irrigation problems and system planning, the research team has designed an Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things. The system is divided into 3 main components as follows

1) Designing the overall system operation.

The research team has designed the overall operation of the Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things in the form of algorithms. The algorithms are as follows.

Control system for fogger, lights, and drip irrigation
Check control conditions for fogger, lights, and drip irrigation:
If true, activate RELAY1 to turn on the lights.
If true, activate RELAY2 to start drip irrigation.
If true, activate RELAY3 to turn on the fogger.
The variables are received as follows: RELAY1 = 1, RELAY2 = 1, RELAY3 = 1.
Check if the board received RELAY1 = 1:
If true, start the operation of the light bulb.
If false, stop the operation of the light bulb.
Check if the board received RELAY2 = 1:
If true, start drip irrigation.
If false, stop drip irrigation.
Check if the board received RELAY3 = 1:
If true, start the fogger operation.
If false, stop the fogger operation.
If none of the above conditions are true, stop the operations of RELAY1, RELAY2, RELAY3.
Display the status of operations (on/off) through a web application.
End of operation.
Display the opening/closing status via a web application.

Figure 3: The program controls the on-off operation of the misting system, lights, and drip irrigation.

Water volume control program
If true, activate RELAY2 to start drip irrigation.
Receive variables: controlled volume data and current usage volume data.
Check if the current usage volume is less than the controlled volume
If true, start drip irrigation.
If false, stop drip irrigation.
If not true, stop the operation of RELAY2.
Display the opening/closing status via a web application.

Figure 4: The system is programmed to control the specified water quantity

Humidity control program
If true, activate RELAY3 to start the fogger.
Receive variables: target humidity and current humidity.
Check if the target humidity is less than the current humidity
If true, start the fogger.
If false, stop the fogger.
If not true, stop the operation of RELAY3.
Display the opening/closing status via a web application.

Figure 5: The programmed system controls the specified humidity level.

Control system for program to send cumulative water and electricity usage data
Check the condition for sending cumulative water and electricity usage data:
If true, activate RELAY1 to calculate and sum up electricity usage.
If true, activate RELAY2 to calculate and sum up drip irrigation water usage.
If true, activate RELAY3 to calculate and sum up fogger water usage.
Receive variables: RELAY1 = 1, RELAY2 = 1, RELAY3 = 1.
Check if the board received RELAY1 = 1
If true, calculate and sum up electricity usage.
If false, stop calculation and send cumulative electricity usage data to the database. Check if the board received RELAY2 = 1
If true, calculate and sum up drip irrigation water usage.
If false, stop calculation and send cumulative drip irrigation water usage data to the database.
Check if the board received RELAY3 = 1
If true, calculate and sum up fogger water usage.
If false, stop calculation and send cumulative fogger water usage data to the database
If not true, deactivate RELAY1, stop calculation, and send cumulative electricity usage data to the database.
If not true, deactivate RELAY2, stop calculation, and send cumulative drip irrigation water usage data to the database.
If not true, deactivate RELAY2, stop calculation, and send cumulative drip irrigation water usage data to the database.
Display the opening/closing status via a web application.

Figure 6: The control system manages the program that sends cumulative data on water and electricity usage.

Figure 3 to 6 represent the overall design of the Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things. The system incorporates the design of the program to control the on-off operation of the misting system, lights, and drip irrigation. The program checks the conditions to ensure that the board receives the values of variables for Relays in Channels 1 - 3 . Additionally, the system is designed to control the program for

regulating the specified water quantity, activating Relay in Channel 2 when meeting the conditions. Furthermore, the program controls the humidity level as per specifications, activating Relay in Channel 3 under the defined conditions. The design also includes a program to control and send cumulative data on water and electricity usage, checking conditions to ensure the board receives the values of variables for Relays in Channels 1-3.

2) Designing a greenhouse for cultivating tomatoes using Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things.

After studying the issues and planning the development, the research team selected Queen Sirikit tomatoes as the sample crop. They examined the results of implementing the Automatic Drip Irrigation System Using Internet of Things. The greenhouse for growing Queen Sirikit tomatoes was designed using the SketchUp program, as shown in Figures 7-8.

Figure 7: Designing the interior layout of the greenhouse.

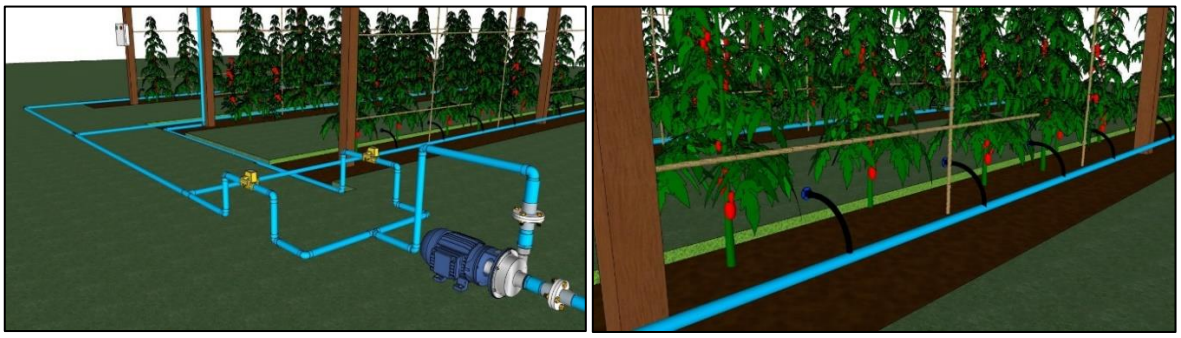

Figure 8: Designing the water pipe system.

3) Designing the operational principles of the Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things.

The research team has developed the operational principles of an intelligent agricultural irrigation system via the Internet of Things, as shown in Figure 9.

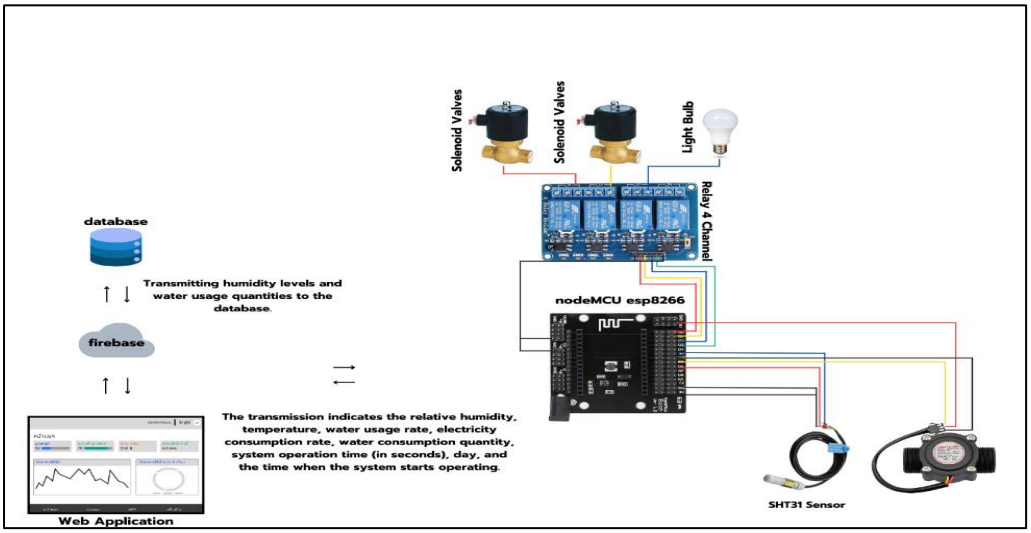

Figure 9: Designing the operational framework of the Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things.

From Figure 9, the system design involves using a web application to control an ESP8266 board, which commands the on-off status of a 4-channel relay to control two solenoid valves and one light bulb. It also regulates water usage rates using a water flow sensor. The board sends temperature and humidity data from an SHT31 sensor and displays the results in the web application. Data transmission occurs via Firebase, serving as an intermediary, and stores information on water usage, electricity consumption, temperature, and humidity in the database.

3. Development System

Developing an Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things for nurseries and farms involves the following steps.

3.1 Preparation of land for planting crops.

Figure 10: Preparation of land for planting crops.

3.2 Designing a Water Pipe System for Plant Irrigation.

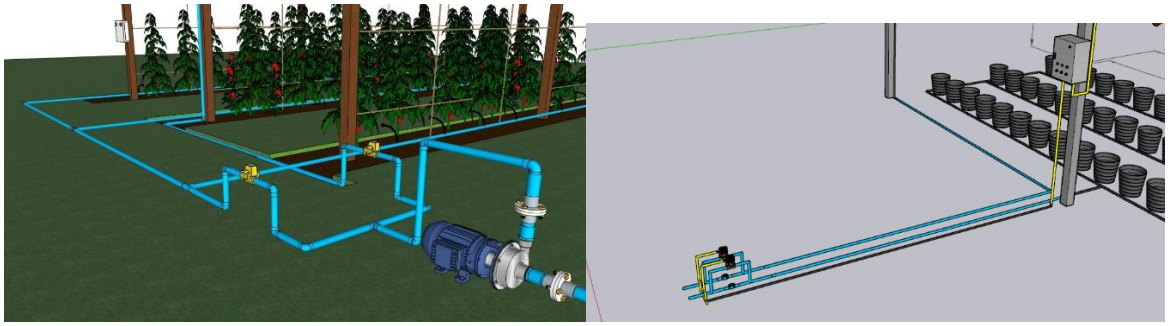

Figure 11: Laying the water pipe system.

3.3 Developing and installing a control box inside the plantation plot.

Figure 12: Development and installation of control boxes

Figure 1 2 the step-by-step process for installing the control box within a crop cultivation facility to manage the operations of equipment is depicted. This control box is essential for controlling the overall system and consists of the following 1) Control of Solenoid Valves 2) Flow Rate Monitoring 3) Moisture Level Sensing 4) Control of Light Tubes

3.4 This article discusses the programming of a system for controlling the operation of a plant cultivation plot. The system can be divided into 4 parts.

1) Development of the home page.

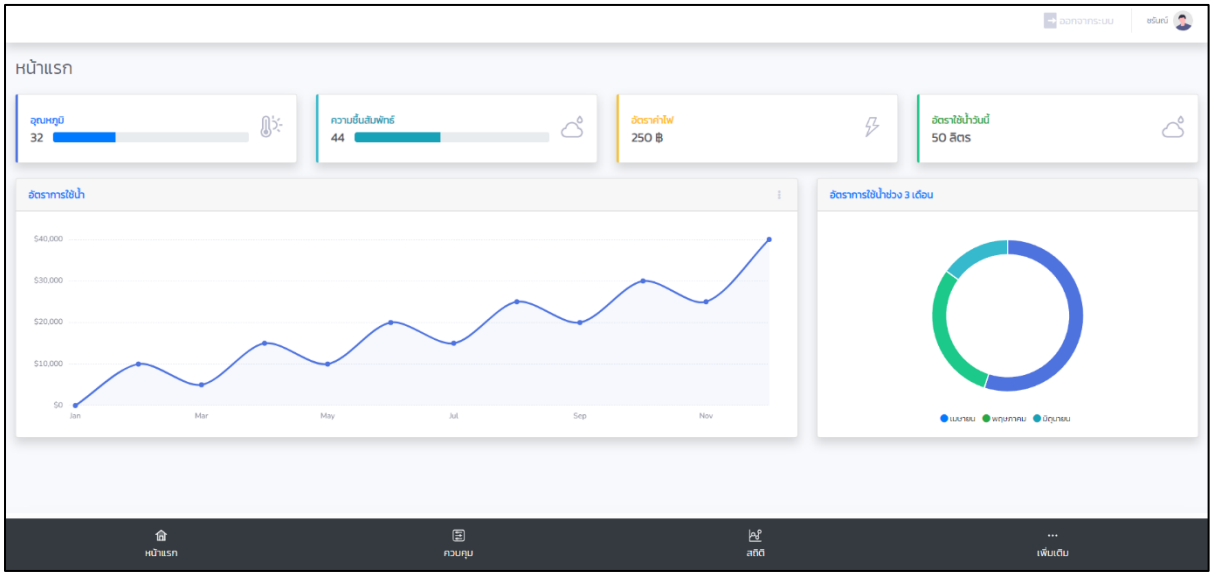

Figure 13: Development of the home page.

Figure 13 depicts the use of a web application to access information within a crop cultivation area. The displayed data includes temperature, relative humidity, electricity consumption rate, daily water consumption rate, a graph illustrating the water consumption rate, and the water consumption rate over a 3 month period0

2) Development in the control panel section.

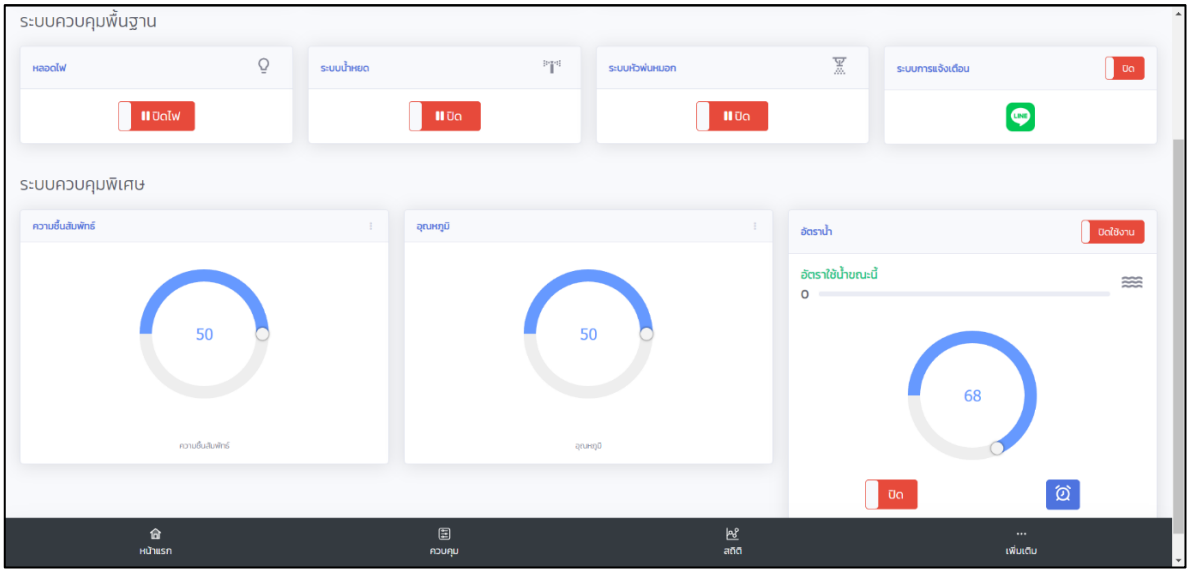

Figure 14: Development in the control panel section.

Figure 14 showcases the utilization of a web application for accessing information and controlling operations within a crop cultivation area. The displayed data and control features include temperature, relative humidity, electricity consumption rate, daily water consumption rate, and various fundamental operational controls. These controls encompass the management of light tubes, drip irrigation systems, misting systems, Line notification alerts for water flow without irrigation, and specialized controls such as humidity and temperature regulation. Additionally, the system allows for scheduled time settings and daily water consumption rate configuration measured in liters.

3) Development of the statistics page.

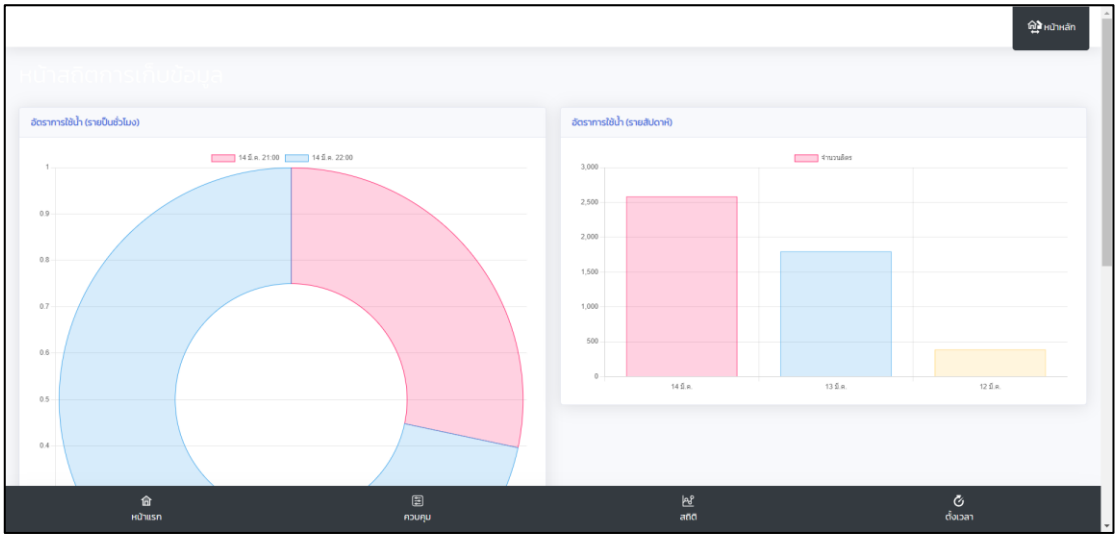

Figure 15: Intelligent Agricultural Irrigation System Controller Statistics Page.

Figure 15 it is a statistical data display page in the form of a bar graph for water usage rates over different time intervals. The data to be displayed includes hourly data showing the date, month, and time, weekly data showing the date, month, and monthly data showing the month. The statistical data in this bar graph format is measured in liters.

4) Development in the section of scheduling.

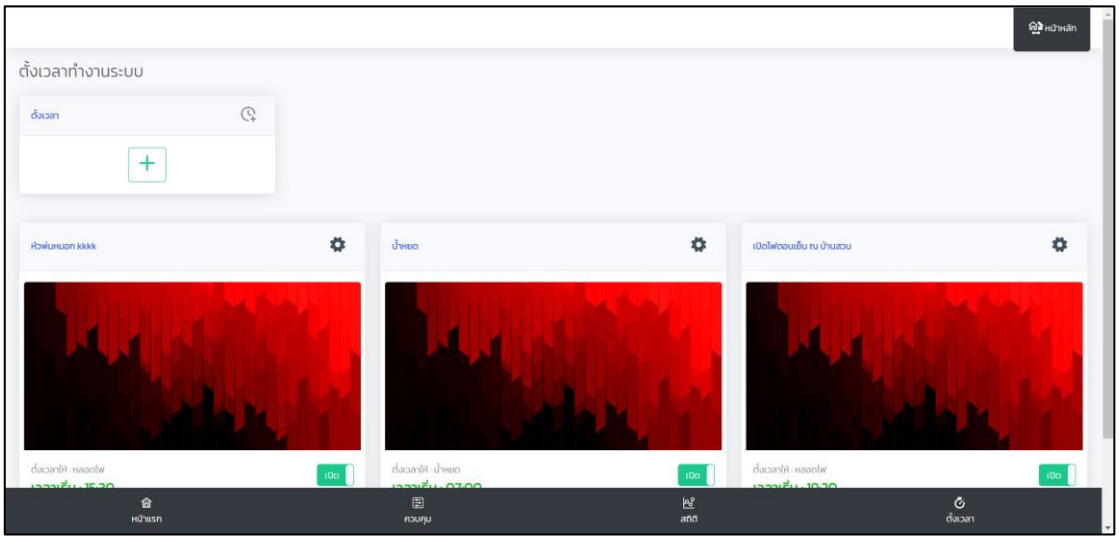

Figure 16: Development in the section of scheduling**.**

Figure 16 it is a section allows users to schedule watering times for Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things. Users can set titles, start times, end times, select devices for activation, and choose days for operation. Users can add multiple scheduling entries, each with its own set of details, and edit the details of each entry as needed.

4. Testing

The research team conducted performance evaluation tests using an assessment form for the Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things. These tests aimed to assess the overall system performance to determine if the processes align with the predefined objectives. Additionally, the tests were conducted to identify any system errors or discrepancies. Following the evaluation, the research team made improvements and adjustments to enhance the system. The evaluation process involved the participation of five experts in the field.

5. Evaluation System**.**

The system evaluation process involved the creation of an efficiency assessment form. 5 expert assessors were enlisted to conduct a thorough evaluation of the system's performance

The outcomes derived from the assessment process will be subjected to statistical principles to aid in summarizing the efficiency of the developed system. Statistical calculations, including mean (average) and standard deviation (S.D.), will be employed for each dimension of the assessment. This statistical approach aims to provide a comprehensive overview of the system's efficiency and quality across various aspects. (Boonchom, 1998)

4.51–5.00 mean The performance and quality of the system is very good
3.51–4.50 mean The performance and quality of the system is good
2.51–3.50 mean The performance and quality of the system is medium
1.51–2.50 mean The performance and quality of the system is Low
1.00–1.50 mean The performance and quality of the system is Very few

The statistical data shows as follows:

1.Arithmetic mean

$$\overline{X} = \frac{\Sigma^{x_i}}{n}$$

When $\overline{X}$ is arithmetic mean
Σ_i^x is Sum of data
n is Amount of data

2. standard deviation

$$SD. = \sqrt{\frac{\Sigma(X_i - \overline{X})^2}{n}}$$

When $S.D.$ is standard deviation
X_i is Personal data
$\overline{X}$ is arithmetic mean
n is Amount of data

6. Assessing farmers' satisfaction with the training.

Assessing farmers' satisfaction with the training for demonstrating and transferring knowledge on the development of an automatic drip irrigation system for tomato farms using the Internet of Things according to the evaluation criteria in stage 5.

Research Findings

A team of researchers has developed Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things. The system can be divided into the following four parts.

1. The result of developing an Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things.

1.1 Results of the software development for the web application component to store data on temperature, humidity, watering times, drip irrigation duration, and daily water volume in the automatic drip irrigation system for tomato farms using the Internet of Things.

1) The first page of the Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things.

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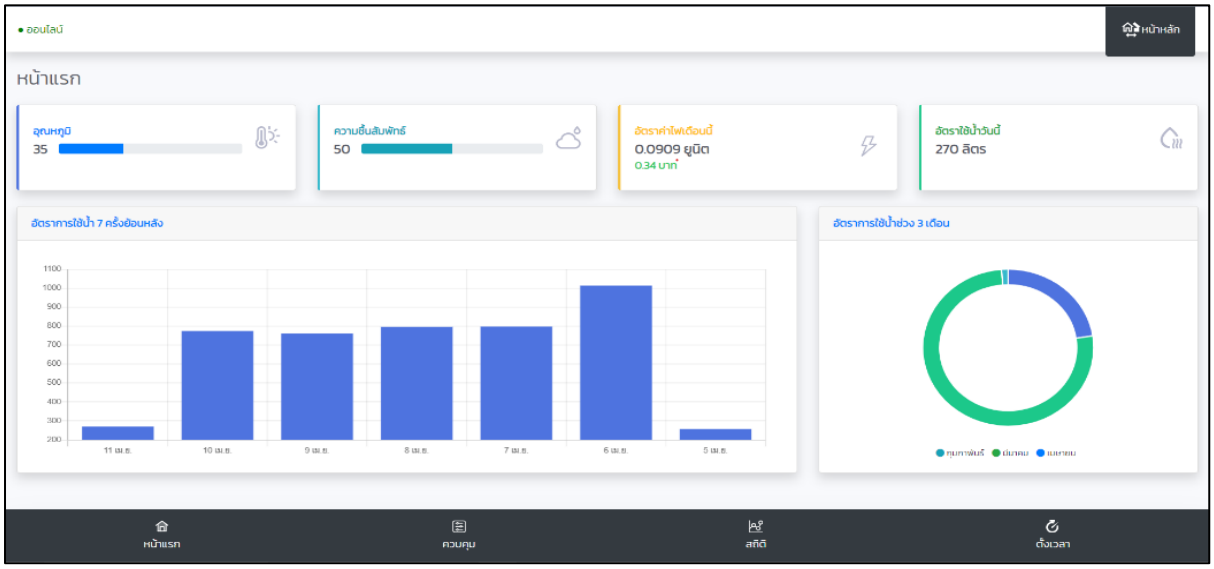

Figure 17: Home page.

Figure 17 illustrates the home page of the Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things, which can display real-time temperature, humidity, electricity usage rate, and water usage rate for the current day. It also presents graphical representations and pie charts of the water usage rate over a three-month period.

2) Control Panel of the Automatic Adapted Drip Irrigation System for Tomato Plat. Using Internet of Things Thing.

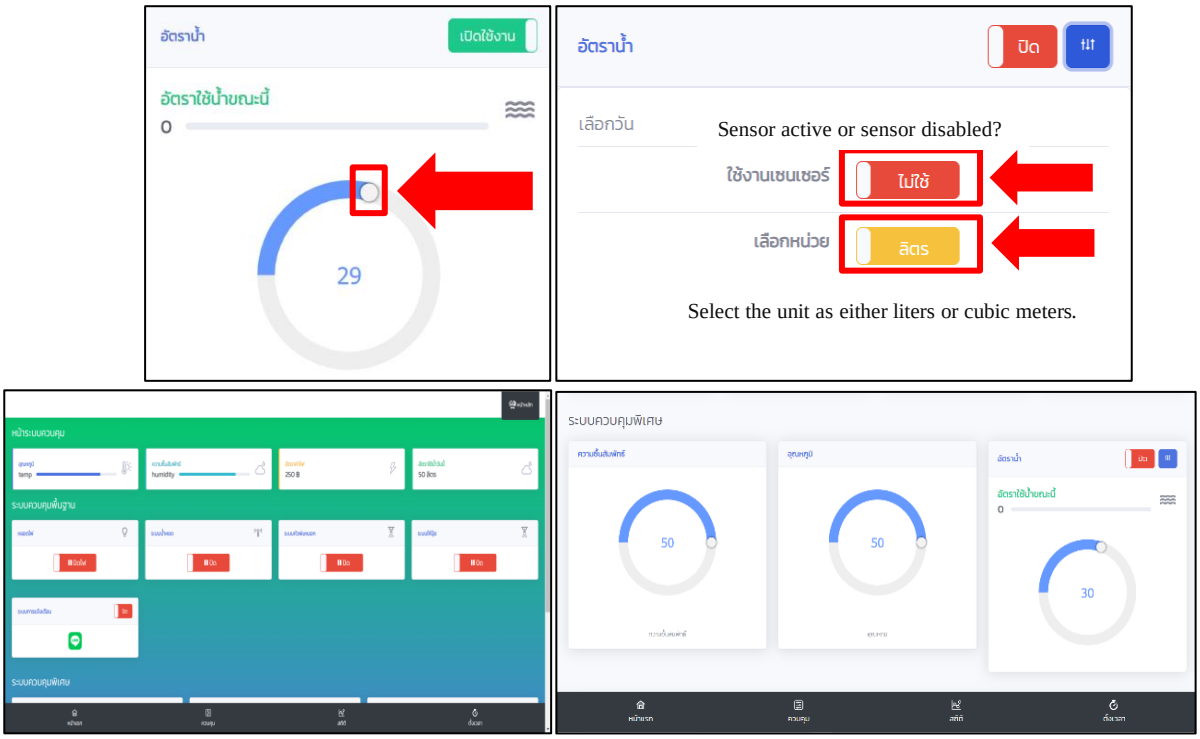

Figure 18: Control Panel

Figure 18 this is the control panel page of the Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things. Users can view various data such as temperature, humidity, electricity cost for the current month, and water usage rate for today. Additionally, users can control basic operations such as turning light bulbs on/off, controlling drip irrigation systems, misting systems, and receiving line notifications in cases where the water system is activated but no water flow is detected. Moreover, there's a special control system for managing humidity and temperature, allowing users to adjust settings according to their preferences. Importantly, users can control water flow rates by setting the desired volume in liters or cubic meters, and the system will stop operation when the set volume is reached.

3) Data Statistics Page

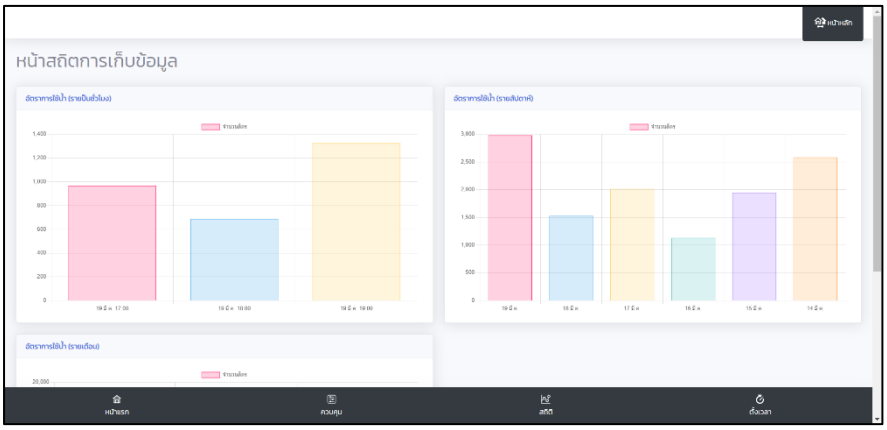

Figure 19: Data Statistics Page

Figure 19 depicts the data statistics page of the Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things, which showcases statistics of water usage rates on an hourly, weekly, and monthly basis. The data is presented in bar graph format, with the unit of measurement being liters.

4) System Scheduling

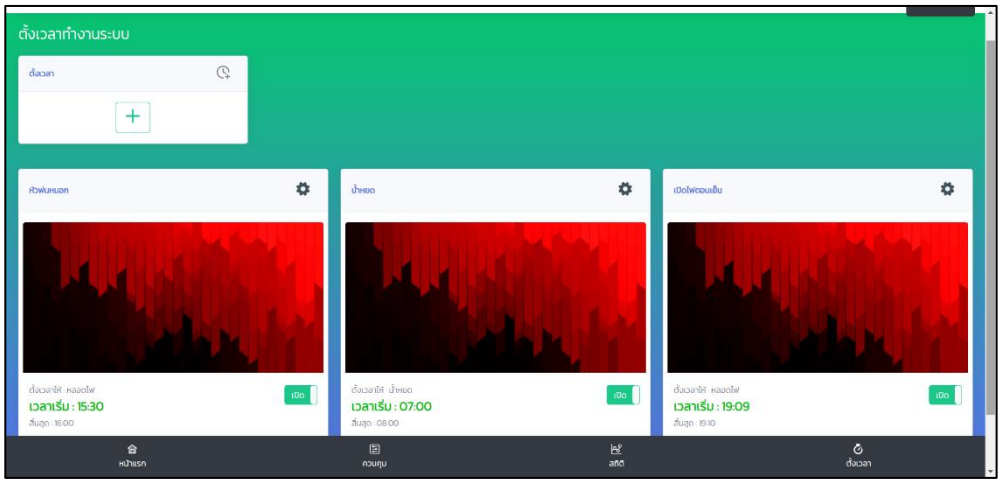

Figure 20: System Scheduling.

Figure 20 this is the system scheduling page of the Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things, where users can schedule multiple system operations. Users can add more than one schedule entry, specifying a title, start time, end time, and selecting the days for scheduling. The system allows users to choose both desired and undesired days for scheduling. Users can also assign devices for activation and set their status. After configuring the system, users can edit the settings. Editing options include modifying the title, start time, end time, selected days, device activation time, and status adjustment.

1.2 Results of the development of the control device box for the automatic drip irrigation system for tomato farms using the Internet of Things.

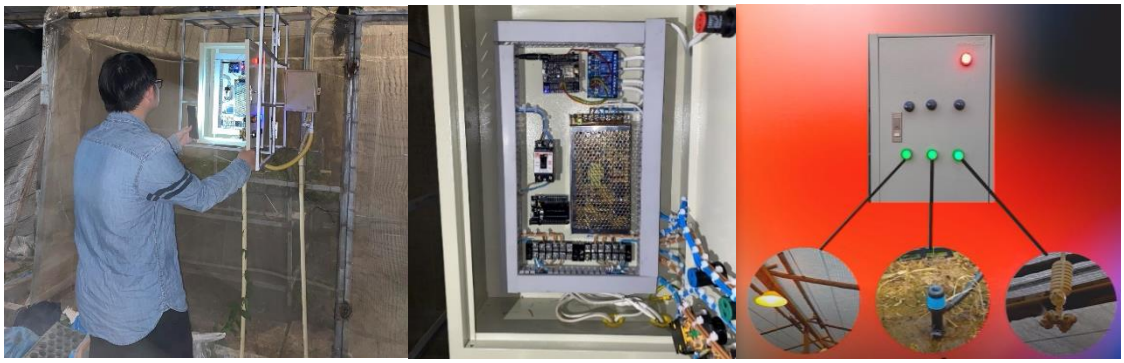

Figure 21: Results from the Development an Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things.

Figure 21 shows the development of the Automatic Drip Irrigation System Using Internet of Things, resulting in a control box that plays a pivotal role in managing the system's operations. The control box comprises essential components, including an ESP8266 board for sensor control (measuring humidity and temperature), a solenoid valve for regulating water flow, a Water Flow Sensor module for monitoring the rate of water flow, and a Relay acting as a switch to control various electrical devices.

2. Evaluation results of Smart Irrigation Systems using Internet of Things

After five experts conducted tests on the Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things, the system's performance was evaluated across four dimensions, as shown in the following table.

Table 1: The results of the functional evaluation meet the needs of the user.

Evaluation list	Performance and Quality		
	$\bar{x}$	S.D.	Results
1. The system excels in its ability to control various aspects of plant cultivation, efficiently managing the operation of light tubes, drip irrigation, and a misting system in a responsive manner.	4.80	0.45	Very good
2. The system effectively employs rate limiting functionality, showcasing its ability to optimize and control water usage efficiently	4.60	0.55	Very Good
3. Line notification when water is not flowing	4.60	0.55	Very Good
4. Reporting of temperature, humidity, electricity consumption, and water consumption	4.80	0.45	Very Good
5. Fast and efficient control	4.80	0.45	Very Good
Overall Average	**4.72**	**0.49**	**Very good**

From Table 1 , the evaluation results indicate that the system's performance in meeting user requirements has an overall average rating of 4.72 with a standard deviation of 0.49 This shows that the developed system is very effective in meeting user needs.

Table 2: The results of the evaluation findings correspond with the features of the system.

Evaluation list	Performance and Quality		
	$\bar{x}$	S.D.	results
1. Accuracy of Data Storage	4.80	0.45	Very Good
2. Accuracy of Data Presentation	4.60	0.55	Very Good
3. Accuracy of Alerts	4.80	0.45	Very Good
Overall Average	**4.73**	**0.48**	**Very Good**

From Table 2 , the evaluation results indicate that the system's performance in fulfilling its designated functions has an overall average rating of 4.73 with a standard deviation of 0.48. This demonstrates that the developed system is very effective in performing its assigned tasks.

Table 3: The results of the evaluation on user-friendliness.

Evaluation list	Performance and Quality		
	$\bar{x}$	S.D.	Results
1. Appropriate Use of Text Colors	4.80	0.45	Very Good
2. Appropriate Use of Background Colors	4.80	0.45	Very Good
3. Effective Use of Descriptive Language on Screen	4.80	0.45	Very Good
4. Text Clarity on the Screen	4.60	0.89	Very Good
5. Overall System Layout Appropriateness	4.60	0.55	Very Good
6. User-Friendly System Development	4.80	0.45	Very Good
Overall Average	4.73	0.54	**Very Good**

From Table 3, the evaluation results indicate that the system's ease of use has an overall average rating of 4.73 with a standard deviation of 0.54. This shows that the developed system is very effective in terms of usability.

Table 4: The results of security aspects assessment of the electrical system.

Evaluation list	Performance and Quality		
	$\bar{x}$	S.D.	results
1. System Access Security	4.60	0.55	Very Good
2. Data Security within the System	4.80	0.45	Very Good
Overall Average	**4.70**	**0.50**	**Very Good**

From Table 4, the evaluation results indicate that the system's data security has an overall average rating of 4.70 with a standard deviation of 0.50. This shows that the developed system is very effective in terms of data security.

Table 5: Overall Evaluation of the Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things

Evaluation list	Performance and Quality		
	$\bar{x}$	S.D.	Results
1. The results of the functional evaluation meet the needs of the user	4.72	0.49	Very Good
2. The results of the evaluation findings correspond with the features of the system	4.73	0.48	Very Good
3. The results of the evaluation on user-friendliness	4.73	0.54	Very Good
4. The results of security aspects assessment of the electrical system	4.67	0.50	Very Good
Overall Average	**4.71**	**0.50**	**Very Good**

From Table 5, the evaluation results show that the overall average rating of the system is 4.71 with a standard deviation of 0.50, indicating that the developed system has a very high level of overall effectiveness.

3. Comparison of the Performance of an Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things with Commercially Available Irrigation Control Systems

The comparison results show that the Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things has more functions than commercially available irrigation control systems, as follows: 1) A notification system via LINE alerts the user when there is no water flow in the system. 2) A system that automatically shuts down the water pump if there is no water flow. 3) The system allows setting the daily water application rate. 4) The system displays electricity costs. 5) The system can report daily water usage and water usage during the cultivation cycle for the following benefits: 5.1) To provide information on adequate daily water supply for the plants. 5.2) To provide data on water usage during the harvest cycle. 5.3) To support water management in the cultivation area.

4. The results of the training for demonstrating and transferring knowledge on the development of an Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things to a group of farmers.

Table 6: The results of the training for demonstrating and transferring knowledge from the developed system to farmers

Evaluation list	Performance and Quality		
	$\bar{x}$	S.D.	results
1. The relevance of the training topic	4.86	0.35	Very Good
2. The knowledge and ability of the trainer (knowledge transfer appearance/presentation style)	4.60	0.49	Very Good
3. The appropriateness of the content relative to the duration of the training	4.44	0.50	Good
4. The knowledge gained can be practically applied	4.76	0.43	Very Good
5. To what extent is the venue suitable for conducting the activity	4.43	0.50	Good
Overall Average	**4.61**	**0.45**	**Very Good**

From Table 6, the results of the training for demonstrating and knowledge transfer on the development of an Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things showed that overall satisfaction with the training was at a very high level, with an average rating of 4.61 and a standard deviation of 0.45 When considering individual aspects: The relevance of the training topic had an overall average rating of 4.86 with a standard deviation of 0.35, indicating a very high level, The applicability of the knowledge gained had an overall average rating of 4.76 with a standard deviation of 0.43, indicating a very high level, The knowledge and ability of the trainer had an overall average rating of 4.60 with a standard deviation of 0.49, indicating a very high level, The appropriateness of the content relative to the duration of the training had an overall average rating of 4.44 with a standard deviation of 0.50, indicating a high level, The suitability of the venue for conducting the activity had an overall average rating of 4.43 with a standard deviation of 0.50, indicating a very high level.

Discussion

The development of the Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things was carried out according to the five-step SDLC Model, which includes: 1) Problem study and system planning, 2) Analysis, 3) System design, 4) System development and testing, and 5) System evaluation. The performance of the automatic drip irrigation system was evaluated by experts, and the results showed that the system's overall performance is at the highest level. This is because the system can control the moisture in the cultivation area according to the settings in the web application. The system can store control data on a cloud database, which is an unstructured database, allowing for rapid control of

electrical devices. It also stores cultivation data in the cloud database at various times, and when the scheduled time arrives, the data is transferred to a relational database on a daily basis. The data stored in the relational database includes temperature, humidity, electricity usage rate, and daily water usage up to the harvest cycle. This information will later be analyzed and processed into information to be used in agricultural science and shared with farmers. Additionally, the system controls errors in case of no water flow through the developed web application, alerts users via LINE, and shuts down the water pump. This aligns with the research of Choeichom (2019) and Rungruangnattakul (2019), which studied guidelines for developing smart farming models and found that adopting a smart farming management model reduces labor and costs in the long term. It also aligns with the research of Fongnern et al. (2018) and Saetang et al. (2017), which focused on designing and developing temperature and humidity control systems suitable for mushroom growth. These studies identified issues with inconsistent mushroom yields due to temperature and humidity conditions, and that consistent mushroom production can be achieved with controlled temperature and humidity in the cultivation greenhouse.

Conclusion

1.The research on the Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things can be summarized as follows:

The development of the irrigation control system using an Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things, controlled by a NodeMCU ESP8266 microcontroller, which manages sensors to detect temperature, humidity, water flow rate, and water usage, as well as reports environmental data of the greenhouse and controls errors in case of no water flow through a developed web application, shows that the overall system efficiency is at the highest level

2. The comparison of the performance of the Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things with commercially available irrigation control systems found that the developed system offers more functionality as follows: 1) A notification system via LINE alerts users when there is no water flow in the system. 2) A system that automatically shuts down the water pump if there is no water flow. 3) The system allows setting the daily water application rate. 4) The system displays electricity costs. 5) The system can report daily water usage and water usage during the cultivation cycle for the following benefits: 5.1) To provide information on adequate daily water supply for the plants. 5.2) To provide data on water usage during the cultivation cycle. 5.3) To support water management in the cultivation area.

3. The results of the training demonstration and knowledge transfer on the development of an Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things show that the farmers' overall satisfaction with the training across all aspects is at a very high level.

Suggestion

The Automatic Adapted Drip Irrigation System for Tomato Plat Using Internet of Things cannot yet be used in cultivation areas without electrical access. If further development occurs, the system could be enhanced to include environmental control that works with solar power in conjunction with electricity. This would make the system suitable for cultivation areas based on their specific context

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Innovative Leadership that Influences Becoming an Innovative Learning Organization Private Universities in Bangkok

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Abstract

The objectives of this research article are 1. To study the components of innovative leadership among executives. University, private university, Bangkok area. 2. To study the elements of innovative leadership of executives that influence being an innovative learning organization. University, private university, Bangkok area. 3. To study the academic leadership of administrators that affects being an innovative learning organization in universities, and private universities in Bangkok. It is quantitative research. Executives and academic personnel University affiliation, private university, Bangkok area 4 places, 113 people, open the Craigsy and Morgan tables by simple random sampling with proportions using the lottery method. The tool used to collect data was a 3-part questionnaire with a 5-level scale. The statistics used were percentage values. average Standard deviation and find the Pearson correlation coefficient. The results of the research found that 1. Innovative leadership influences being an innovative learning organization. University, private university, Bangkok area Opinions of administrators and academic personnel Overall, it is at the highest level. 2. Being an organization of innovation and learning for the university, a private university in Bangkok According to the opinions of administrators and academic personnel Overall it is at a high level. 3. Innovative leadership that influences being an innovative learning organization Universities, private universities in Bangkok, according to the opinions of administrators Overall, there is a high level of relationship between them. Statistically significant at the .01 level.

Keywords: Innovative Leadership, Influence, Innovative Learning Organization, University, Private University in Bangkok

Introduction

Innovative leaders give importance to innovation and recognize the importance of innovation. Putting new knowledge and innovation to good use It is a drive for innovation that arises out of necessity for an organization to survive and is a key engine for organizational growth by doing things differently from what is available. Including expansion through continuous improvement and development. The form of innovation may be different. It may be innovation in the form of products, services, or processes. Especially changing concepts, ways of thinking, and operational strategies in various areas, Arunmek.K. (2022) Related to information technology and creativity to create innovation within the organization. If we consider the meaning, we will find that innovation means something new (new service, new production process, new Management New organization, and new labor skills) Baojanraya.N. , Bunchuay.P, Saikham.S, Worapongpat.N. (2023) and new working conditions arising from the use of knowledge and creativity that are beneficial to the economy and society. Organizations therefore need to exist with innovation both as a result of operations and as a result of processes, such as the process of solving problems that arise in the organization or the interaction process that arises from relationships between the organization and other key players through the network. A network of cooperation or a learning process that includes both internal and external knowledge of the organization. Boonphet Kaew.N , Chuchartpuang Somjit , Chulalak Sorapan . (2023) Therefore, knowledge and learning occurring throughout the organization will cause creative thinking and continuous innovation development. If any organization can create and develop innovations before or better, it will surely make that organization move towards excellence as well. Every organization therefore finds a way to continually develop its innovation so that it does not become inferior to competitive advantage by directly setting up an innovation department to select innovation creation methods appropriate to the type of organization. Nirundorn,ThansayaThassopon and Worapongpat.N., (2022) Including the development of innovative leaders. For clarity in analyzing the components of innovative leadership (Innovative Leadership) for administrators of vocational education institutions, the study issues have been defined as components of innovative leadership in terms of roles, behaviors, and innovative leadership characteristics that must be consistent Chongwen., G., Worapongpat., N. (2020) and Dongling, Z., & Worapongpat, N. (2023)

Learning organization for agencies Therefore, every agency or organization must provide support for personnel. Or workers in the organization have sources to study and find new knowledge. However, the leader should be the spark. or trying to make the organization a true learning organization Min, Y., & Worapongpat, N. (2023) Because a learning organization is like a source of knowledge that workers can use as a source for researching knowledge that is nearby at all times Ning, L, Worapongpat, N ,Wongkumchai, T, Zidi, X, Jiewei, W, Mingyu, Z. (2023). Especially organizations that are educational units. There must be a source of up-to-date knowledge available to teachers. Or the teacher can research and find new knowledge all the time. which is in line with the National Education Development Plan 2017-2031 That has determined the essentials for achieving the goals of educational development in five areas: accessibility (accessibility), equality (Equity), quality (Quality), efficiency (Efficiency) and responding to changing contexts (Relevance) over the next 15 years. Rungrachana.V , Worapongpat., N., (2023) and TianShu, M., Worapongpat., N. (2022).

From the reasons mentioned above, educational institution administrators should have leadership characteristics and academic innovation that can promote educational institutions

to become learning organizations (Learning Organization: LO). Somboon.T. (2022) and Pramathikul.A , Worapongpat., N., (2023) to change or develop the organization to be an organization of innovation and learning effectively. Agencies must have leaders who have characteristics that facilitate knowledge creation. or innovations that are valuable and beneficial to the organization, Worapongpat, N, Suriya Wachi Ruang Phaisan , Phakamat.P. , Jira Nan Yai Lamyong. (2022) In addition, administrators with leadership and academic innovation will be able to give advice and motivate teachers. Coordinate and allow teachers and personnel in educational institutions to work together using quality techniques. As a result, the academic administration of educational institutions is more efficient and effective (Seyfarth, JT (1999).

Therefore, it can be seen that the leadership and academic followers of administrators Being an innovative organization, learning is extremely important. in developing the quality of teaching and learning The researcher therefore is Interested in studying leadership and Academic innovation of administrators that affect an organization of innovation and learning Private universities in Bangkok Educational areas 1) Bangkok Thonburi University 2) Sripatum University 3) Shinawatra University 4) Mahanakhon University To know what factors in academic leadership affect being an innovative learning organization for use as a guideline for developing educational institution administrators to have academic leadership which will be Benefits to the development of educational institutions to be effective organizations of innovation and learning.

Objective

1. To study the components of innovative leadership among executives. University, private university, Bangkok area.

2. To study the elements of innovative leadership of executives that influence being an innovative learning organization. University, private university, Bangkok area.

3. To study the academic leadership of administrators that affects being an innovative learning organization in universities, and private universities in Bangkok.

Literature Review

The Researcher Has Taken The Elements Of Innovative Leadership Of Institutional Administrators According To The Concept Of Worapongpat, N., Wongkumchai, T., Saikham. S.,Boonchuay.,P., Chotiwongso, Bhasabutr,P., (2023) In 11 Areas, Including Innovative Leadership 1) Personality And Leadership Skills 2) Leading A Team 3) Being A Good Role Model 4) Being A Thought Leader 5) Promoting Development 6) Leadership Communication 7) Creating A Learning Atmosphere, 8) Change Management, 9) Support And Competency Development, 10) Participatory Management, And 11) Professional Leadership. And Being A Learning Organization According To The Concept (Senge, 2006) In 5 Aspects: Being A Well-Rounded Individual Having A Thought Plan Creating A Shared Vision Learning Together As A Team, And Systematic Thinking

Jianzh.,X, Worapongpat., N. (2020) and Worapongpat., N. (2023) and Worapongpat., N., Phakamat.P. Darunee Panja Rattanakorn. (2020) Innovative Leadership Characteristics Are Personality, Competency, And Roles And Responsibilities. And Social Characteristics It Is A Main Characteristic Of Administrators Of Educational Institutions In The Reform Era.

They Must Have Knowledge And Ability In The Field Of Educational Administration. Has A Vision For Educational Administration To Be Up-To-Date With Changes, Has Innovative Leadership, And Has Human Relations That Are Accepted By Those Involved. And Is Democratic To Lead To Learning Reform So That All Educators Have Knowledge, Abilities, Personalities, And Qualifications According To The True Educational Curriculum, Which Will Allow Administrators To Link This Knowledge To Develop The Institute And Develop Students To Be Well-Versed In Quality Practice.

Worapongpat., N. Phakamach., P., Choothong., R., Tuachob.,S. (2020) and Worapongpat., N. (2023) An Organization Of Innovative Learning Means An Organization That Develops Itself. And Others All The Time Continuously Expand The Scope Of One's Abilities At The Individual Level And The Level Of Friends' Organizations Leading To The Goals Of People At Various Levels Facilitate And Create An Atmosphere Conducive To Learning Be Alert And Develop Your Potential Continuously There Is An Analytical Thinking Process. Connect The Relationships Of People In The Organization To Create A Common Spirit. Use Knowledge As A Tool Always Check For Improvements To Lead To Success. And Apply Modern Technology It Is An Organization With New Ideas. Be Accepted And Cared For. Knowledge Is Shared And Transferred As A Network. It Is An Organization That Receives Continuous Learning And Learns Together As A Whole Organization. A Sustainable Development Path And Filled With A Good Conscience Of Personnel Throughout The Organization, Which Is Consistent With Senge Senge, P. (2006) Who Defined A Learning Organization As An Organization In Which People In The Organization Expand Their Abilities Continuously. Continuously At The Individual Level And Organizational Level To Lead To The Goals Of People At Various Levels Truly Want It Is An Organization With New Ideas. And All Branches Of Thought Are Accepted It Is An Organization Where People Continually Learn How To Learn Together As A Whole.

Research Conceptual Framework

This Research is Quantitative Research Using 11 Concepts As Independent Variables. And Being A Learning Organization According to The Concept (Senge, 2006) In 5 Areas As Dependent Variables As A Conceptual Framework For Research The Details Are As Follows:

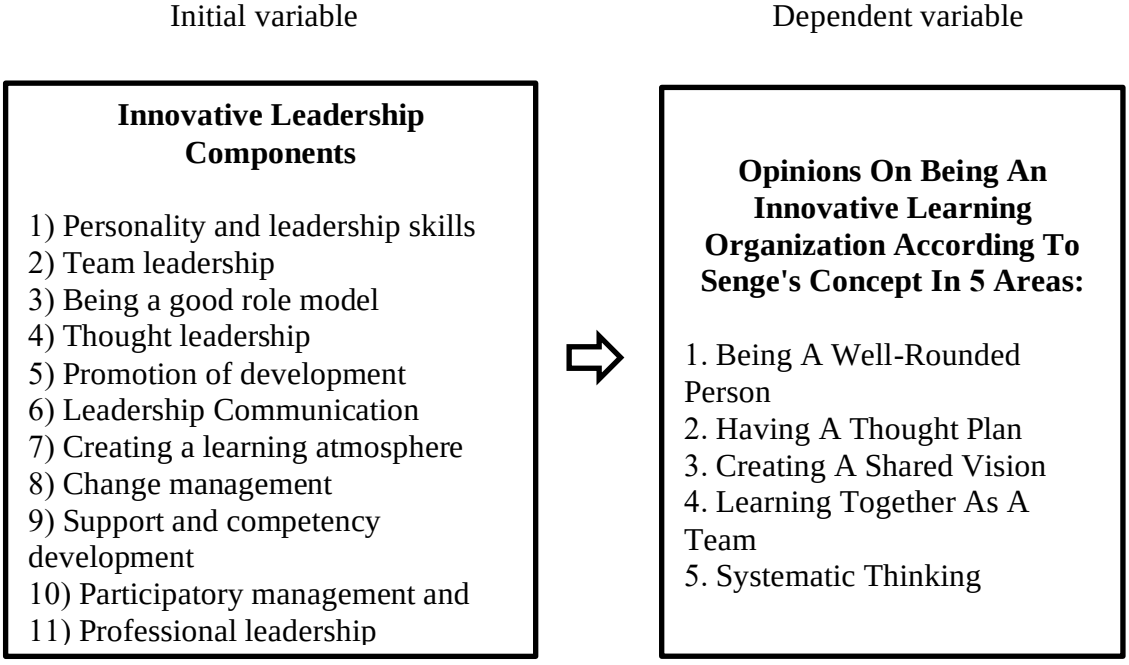


Figure 1: Shows the Conceptual Framework for The Research.

Research Methodology

This research is quantitative (Quantitative Research) with research methods as follows.

1. Population and sample groups in the research include:

1.1 Population includes administrators and academic personnel affiliated with Rajabhat University in Bangkok, Educational Area Education 1) Bangkok Thonburi University 2) Sripatum University 3) Shinawatra University 4) Mahanakorn University, 162 people

1.2 The sample group includes administrators and academic personnel. Affiliated with Rajabhat University in Bangkok Area Educational Area Education 1) Bangkok Thonburi University 2) Sripatum University 3) Shinawatra University 4) Mahanakorn University, 113 people, using the selection method by determining the sample size according to Krejcie and Morgan's table Krejcie, R. V. & Morgan, D. W. (1970) then using simple random sampling with proportions. (Proportional Simple Random Sampling) by drawing lots.

2. Research tools include

Part 1: General status of the respondents. It is like a survey. General status of respondents It has a multiple choice format (Checklist) classified by gender, age, and educational level. and work experience

Part 2: Opinion questionnaire about Components of executives' innovative leadership that influence an innovative learning organization. Private universities in Bangkok Educational areas 1) Bangkok Thonburi University 2) Sripatum University 3) Shinawatra University 4) Mahanakorn University It has the characteristics of a rating scale (Rating Scale) of 5 levels: the most, the most, the moderate, the least, and the least.

Part 3: Questionnaire for opinions regarding being an innovative learning organization of private universities in Bangkok. Educational areas 1) Bangkok Thonburi University 2) Sripatum University 3) Shinawatra University 4) Mahanakorn University is characterized by a rating scale (Rating Scale) with 5 levels: most, very, moderate, little, and least, including 1) Bring the questionnaire to meet with a consultant and proceed with improvements according to the recommendations. 2) The revised questionnaire was presented to 3 experts to check the consistency of the content by estimating the consistency of the objectives with the questions (Index of Item–Objective Congruence: IOC) (Luan Saiyot and Angkana Saiyot, 2000) found that the IOC value was between 0.80–1.00 and 3) testing the tool with a non-sample population of 30 sets, with the evaluation results having discriminatory power between 0.25–0.75 and finding the confidence value of the questionnaire using the method of Cronbach, L. J. (1974). which the confidence evaluation results had a confidence value of 0.95.

3. Data collection includes collecting data from, which is information obtained from collecting information from various documents such as books, textbooks, academic documents, research and related electronic media, etc.

4. Data analysis includes quantitative data analysis. Taking the data obtained from the distribution of questionnaires and analyzing them using a statistical program to analyze with basic statistics, namely percentage , mean, standard deviation , and find reference statistics by finding Pearson's product-moment correlation coefficient.

5. Statistics used in the research include ready-made quantitative statistics programs to analyze with basic statistics, namely percentage, mean , standard deviation, and find reference statistics by finding coefficients. Pearson's product-moment correlation coefficient.

Research Finding

Objective 1 The results of the research found that the innovative leadership elements of executives have an influence on being an innovative learning organization in private universities in Bangkok. Educational areas 1) Bangkok Thonburi University 2) Sripatum University 3) Shinawatra University 4) Mahanakorn University According to the opinions of the executives Overall, it is at the highest level. When considering each aspect It was found that school administrators had the highest level of academic leadership in every aspect.

Table 1: Shows The Mean and Standard Deviation Of Executives' Innovative Leadership Components. Private Universities in Bangkok Educational Areas 1) Bangkok Thonburi University 2) Sripatum University 3) Shinawatra University 4) Mahanakorn University.

(n= 113)

Innovative Leadership Components	Comment		
	Average ($\bar{x}$)	Standard Deviation (SD)	Level
1. Personality And Leadership Skills	4. 6 1	0.78	High
2. Team Leadership	4. 6 7	0.75	High
3. Being A Good Role Model	4.67	0.78	High
4. Thought Leadership	4.65	0.78	High
5. Promotion Of Development	4.62	0.80	High
6. Leadership Communication	4.72	0.75	High
7. Creating A Learning Atmosphere	4.73	0.71	High
8. Change Management	4.66	0.71	High
9. Support And Competency Development	4.63	0.73	High
10. Participatory Management	4.67	0.76	High
11. Professional Leadership	4.64	0.74	High
Together	**4. 67**	**0.78**	**High**

From Table 1 , it is found that the innovative leadership components of executives Private universities in Bangkok Educational areas 1) Bangkok Thonburi University 2) Sripatum University 3) Shinawatra University 4) Mahanakorn University overall is at the highest level ($\bar{x}$ = 4. 6 7 , SD= 0. 78) when considering each aspect. It was found that school administrators have innovative leadership among administrators. At the highest level in every aspect, arranged in order of average from highest to lowest, is leadership communication. ($\bar{x}$ = 4. 7 3 , SD= 0. 7 1) and for the aspect with the least mean value is personality and leadership skills. ($\bar{x}$ = 4. 6 1 , SD= 0. 7 8) respectively

Objective 2 The results of the research found that being an innovative learning organization of private universities in Bangkok Educational areas 1) Bangkok Thonburi University 2) Sripatum University 3) Shinawatra University 4) Mahanakorn University According to the opinions of the executives Overall it is at a high level. When considering each aspect, it was found that it was at the highest and greatest level in every aspect.

Table 2: shows the average standard deviation Organization of learning innovations of private universities in Bangkok Educational areas 1) Bangkok Thonburi University 2) Sripatum University 3) Shinawatra University 4) Mahanakorn University Overall and each aspect.

(n= 113)

Being an Organization of Innovation and Learning	Comment		
	Average ($\overline{x}$)	Standard Deviation (SD)	Level
1. Being a well-rounded person	4.54	0.68	High
2. Having a model of thought	4.55	0.67	High
3. Having a shared vision	4.49	0.55	Lowest
4. Team learning	4.37	0.66	Lowest
5. Systematic thinking	4.48	0.46	Lowest
Together	**4.49**	**0.60**	**Lowest**

From Table 2, it is found that being an innovative learning organization of private universities in Bangkok Educational areas 1) Bangkok Thonburi University 2) Sripatum University 3) Shinawatra University 4) Mahanakorn University overall is at a high level ($\overline{x}$ = 4. 4 9, SD = 0. 6 0) when considering each aspect. It was found that being an innovative learning organization of Rajabhat University in Bangkok is at the highest and greatest level in every aspect, arranged in order of average values from highest to lowest, including having a prototype of ideas ($\overline{x}$ = 4. 5 5, SD = 0. 6 7), followed by being a well-rounded person ($\overline{x}$ = 4. 5 4, SD = 0. 6 8). and team learning had the lowest mean ($\overline{x}$ = 4. 3 7, SD = 0. 6 6), respectively.

Objective 3 The results of the research found that the innovative leadership elements of executives influence an innovative and learning organization. Private universities in Bangkok Educational areas 1) Bangkok Thonburi University 2) Sripatum University 3) Shinawatra University 4) Mahanakorn University According to the opinions of administrators and teachers Overall, there is a high level of relationship between them.

Table 3: Shows The Relationship Between The Innovative Leadership Components of Administrators That Influence An Innovative Learning Organization In Private Universities In Bangkok. Educational Areas 1) Bangkok Thonburi University 2) Sripatum University 3) Shinawatra University 4) Mahanakorn University.

(n= 113)

Innovative Leadership Components	Being An Organization of Innovation and Learning					
	Being a well-rounded person	Having a role model	Vision shared vision	Team learning	Systematic thinking	Together
1. Personality and leadership skills	.690**	.752**	.776**	.716**	.712**	.784**
2. Team leadership	.663**	.797**	.781**	.770**	.749**	.834**
3. Being a good role model	.670**	.734**	.765**	.713**	.691**	.782**
4. Thought leadership	.682**	.716**	.735**	.713**	.691**	.782**
5. Promotion of development	.787**	.798**	.848**	.854**	.789**	.877**
6. Leadership Communication	.682**	.716**	.735**	.713**	.681**	.782**
7. Creating a learning atmosphere	.717**	.713**	.748**	.693**	.674**	.776**
8. Change management	.663**	.711**	.699**	.687**	.671**	.686**
9. Support and competency development	.671**	.698**	.684**	.678**	.672**	.690**
Together	**.845****	**.853****	**.858****	**.821****	**.795****	**.873****

Table 3, the relationship between Components of innovative leadership of executives that influence an organization of innovation and learning. Private universities in Bangkok Educational areas 1) Bangkok Thonburi University 2) Sripatum University 3) Shinawatra University 4) Mahanakorn University Summary of the overall relationship between leadership and followers in the field of innovation and academics of administrators. that influences becoming a learning organization in private universities in Bangkok Educational areas 1) Bangkok Thonburi University 2) Sripatum University 3) Shinawatra University 4) Mahanakorn University have a relationship Overall, there is a high level of relationship ($\overline{x}$ = 0.873). The pairs with a high level of relationship are The aspect of creating a learning atmosphere ($\overline{x}$ = 0.8 5 8), followed by the aspect of measurement, evaluation, and research with shared vision ($\overline{x}$ = 0.8 4 8), and the aspect of team learning. ($\overline{x}$ = 0.8 5 4) and the pair with the lowest relationship is Thought leadership ($\overline{x}$ = 0.6 7 0) respectively.

Discussion/Conclusion

Results from research objective 1 found that innovative leadership influences becoming an innovative learning organization. Private universities in Bangkok Educational areas 1) Bangkok Thonburi University 2) Sripatum University 3) Shinawatra University 4) Mahanakorn University According to the opinions of administrators and teachers Overall, it is at the highest level. This is because school administrators and academic departments have given importance to educational reform according to the educational reform framework, namely teacher reform, and learning reform. Increase - spread opportunities and quality thoroughly Reduce inequality Produce and develop manpower to increase competitive potential Adjust the system for using ICT and IOT, organize training Meeting with educational institution administrators to gain knowledge and understanding of educational institution management. Makes it possible for educational institution administrators to use it to manage educational institutions. Educational institution administrators must therefore constantly develop themselves. To develop one's academic leadership to be well-rounded. As a result, educational institution administrators can develop academic planning work. Developing and using the curriculum, motivating, supporting, and promoting teachers in organizing teaching and learning activities. Supporting student evaluations as a coordinator Control academic work, develop working conditions for teachers, and create a good working atmosphere within educational institutions. This is consistent with the research of Maneeploypairin Pitchapo , Worapongpat., N. (2024) Study on the development of the form of Learning organization of educational institutions under the Trang Primary Educational Service Area Office 1 Found that there are 5 elements of being a learning organization of an educational institution. Under the Trang Primary Educational Service Area Office, Area 1, sorted according to the needs index as follows: Knowledge Sharing, Innovative Thinking, Opinion Leader, and Generalist. unity (Unity) was developed into the KIOGU Learning Organization Model, a learning organization model for educational institutions. Under the jurisdiction of the Trang Primary Educational Service Area Office, Area 1, which is appropriate There is a possibility consistent Every element is useful. and educational results which are consistent with Phakamat.P. (2023) and Phunahha.R , Worapongpat.N. (2023) and Worapongpat., N., Yaowalak Jirayu , Supaphit Tirayananamwong. (2023) The results found that The characteristics of a transformational leader include personal characteristics. Developing work to strive for excellence Personnel development and adapting to the new normal and consists of 8 elements. For guidelines for developing transformational leadership to create innovative organizations in the education of nursing college administrators in Thailand, there are 8 main elements. Development methods can be done in 5 ways: (1) self-learning and development, (2) online learning, (3) using case studies, (4) learning through AI, and (5) training. Workshop The appropriate development process using PIERI includes (1) planning, (2) implementation, (3) evaluation, (4) reflection, and (5) improvement by setting policies and annual plans for Developing executives to have higher performance The results of the research can be used to develop the transformational leadership of administrators for producing quality nursing graduates.

Results from research objective 2 found that being an innovative learning organization of private universities in Bangkok Educational areas 1) Bangkok Thonburi University 2) Sripatum University 3) Shinawatra University 4) Mahanakorn University According to the opinions of administrators and academic personnel Overall it is at a high level. This is because educational institution administrators have developed educational institutions into learning organizations. To create maximum work efficiency for organizations, especially educational

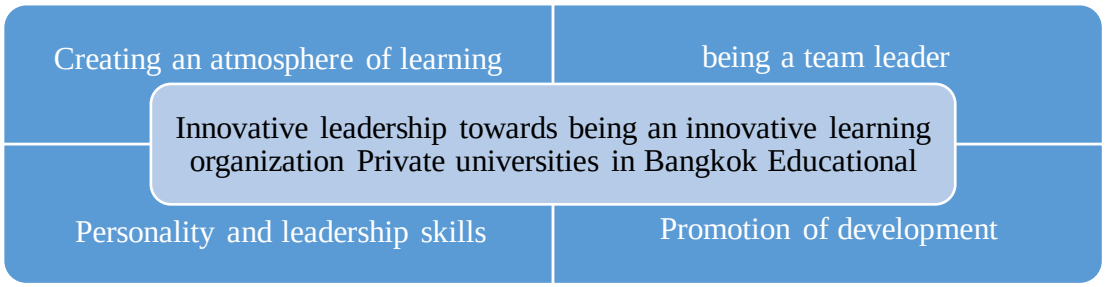
institutions, which cannot avoid rapid changes in competitive technology around the world. Modifying new regulations political fluctuations Economy and society as well as the trend toward becoming a society in the age of services and information. Driving power like this makes organizations in all affected countries linked together in a chain. Until having to enter the competitive field, which results in having to change into an organization that is agile, adaptable, and ready to learn. and full of creativity which is in line with (Kriti Ya Srisangsom, Kanporn Iampaya, Niwatt Noimanee, 2023) and Xunan, L., & Worapongpat, N. (2023) and Zi Yun, H, & Worapongpat, N. (2023) study of factors affecting an organization Learning at educational institutions under the Chonburi Primary Educational Service Area Office 2 It was found that 1) leadership factors Organizational culture A supportive atmosphere, motivation, and organizational structure. Overall, the average is at a high level. 2) The learning organization of the educational institution. Under the jurisdiction of the Chonburi Primary Educational Service Area Office, Area 2, in terms of thinking patterns. The aspect of self-knowledge Learning together as a team Systematic thinking and creating a shared vision Overall, the average is at a high level. 3) The relationship between factors in leadership, motivation, and organizational structure. Organizational culture The atmosphere that promotes and supports the learning organization of the educational institution. under the Office of Chonburi Primary Educational Service Area 2 has a positive relationship at the highest level, and 4) factors in the atmosphere that promote and support Organizational culture factors Motivational factors, and organizational structure factors Affecting the learning organization of the basic educational institutions under the Chonburi Primary Educational Service Area Office, Area 2. They were able to jointly predict the learning organization at 84.60 percent. and education, which is consistent with Worapongpat., N., Benjamat Muensai. (2023). And Worapongpat., N, Barnee Sopha. (2023) Research results found that Components of developing vocational education institutions in the eastern region of Thailand into organizations of educational innovation in the digital age have 8 important elements: 1) setting a vision and strategy that will lead to an organization of educational innovation; 2) determining the structure An organization of appropriate educational innovation. 3) Creating an organizational culture that supports educational innovation in all dimensions. 4) Forms, processes, and practices that facilitate the creation of educational innovation. 5) An innovative leadership team that is committed to becoming an organization. of effective educational innovations 6) Ecological atmosphere and teams in creating educational innovations. 7) Promoting personnel to think creatively and develop quality educational innovations. 8) Inspiring learning and training professional skills of learners for a diverse society. and 9) Developing students' professional skills in line with the Eastern Economic Corridor Development Project in the digital age of Thailand. The results of the research can be applied to develop and build vocational education institutions into organizations of effective digital educational innovation to further develop the nation's vocational education towards sustainability.

Results from research objective 3 found that the academic leadership of administrators affects the organization of innovative learning in private universities in Bangkok. Educational areas 1) Bangkok Thonburi University 2) Sripatum University 3) Shinawatra University 4) Mahanakorn University Overall, there is a high level of relationship between them. This is because school administrators can use strategies. Have leadership and management By applying knowledge and various skills to promote and support Including creating an atmosphere of learning. This is in line with Worapongpat., N., Rawiporn Yuwaree , Jariya Rujongsaw Jang Bovorn . (2023) and Worapongpat., N., Thiwaporn Waranya , Teerawat Sarawut, Phrakru Paladbunchuay Chotivam So , Sunthorn Saikham. (2023) study of academic leadership of educational institution administrators that affects being an organization. Learning

at educational institutions under the Samut Sakhon Primary Educational Service Area Office It was found that most of the respondents had the opinion that number 1 is having a thought plan, number 2 is being a well-rounded person, number 3 is creating a shared vision, and number 4 is learning together. as a team and lastly, thinking systematically in order The relationship between academic leadership and being a learning organization in educational institutions. Under the Samut Sakhon Primary Educational Service Area Office, it was found that the a correlation between academic leadership and being a learning organization in educational institutions. Under the jurisdiction of the Samut Sakhon Primary Educational Service Area Office Analysis of the results of academic leadership of school administrators that affect being a learning organization. It can be concluded that the evaluation of student learning outcomes and planning for progressive development Affecting the educational institution's learning organization to develop learning for Learners have achieved the goals that have been set with quality. Executives organize a systematic and efficient collaborative learning process to keep up with changing conditions. Administrators encourage personnel in educational institutions to develop themselves. and jointly set the vision and guidelines for action so that the shared vision moves in the same direction. Allow teachers to express their opinions. There is a consultation. work together to solve problems It causes learning in teams and thinking systematically. Therefore, the academic leadership of educational institution administrators and the learning organization of educational institutions. Therefore, it is a guideline for developing a higher-quality education. which is consistent with Worapongpat., N., Natthanaree Jutha Wan , Channakarn Se Ta Wuttisuwanan. (2023) and Worapongpat., N., Supachai Phosri.(2024) The research results found that Innovative leadership of administrators of vocational education institutions has 11 components, including 1) leadership personality and skills, 2) team leadership, 3) being a good role model, 4) being a thought leader, 5) promoting development, 6) Leadership communication, 7) creating a learning atmosphere, 8) change management, 9) support and competency development, 10) participatory management, and 11) professional leadership.

New Knowledge From Research

From The Study, Innovative Leadership Influences Becoming An Innovative Learning Organization. Private Universities In Bangkok Educational Areas 1) Bangkok Thonburi University 2) Sripatum University 3) Shinawatra University 4) Mahanakorn University.



Innovative leadership that influences the organization of learning innovation for good administrators and academic personnel requires educational institution administrators to have the ability to use strategies. Have leadership Encourage personnel in educational institutions to develop themselves. and jointly set the vision Practice guidelines to keep the vision moving in the same direction By applying various knowledge and skills to promote and support and create an atmosphere of learning. To develop learning for students to achieve the goals that have been set with quality. Administrators organize a systematic and efficient collaborative learning process in response to changing conditions, giving teachers opportunities to express their opinions. There is a consultation. Working together to solve problems results in team learning and systematic thinking. Therefore, the academic leadership of Executives and academic personnel Educational institutions and being learning organizations of educational institutions Therefore, it is a guideline for developing higher quality of education.

Summary of Research Results

Summary of the overall article Innovative leadership that influences becoming an innovative learning organization Private universities in Bangkok Educational areas 1) Bangkok Thonburi University 2) Sripatum University 3) Shinawatra University 4) Mahanakorn University Overall, it is at a high and highest level. and their relationship with each other was at a high level.

Suggestion

1. Suggestions for applying research results

1.1 Results from research objective 1 found that the innovative leadership components of executives Private universities in Bangkok Educational areas 1) Bangkok Thonburi University 2) Sripatum University 3) Shinawatra University 4) Mahanakorn University Overall, it was at the highest level in every aspect. When considering each aspect, it was found that personality and leadership skills had lower averages than other areas. Therefore, educational institution administrators should arrange for the development of personality and leadership skills aimed at promoting and stimulating work in the areas of teaching media innovation or design innovation , innovation in content and innovation in teaching methods, jointly creating local curricula with the community.

1.2 Results from research objective 2 found that the elements of innovative leadership of executives have an influence on being an innovative learning organization in private universities in Bangkok. Educational areas 1) Bangkok Thonburi University 2) Sripatum University 3) Shinawatra University 4) Mahanakorn University Overall, it is at the highest and highest level in every aspect. When considering each aspect, it was found that the learning aspect was teamwork. It is less average than other areas. Therefore, educational institution administrators The thought process should be encouraged. Team learning Organizing group activities exchange of knowledge Leave a comment and listen to each other together to solve problems and make decisions in accordance with organizational change This will result in a learning organization occurring when personnel have a mental model. Have unity learn from each other and aiming to do it for the common good

1.3 Results from research objective 3 found that academic leadership of administrators affects being an innovative learning organization in private universities in Bangkok. Educational areas 1) Bangkok Thonburi University 2) Sripatum University 3) Shinawatra

University 4) Mahanakorn University Overall, there is a high level of relationship between them. When considering each pair, it was found that the aspects of developing learning media and being a knowledgeable person were at the lowest level. Administrators should develop and build learning potential in using various types of learning media, promoting and supporting training. Learning how to create and use media in 21st century education will result in the educational institution being developed into a more complete educational institution learning organization.

2. Suggestions for next research

This research has found that the academic leadership of administrators affects the organization of innovative learning in private universities in Bangkok. Educational areas 1) Bangkok Thonburi University 2) Sripatum University 3) Shinawatra University 4) Mahanakorn University Educational institutions must have the ability to use strategies. Have leadership Encourage personnel in educational institutions to develop themselves. and jointly set the vision Practice guidelines to keep the vision moving in the same direction By applying various knowledge and skills to promote and support Including creating an atmosphere of learning. In order to develop learning for students to achieve the goals that have been set with quality, for the next research issue, research should be done on the issue of academic leadership of administrators and academic personnel. that influences being a learning organization in basic educational institutions under other educational areas In order to use the information obtained to further develop education in that area, there should be studies to analyze other elements. To the factors affecting the academic leadership of administrators and academic personnel. Educational institutions and learning organizations of educational institutions.

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The Impact of Work Environment and Participatory Management on Performance Through The Motivation of Affiliated Personnel Office of The Permanent Secretary, Ministry of Education and The Area Responsible for Operation Regional Education Office No 14

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Abstract

The purpose of this study is to 1. Study the impact of work environment participatory management and incentive measures on the performance of affiliated personnel Office of the Permanent Secretary, Ministry of Education and the area responsible for operation Regional Education Office No 14. 2. Study the impact of work environment and participatory management on performance of affiliated personnel Office of the Permanent Secretary, Ministry of Education and the area responsible for operation Regional Education Office No 14 Through motivation. 3. Study the impact of work environment and participatory management on motivation in the work of affiliated personnel Office of the Permanent Secretary, Ministry of Education and the area responsible for operation Regional Education Office No 14.

For example affiliated personnel Office of the Permanent Secretary, Ministry of Education and the area responsible for operation Regional Education Office No 14 400 government officials permanent employees and temporary employees used the proportional sampling method.

1.The tools used include the survey results show that participatory management and work motivation have a direct impact on performance and work environment. 2. The work environment and participatory management indirectly affect performance. 3. The work environment and participatory management affect work motivation.

Keywords: Work Environment, Participatory Management, Work Motivation, Performance

Introduction

The Office of the Permanent Secretary, Ministry of Education has the right and obligation to carry out general government affairs of the Ministry of Education and carry out supervision work that must comply with the provisions of the Administrative Regulations and Law of the Ministry of Education. B. E. 2003 or other legal provisions related to the National Education Law and implementing other actions stipulated in the Ministerial Regulations on the Division of Government Institutions. Office of the Permanent Secretary, Ministry of Education Therefore it is an institution with various tasks including government policy work that must be promoted to achieve results as soon as possible including work that must be integrated into the overall budget of the Ministry of Education. Government action plans and accelerated monitoring and evaluation of the department's performance to achieve goals. In all aspects.

Office of the Permanent Secretary, Ministry of Education In 2007 the government performance evaluation framework effectively reflected the performance of the Ministry of Education and the Office of the Permanent Secretary, Ministry of Education. According to the Presidential Decree No. 19/2017 of the National Peace and Order Commission on Regional Education Reform issued by the Ministry of Education on April 3, 2017 The goal is to address issues in national education management in the region including organizational structure and management systems. Ministry of education.

Human resources are crucial to the work of every organization serving as a crucial mechanism for achieving task success and advancing on an equal footing with other organizations. The overall focus of this organization is operational efficiency. The operational efficiency within an organization depends on many factors. But the most important factor is that the organization must have effective personnel.

The work environment is crucial for employees to achieve organizational goals including the physical environment. This is a characteristic or thing that makes employees feel safe and confident in their work. The workplace is proportional and organized. If the work environment is not appropriate it can pose dangers and risks to the work. This will affect the health of workers. The social environment promotes clear and standardized communication. There are clear communication forms and guidelines and good interpersonal relationships. And the psychological environment is the recognition support promotion assistance and freedom of thought of abilities to effectively achieve work results.

Participatory management is a popular form of management between management and employees today providing opportunities for all employees to participate in important decisions. In order to achieve the potential goals or issues that management may encounter and based on the concept of Swansburg (1996) participatory management elements were proposed. 4 elements: 1) Trust 2) Commitment 3) Goals and objectives 4) Autonomy is an important factor in supporting and promoting the effective operation of schools. Management must create incentives which is the process by which supervisors encourage subordinates to cooperate. And willing to work towards achieving common goals which aligns with Frederick Herzberg's ideas there are two important factors. 1) Motivational factors: Motivational factors are

work-related factors

According to the official performance certificate of the Regional Education Office No 14

in the 2019 fiscal year the overall performance of the government is better than the target value. Budget In 2020 the overall performance of the Regional Education Office No 14 far exceeded the target. In the fiscal year 2021 the evaluation criteria were changed from government performance certificates to indicator evaluations. The evaluation results of the Regional Education Office No 14 are only primary standards while the provincial education office in the region is responsible for the regional education office. Around 2019 the overall government performance was at an average level for Regional Education Office No 14 and around 2020 the average level was the highest. In the fiscal year 2021-2022 the evaluation criteria were changed based on the performance certificates of the regional and provincial education offices responsible by the regional education offices. Overall the government's performance has reached high standards but many institutions responsible for the Regional Education Office No 14 still have many improvement suggestions. For example.

According to the official performance certificate of the Regional Education Office No 14 in the 2019 fiscal year the overall performance of the government is better than the target value. In the fiscal year 2020 the overall performance of the Regional Education Office No 14 far exceeded the target. Later in the fiscal year 2021. According to government performance certification the evaluation criteria have been changed to indicator evaluation. The evaluation Regional Education Office No 14 are only preliminary standards. The provincial education office in the region is responsible for the regional education office for a period of 14 years approximately 2019 overall the government's performance is at a very high average level. Around 2020 the overall standard for average level was the highest but later in the 2021-2022 fiscal year the evaluation criteria changed and the indicators were evaluated based on performance certificates from the provincial education department responsible for the region. Overall the government's performance has reached high standards but many institutions Regional Education Office No 14 still have many improvement suggestions. For example.

Due to these issues researchers are interested in studying the work environment participatory management and incentives that affect the performance of personnel in the Office of the Permanent Secretary, Ministry of Education. Regional Education Office No 14 Participate in management and motivation to enhance work potential. In addition the unit also uses it as a decision-making tool for formulating management policies. Be able to find ways to prevent and solve problems within the organization and retain high-quality personnel. Stay in the organization as long as possible and work happily and efficiently for the organization.

Objective

1. Study the impact of work environment participatory management and incentive measures on the performance of affiliated personnel Office of the Permanent Secretary, Ministry of Education and the area responsible for operation Regional Education Office No 14.

2. Study the impact of work environment and participatory management on performance of affiliated personnel Office of the Permanent Secretary, Ministry of Education and the area responsible for operation Regional Education Office No 14 Through motivation.

3. Study the impact of work environment and participatory management on motivation.

in the work of affiliated personnel Office of the Permanent Secretary, Ministry of Education and the area responsible for operation Regional Education Office No 14.

Literature Review

Performance concept

Performance definition

Siraon (2023) It is said that performance refers to the skills strategies or techniques that are performed to achieve a high level of work. Maximum benefit to the organization using energy costs And it doesn't take long.

Pantaengthai (2021) He said that work or create high-quality work use resources suitable for the job work accurately timely and orderly and standardize.

Kanchanakulpaisarn（2017）He said that performance refers to a person's ability to fully utilize their skills by using technology or experience to create work. The standards for work quality and workload. Work must be completed on time or to minimize work time and costs.

Through the review and research of relevant studies it can be concluded that performance refers to the use of strategies or techniques to wholeheartedly carry out work.

Create satisfactory high-quality work without wasting costs energy consumption and time.

Performance elements

Thepho and Luangalongkot (2020) The key elements of the most effective work are work quality workload and operational time. And operating costs.

Thongnoi (2019) The four elements of performance measurement include work quality workload time and operating costs.

Peterson and Plowman (1989) Performance elements include quality quantity time and cost.

By reviewing and studying relevant research it can be concluded that performance factors include quality quantity time and operating costs. This is the key to leading an organization to achieve operational success.

Concept of Work Environment

Definition of Work Environment

Aunsri（2021） Said that the work environment refers to the various circumstances surrounding employees. that promotes or facilitates the performance of duties and responsibilities Causes efficiency in work.

Suwannarat（2 021）Said that work environment refers to the workplace that the organization should give importance to. Because there must be an environment that is suitable for working. In order to have a positive impact on personnel within the workplace both physically and mentally.

Mahanukulwongchai（2020）Said that work environment refers to the design and arrangement of work spaces air quality temperature noise lighting materials and equipment within the office. Location and access Including the atmosphere and green space around the building.

Through a review and research of relevant studies it can be concluded that the work environment means both living and non living things around us. Tangible and intangible.The physical chemical biological and organic environments affect performance and contribute to creating a better culture within the organization.

Work environment elements

Piamnuan and Pimchangthong (2020) The work environment is an important factor that enables individuals to work effectively on the basis of satisfaction. It is directly related to the environment. It consists of physical environment0 social environment colleague relationships and cultural environment all of which are human made environments.

Promsorn (2015) The work environment includes physical aspects such as sound light temperature and work equipment. Social aspects include. The employee relationship within the organization within sub departments and between departments is good and employees perform well towards others both physically and mentally. Psychological aspect. This is a factor that affects one's thinking work freedom and

Work related decisions including obtaining work feedback enable employees to use the information they receive to improve their work.

Moos (1994: 13) The work environment can be divided into three aspects: interaction progress maintenance and change. On an interactive level it means strengthening relationships and building trust. Mutual support and support. Reduce trouble and create a good working environment. Three aspects participation in work establishing connections willingness to work for the organization and interpersonal relationships. Enable employees to share opinions and decisions with the support of their supervisors. Provide support when problems arise at work. Dimensions of work progress. This means that the internal environment of the workplace has an impact. The dimension of work progress can be divided into three aspects. work freedom. The focus of work work pressure maintenance dimensions and job changes imply a clear understanding of organizational structure and a perception of job changes. Or location.

From reviewing and studying related research. It can be concluded that Components of the work environment include the physical environment. social environment psychological environment To increase performance encourage creativity create Relaxation at work creates a good culture within the organization.

The theory of Herzberg et al. (1959) suggests that the two factor theory is influenced by a theory that humans will have the hierarchy of needs invented by Maslow. When it was found that there was no reliable measure of satisfaction the two factor theory was created divided into two parts. The types are motivational factors and hygiene factors. 1) Motivational factors are factors directly related to work. They are the driving force behind work. Improve performance. It includes five aspects: success recognition and practice of work. Responsibility and career development 2) Supporting factors come from external factors. He is not satisfied with his job. It includes 10 things: salary means relationships

with supervisors subordinates and colleagues. Occupational status policies and management of working conditions personal life safety.

Participatory management philosophy

The meaning of participatory management

Somjai (2018) Participatory management refers to the process in which managers teachers personnel or stakeholders directly or indirectly participate in expressing their opinions. Decision making responsibility planning operation and evaluation of using creative operations to achieve goals.

Kasemrad (2016) Participatory management refers to the process of individuals participating in expressing their opinions. Use creativity and professional knowledge for decision-making responsibility operational planning and evaluation to achieve goals.

Khunsri (2014) Participatory management refers to the management that emphasizes employee participation in collusion decision-making and work. And jointly responsible for the development of work building trust in society teamwork leads to achieving goals and objectives.

From a review of related documents and research. Makes it possible to summarize the meaning of participatory management meaning management that provides opportunities for workers to cooperate make decisions and carry out activities. monitoring and joint evaluation is carried out with freedom.

The elements of participatory management

Naksawat and Sirirak (2022) The elements of participatory management include participation in decision-making participation in operations and participation in welfare. Participate in evaluations and benefit from them

Konkaew (2019) There are four elements to participation. Participate in decision-making operations benefits and evaluations.

Swansburg (1996) The elements of participatory management include. Mutual trust commitment common goals and objectives independent responsibility.

By reviewing relevant documents and research it is concluded that the elements of participating in management include participating in proposing ideas and opinions. Conduct activities monitor evaluate and make decisions on an equal basis and freely set goals and allocate work according to plans or projects. Improving Decision Quality.

The theory about intermediary variables Baron and Kenny (1986) states that intermediary variables mediators or mediating variables are variables that transmit influence from the primary variable to the dependent variable. There are 2 characteristics of transmission of variables: 1) complete transmission (Complete Mediation or Full Mediation) 2) partial transmission (Partial Mediation).

Research Conceptual Framework

From reviewing the literature studying concepts theories and related research. The researcher has established a conceptual framework for the research as shown in Figure 1 as follows.

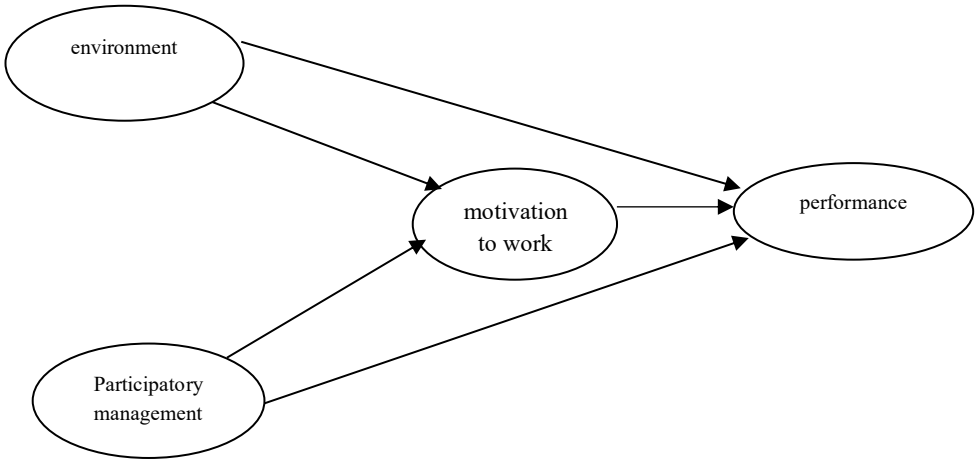

Figure 1: Research concept framework

Research Methodology

Population and sample The population used in the research is civil servants permanent employees government employees. educational personnel of private schools Under the jurisdiction of the Office of the Permanent Secretary, Ministry of Education and the area of responsibility for the operations of the Regional Education Office No 14 there are a total of 42,692 people (Regional Education Office No 14, 2023).

The sample group in this research is government officials employees and private school personnel. Under the jurisdiction of the Office of the Permanent Secretary of the Ministry of Education and the area of responsibility for the operations of the Regional Education Office No 14 which used the sample size determination method of Hair et al. (2010) the sample size was 400 people using the stratified sampling method according to proportion divided Population using area as a stratification.

The research tool is a questionnaire divided into 6 sections as follows: Section 1: General information of the respondents. Section 2: Questions about the working environment. Section 3: Questions about participatory management. Section: 4 questions about work motivation part 5 questions about work performance part 6 suggestions.

Questionnaire test The researcher experimented with distributing a trial questionnaire (Try out) to personnel under the Office of the Permanent Secretary of the Ministry of Education and the area of responsibility for the operations of the Office of Education Region No 12 totaling 50 sets in order to find the reliability of the instrument before collecting data from the sample group being studied. By analyzing the confidence of each question checking the

consistency of each question. Has reliability The overall picture has a confidence value of 0.97 for the working environment. Has a reliability value of 0.96 participatory management has a reliability value of 0.97 Work motivation has a reliability value of 0.96 Performance has a reliability value of 0.92.

Research Findings

The results of the analysis on general information include gender age education level. Monthly income job position work location area working age. It was found that a total of 400 respondents were female 57.80% were between 30 - 40 years old had a bachelor's degree and 75.5% had an income. Months from 10,001 - 20,000 baht 48.50 percent are civil servant positions 71.25 percent are personnel who are administrators teachers educational personnel in educational institutions in the area of responsibility of the Education Office Region No 14, 99.50 percent are in the area of Ubon Ratchathani province. 44.25 each with a working life of 5 - 10 years 43.50 percent**.**

Table 1: Correlation coefficients to check the discriminant validity between variables.

variable	WE	PM	MTW	EFFIC
work environment	1			
Participatory management	0.66**	1		
motivation to work	0.69**	**0.76****	1	
performance	**0.53****	0.64**	0.76**	1

** Statistical significance level at 0.01 level

From Table 1 it is found that every independent variable namely work environment (WE) and participatory management (PM) has an effect on performance (EFFIC) through employee motivation to work (MTW). The values are statistically significantly related. Statistically at the .01 level when considering the relationship between the variables it was found that the correlation coefficient (r) was between 0.53 and 0.76 (when r≤.80) so no problems were found. Multicollinearity and all observable variables are on a common component. Therefore the obtained data are suitable for further multiple regression analysis.

Table 2: Results of direct influence analysis Indirect influence and total influence

Type Effect	Path	Estimate	SE	β	z	p
Direct	WE ⇒ EFFIC	0.03	0.05	0.03	0.73	0.46
	PM ⇒ EFFIC	0.16	0.05	0.16	3.22**	0.00
	MTW ⇒ EFFIC	0.60	0.04	0.65	12.24**	0.00
Component	WE ⇒ MTW	0.41	0.04	0.34	8.54**	0.00
	PM ⇒ MTW	0.56	0.04	0.53	13.42**	0.00
Indirect	WE ⇒ MTW ⇒ EFFIC	0.25	0.03	0.22	7.00**	0.00
	PM ⇒ MTW ⇒ EFFIC	0.34	0.03	0.35	9.04**	0.00
Total	WE ⇒ EFFIC	0.21	0.05	0.19	3.77**	0.00
	PM ⇒ EFFIC	0.51	0.04	0.51	10.30**	0.00
F= 191 Sig. = .000 R = 0.76 R^{2} = 0.59 R^{2}_{adj} = 0.58						

** Statistical significance level at system 0.01

From Table 2 it was found that the direct influence (Direct) found that participatory management (PM) and work motivation (MTW) had a direct influence on performance (EFFIC) with statistical significance. Level 0.01. The work environment (WE) does not have a direct influence on work performance. Indirect influence: It was found that the work environment (WE and participatory management (PM) have an indirect influence on work performance. through motivation to work (MTW) with statistical significance at the 0.01 level by the path of Influence of work environment (WE) and participatory management (PM) on work performance. Through the motivation to work of personnel as follows:

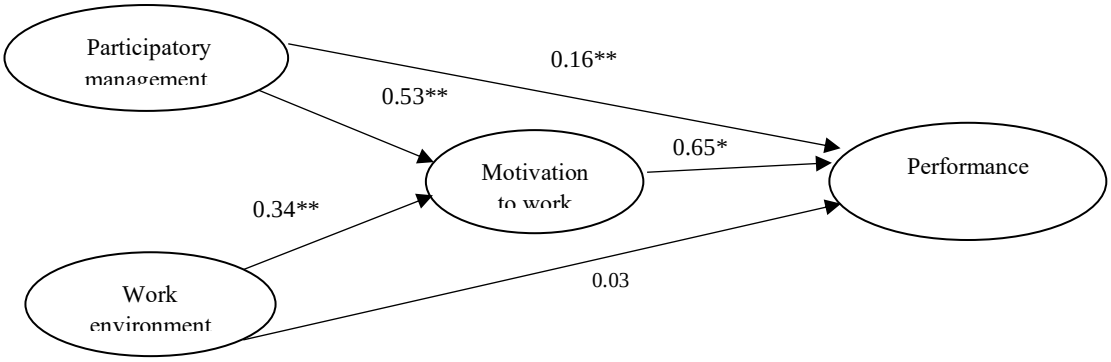

Figure 2. Path of the impact of work environment and participatory management on performance through the motivation of affiliated personnel Office of the Permanent Secretary, Ministry of Education and the area responsible for operation Regional Education Office No 14.

Discussion

From the results of the study of direct influence it was found that Participatory management (PM) and work motivation (MTW) have a direct influence on work performance (EFFIC) at the 0.01 level (accepting hypotheses H2, H3). As for work environment (WE) has no influence on work performance (EFFIC) (H1 hypothesis not met). As for the study of indirect influences it was found that work environment (WE) and participatory management (PM) have an influence on Work efficiency (EFFIC) through motivation to work (MTW) with statistical significance at the 0.01 level (accepting hypotheses H4, H5) and the study found that Work environment (WE) and participatory management (PM) have a significant effect on motivation to work (MTW) at the 0.01 level (hypotheses H6, H7 accepted).

Discussion of research results

The researcher presents a discussion about the research study. work environment and participatory management that influence performance Through the work motivation of personnel under the Office of the Permanent Secretary Ministry of Education and the areas of responsibility for the operations of the Regional Education Office No 14 as follows:

The results of the work environment analysis indicate that the work environment (WE) has no direct impact on performance (EFFIC) but also has an indirect impact on efficiency. Working through Motivation at Work (MTW) is an intermediate variable. The problem may

not be an impact on performance. Units can manage and create the physical environment of each unit as well as the problem conditions or needs of different personnel in each area. The analysis results also found that the work environment (WE) has a direct impact on employee work motivation (MTW) indicating that the work environment has a positive impact on employee work motivation and an increase in employee work motivation is a result of the increase in work environment. Promote institutional support for projects or activities that create a good and appropriate working environment. Arrange budget personnel in information, equipment appliances and facilities. that's enough. This will generate a motivation for individuals to work actively with determination and willingness to complete their tasks.
According to Julerttrakul (2021) this study investigated the factors that influence the performance motivation of Generation Y employees in Bangkok. Research has found that the relationship between supervisors and colleagues as well as work environment factors affect the performance motivation of Generation Y employees in Bangkok. Prajit and Taweepaiboonwong (2020) studied the impact of work environment and employee pursuit on employee performance. Chonburi Buakao (2018) studied the physical environment and safety management that affect employee motivation at Nongbulamp Hospital. Kingi and Kalai (2018) studied the results of teacher engagement in physics resource and material incentive education in Kenya. (Kenya)

The results of work environment analysis indicate that work environment (WE) indirectly affects performance (EFFIC) through work motivation. (MTW) is an intermediate variable that indicates that when employees are in a good and appropriate work environment it increases work motivation and affects their performance. According to Tairian and Sakulkitkarn (2023) work environment and motivation are associated with performance and happiness among private hospital employees. In Bangkok Lis et al. (2022) studied the effects of career development and work environment on motivating employees to work as intervention variables at the Agricultural and Livestock Office in Aceh. (Indonesia) Sisang et al. (2022) studied the relationship between personal characteristics environment and work motivation and employee performance. The motivation of Dewi and Sukarno (2021) from the Thai Electricity Authority is to mediate the relationship between corporate culture and work environment. The Impact of BJB Surabaya Branch (Cambodia) Erawati, Sitiari and indiani (2019) on Employee Performance The Impact of Pressure and Work Environment Mediated by Motivation on Employee Performance a restaurant Case Study.

Participatory management: The analysis results indicate that participatory management (PM) has a direct impact on performance. It indicates that management must encourage personnel to create works based on knowledge abilities and professional knowledge grant work freedom and provide supervision and coordination freedom. The management will provide assistance or advice on how to proceed at any time. According to the research of Rakpram and Phuwittayathorn (2022) the involvement management that affects officer performance was studied. Thitawan and Boonmeepit (2020: 447-558) studied the participatory management that affects the academic performance of schools under the Office of the Education Service Area of Surat Thani Prefectural Air Force No. 7. Sivilai and Techawattanasirimrong (2021) studied the involvement of school administrators in the management of the performance motivation of teachers in the office of primary education service areas in Oita Prefecture, District 3. Johari and Yahya (2016) studied the job description, engagement, and performance of government officials (Malaysia). It was also found that participatory management (PM) has a direct impact on personnel's work motivation (MTW), indicating the implementation of participatory management. Helps motivate employees. When employees have motivation, it can better impact their performance. Promote and support projects or activities, involve employees,

brainstorm existing ideas and potentials, think together, plan to obtain various opinions and comprehensive decisions, jointly monitor, evaluate and solve problems, which will help to solve problems and make decisions more carefully and effectively. According to Sivilai and Techawattatasirimrong's (2021) study, the involvement of school administrators in the management of the work motivation of teachers in the Office of Education Services in the Otsunaga Elementary School was investigated. Somjai (2018) from Zone 1 studied the relationship between participatory management and teacher motivation in Qinglai City.

Participatory management: The analysis results indicate that participatory management (PM) has an indirect impact on performance. By using motivation as an intermediate variable it indicates the implementation support relationship of participating in management. A good organization such as organizing relationships and activities creates positive organizational values that are conducive to organizational cooperation. This will help motivate work. Therefore institutions must develop policies and organize effective personnel management systems to respond to strategies. Motivation to enhance flexibility and focus on achievement. According to the research of Sivilai and Techawattanasirimrong (2021) the participation of school administrators in management affects the performance motivation of school teachers in the Office of Education Service Area of Oita Prefecture Primary School. Upwattananan and Sirisukantha (2020) studied the effects of motivation organizational participation and engagement on personnel performance in the first district. Taghipour and Dejban (2022) conducted a study at the Office of Education Services in Nanbang Province. Work motivation influenced the relationship between work participation and awareness supervisor support and performance. (Iran)

The analysis of work motivation shows that work motivation (MT) directly affects performance (EFFIC) from the most important issue. It refers to the ability of personnel to complete assigned tasks until responsible work is completed resulting in personal pride and a better social status. Colleagues help each other very well which is a more influential issue in terms of work motivation than other issues. According to Silaon (2023) research the motivation behind the performance of government officials was studied. Generation Y Buapong and Chianwattanasuk (2021) from the province of Ayutthaya studied the organizational support awareness and achievement motivation that affect the performance of researchers at the Thai Institute of Science and Technology. Thongnoi (2019) studied motivation relationships with subordinates and colleagues and working conditions that affect employee performance at the Batuntani hydraulic cylinder factory. Jufrizen and Hutasuhut (2022) studied the role of corporate citizenship behavior in mediating the effects of job motivation and job satisfaction on employee performance. Efendi et al. (2020) from Indonesia studied the impact of work motivation mediation on work discipline and employee performance compensation. Indonesian Yogyakarta wax printing small and medium-sized enterprises

Conclusion

In terms of motivation executives must create strategies that can create motivation to work because of motivation. It is an important variable in helping the organization achieve its goals. The agency must praise Promote work Create pride in work The work must have value and make personnel feel loved proud and always want to improve their work. Promote activities that allow personnel to help each other have clear management policies and create morale and encouragement to work at full efficiency.

Work environment Agencies must support facilities integrate them quickly have activities or projects that support improving the landscape around the office building to make

it shady. There is a beautiful decoration. Set a suitable temperature for working so that personnel feel comfortable working. The environment will result in There is a driving force that makes personnel enthusiastic committed and willing to work until they are successful.

Participatory management Agencies must encourage personnel to work with independence in supervision. Follow up and coordinate the performance of assigned tasks yourself. Let personnel create creative work Get full knowledge of the three The executives will be there to help. or give advice Always support work in order to create performance.

Suggestion

In terms of motivation executives must create strategies that can create motivation for work. Create pride Provide personnel who are important to the success of the organization Because of personnel who take pride in their work There will be more determination and determination to work. Create a positive attitude towards the organization Help and support among co-workers should be encouraged and cultivated. And tasks must be clearly assigned to ensure a common understanding. The work will be completed successfully. according to the organization's objectives

Work environment Executives should promote and support the creation of a good and appropriate working environment. There are adequate and adequate facilities to meet work needs. Promote the improvement of the environment both inside and outside the building. In terms of beauty shady and livable control the temperature to an appropriate level. To create satisfaction and motivation in work This will affect performance.

Participatory management Executives should encourage creativity. Give freedom to work Promote self-development Allow personnel to fully learn and develop themselves in various areas. And executives should provide assistance and advice to subordinates appropriately to the situation and needs of subordinates. So that subordinates can work efficiently and achieve the organization's goals.

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Research on The Influence of Enterprise Social Media Interactivity on Employee Task Performance

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Abstract

This paper explores the relationship between corporate social media interaction and employees' task performance. Based on the theory of media synchronization and social exchange, this paper reviews the existing literature and summarizes the existing problems. Through literature research, questionnaire survey, statistical analysis and other research methods, SPSS, AMOS and other analysis tools, through the interview and investigation of different enterprises, the phenomenon and effect of employees' use of corporate social media in work are deeply understood, and the impact of corporate social media interaction on employees' task performance is empirically analyzed. The conclusion of this study confirms that enterprise social media interaction can positively affect employee task performance, interpersonal trust has a significant mediating effect on enterprise social media interaction and employee task performance, and trust tendency can positively regulate the relationship between interpersonal trust and task performance.

Keywords : Enterprise Social Media, Interactivity, Media Synchronization Theory, Task Performance

Introduction

Under the background of the new media era, Internet technology has developed rapidly and penetrated into all aspects of people's lives. Compared with traditional media, social media has changed the mode of information transmission, and has the functions of control and interaction, opening up new prospects for information transmission. Social media features such as inclusiveness, interactivity, transparency and equality, which are not possessed by traditional media. As a result, the role and value of using social media in the workplace is becoming more and more obvious. Through the use of social media, employees can carry out convenient and rapid internal communication at work, obtain timely work feedback, promote knowledge sharing among employees, and facilitate the improvement of employees' work performance. (Leonardi et al.,2013; Ali- Hassan et al.,2015; Fox&Morel ,2015; Zoonen & Rice,2017; Moqbel & Kock,2018; Cheng Huiping, SPL, Wang Jianya,2020). Research has found that when people are unable to observe what other colleagues do, when they work, with whom they work, and how they handle tasks, interpersonal trust between colleagues decreases (Cramton et al.,2017). The introduction and use of enterprise social media breaks the limitations of

information opacity in traditional enterprises. Through corporate social media, employees can observe the communication content between other colleagues and the communication network formed, which has a positive impact on improving employees' work performance.

As mentioned above, in the context of the new media era, the use of corporate social media at work can release value and empower employees' productivity, improve employee morale, enhance interpersonal relationships among employees, and enable individuals to better enjoy their work environment; At the same time, through the use of social media, employees can obtain valuable resources such as information, knowledge and social support, which is more conducive to improving employees' task performance. Therefore, there is a complex relationship between corporate social media and task performance, and how to use corporate social media to improve work performance is an issue that enterprises should pay attention to at present. In this regard, this paper carries out relevant research on the relationship between corporate social media interaction and employee task performance.

Objective

1. Explore the relationship between enterprise social media interactivity and employee task performance. The research samples of this study are employees who use corporate social media, and further explore the role of social media on employees' task performance, so as to help enterprises understand the overall impact of corporate social media use on employees' task performance.

2. Explore the mediating role of interpersonal trust as a mediating variable between enterprise social media interactivity and employee task performance. Starting from three dimensions of enterprise social media interactivity, this study examines the impact of social media interactivity on task performance.

3. Explore the moderating effect of trust propensity on interpersonal trust and task performance. By examining the moderating effect of trust propensity, we explore whether interpersonal trust has an impact on task performance.

Literature Review

1. The impact of social media interaction on employees' task performance.

Enterprise employees can maintain consistency with enterprise goals through social media. As an important media communication tool, social media can promote the common development of employees and the organization (Zhang Xiangqian, 2018). This paper takes the findings of Liu and Shrum(2002), who define interactivity as "the degree to which two or more communicating parties can interact with each other, in communication media, in information, and the degree to which such effects are synchronized." They propose three dimensions of interaction: active control, which describes the user's ability to voluntarily participate in and influence communication; Biphasic communication, which captures the two-way flow of information; Synchronicity, which corresponds to the speed of the interaction. According to Suh & Bock(2015), corporate social media interactivity significantly affects the content (expressive or instrumental network) and structure (intra-team centrality or external team structure vulnerability) of individual social networks, thereby improving task performance. Kuegler et al. (2015) believed that enterprise social media interactivity can improve individual performance by increasing employees' acquisition of organizational knowledge. Corporate social media interactivity makes task-related communication between colleagues visible to

others (Leonardi,2015). This transparency can influence employees' perception of tasks (O 'Reilly & Caldwell,1979), such as control over tasks, task interdependence, and autonomous synchronicity, providing goal-relevant information and references on how to use these resources effectively. Thus, employee performance is affected (Ruscio & Amabile,1999). As a new technical collaboration relationship, enterprise social media has been frequently and widely used in enterprises (Kane, 2015). As a web-based platform, companies or teams use corporate social media to facilitate communication and collaboration among employees (Rr et al.,2016). Enterprise social media interaction is conducive to improving performance by promoting participation, open dialogue, co-creation and socializing among employees (Cai et al.,2018; Panahi et al., 2012). Enterprise social media interactivity enables employees to obtain important information and suggestions in a timely manner, which plays a key role in knowledge seeking (Borgatti and Cross,2003) and subsequent task performance (Sparrowe et al,2001). Employees can also seek help from others through corporate social media. By outlining specific problems or asking others to find resources or methods that can solve problems, they can quickly solve problems and improve work efficiency and task performance (Fulk and Yuan, 2013).

In summary, the following research hypotheses are proposed:
H1a: Active control has a positive impact on task performance;
H1b: Two-way communication has a positive impact on task performance;
H1c: Synchronization has a positive impact on task performance;

2.Influence of enterprise social media interactivity on interpersonal trust.

Through corporate social media, employees can deepen mutual understanding and reduce uncertainty about the actions and intentions of others, which is a prerequisite for trust (Valenzuela et al.2009). Individuals who trust each other can promote communication through corporate social media, and the use of corporate social media and mutual trust is a mutually beneficial relationship. Corporate social media builds trust and friendship among employees and enables them to actively participate in mutual communication with resources, which virtually promotes the transparency of information transmission among employees (Huang Lin, Zheng Daqing, Huang Lihua, 2019, Ou & Davison, 2011). Through the enterprise social media platform, employees can independently publish work tasks and create and control the content displayed or disseminated, obtain work-related knowledge and information anytime and anywhere, and effectively manage and interact with tasks to ensure that they can control the situation. This kind of control will make employees overconfident in their own judgment, and create a high degree of trust in the process of using social media. The more comfortable employees feel, the higher level of control they perceive and the more confidence they have in their judgment, thus promoting the desire of employees to communicate. They are more willing to believe that their company and supervisor will give them a greater platform to display their work skills, so as to promote interpersonal relations between employees to achieve the purpose of reciprocal communication, and effectively enhance interpersonal trust.

"Two-way communication" (Srinivasan et al., 2002) refers to this aspect of interaction. Through the use of corporate social media, the bridge of communication between employees and enterprises and between employees can be built, so that they can realize real-time and effective communication, which is conducive to promoting the exchange of information and knowledge sharing, so as to effectively enhance interpersonal trust. Enterprise social media allows employees to effectively manage tasks and interactions, and emphasizes employees' individual control over content creation (Mantymaki & Riemer,2016), thus improving task

performance.

Previous research has found that employees' perception of the reactions of others when using corporate social media platforms positively influences trust in the competence, benevolence and integrity of others (Ridings,Gefen, & Arinze,2002). This perceived synchronicity, as a feedback mechanism, also determines the confidence of employees in the trust belief judgments of enterprises and other employees when using corporate social media. Enterprise social media provides an interactive platform for employees, enabling them to exchange and process information in real time and quickly to achieve immediate results, so as to efficiently complete work tasks. Therefore, synchronization can better promote interpersonal trust among employees.

In summary, the following research hypotheses are proposed:
H2a: Active control has a positive effect on interpersonal trust;
H2b: Two-way communication has a positive effect on interpersonal trust;
H2c: Synchronization has a positive effect on interpersonal trust;

3. Influence of interpersonal trust on employees' task performance.

Trust is a frequently cited determinant of group performance (Golembiewski & McConkie, 1988). Trust is expected to improve interpersonal trust within a team, both in terms of effectiveness and efficiency. In general, the level of mutual trust between team members and other members is considered to be a determinant of the quality of interpersonal interactions. High levels of interpersonal trust relationships may increase awareness of the need to coordinate and help solve problems. If interpersonal trust among employees is high, they may be inclined to contact colleagues frequently, share information, and help each other. Therefore, employees are willing to establish cooperation and cooperative relationships to complete tasks (Liden et al.,2006), and task performance will be higher. Trust has a significant positive main effect on team performance (Klimoski & Karol, 1976), and one study reported a significant positive effect on job performance (Davis, Schoorman, Mayer, & Tan, 2000). Nyhan(2000) proposed that in public organizations, the practice of building trust between employees and supervisors and between employees can improve productivity and strengthen organizational commitment. Chinese scholars Yao Yanhong, Xiao Quartz and Li Wei showed in their research that interpersonal trust determines the allocation of social resources, and employees influence the interaction between organizations and individuals through social behaviors, which plays a crucial role in the effective operation of organizations, the creation of a good working environment and the overall improvement of performance. Trust can encourage creativity and critical thinking in employees, and when leaders create an environment conducive to trust, employees feel freer to express their ideas and, as a result, they perform beyond the expectations of the organization, as individuals who are willing to trust others tend to engage in better task performance, exhibit more motivation and satisfaction, and engage in less counter-productive behavior. If a person thinks that another person is reliable, then he will find it relatively easy to work towards a goal with him, and then he can easily direct all his resources to the target group, thus it is easier to improve task performance. When the trust among employees is increased, the organization can create a more harmonious and good organizational atmosphere and improve the task performance of employees.

In summary, the following research hypotheses are proposed:
H3: Interpersonal trust has a positive impact on employees' task performance;

4. The mediating role of interpersonal trust

Interpersonal trust is the trust that an individual boundary maker has in his or her individual opposite member, indicating the degree of trust of his or her peers in the organization. Several theoretical traditions have recognized the importance of interpersonal trust in economic exchange (Arrow 1974, Granovetter 1985, Macauley 1963), and that trust in inter-employee communication is beneficial and can be a source of competitive advantage (Barney & Hansen 1995). Trust can reduce the cost of negotiations, which, according to this definition, includes the time and effort required to identify effective courses of action and determine the division of costs and benefits (Milgrom & Roberts, 1992). In particular, finiteness, uncertainty, and information asymmetry can increase the cost of negotiations. There is a reciprocal relationship between trust. When employees use corporate social media at work, two-way communication and synchronicity can enable information and knowledge to be shared quickly and reduce the information asymmetry between employees. Interpersonal trust among employees can promote knowledge exchange and information communication among employees through corporate social media, thus improving task performance more effectively.

In summary, the following research hypotheses are proposed:

H4a: Interpersonal trust positively mediates the path relationship between active control and task performance;

H4b: The path relationship between interpersonal trust positively mediated two-way communication and task performance;

H4c: The path relationship between positive mediating synchronization of interpersonal trust and task performance;

5. The moderating effect of trust tendency.

Social exchange theory can be used to support the direct effect of trusting tendencies on outcomes, even when controlling for trust. Rotter(1980) proposed in his research on the structure of trust propensity that individuals with a high propensity to trust themselves would be more trustworthy. That is, "high trusters" exhibit a personality tendency to act in a cooperative, prosocial, and ethical manner across a variety of backgrounds and situations. The results suggest that high-trusters may be better at building social exchange relationships because they are more inclined to adhere to reciprocity norms (Gouldner, 1960) and more likely to commit to protecting exchange relationships in the long term. If so, these individuals should be able to build a broader social network that can bring them the information and support they need to improve their decision-making and performance (botter,1992; Wayne, Shore, & Liden, 1997). The higher the propensity to trust, the easier it is for both trusting parties to establish mutual trust (Bigley & Pearce,1998). For organizations with high trust tendency, employees tend to show self-satisfaction and positive attitude, which is conducive to achieving task performance. Rotter postulates that people with a high propensity to trust are more likely to act in a trustworthy manner. Since trust is crucial in high-quality workplace relationships (cf. Ferrin,Dirks, & Shah, 2006), the alignment of personal and organizational goals and values can promote the improvement of employee task performance under high-quality trust levels (Rezvani et al.,2016).

In summary, the following research hypotheses are proposed:

H5: Trust propensity positively moderates the path relationship between interpersonal trust and task performance;

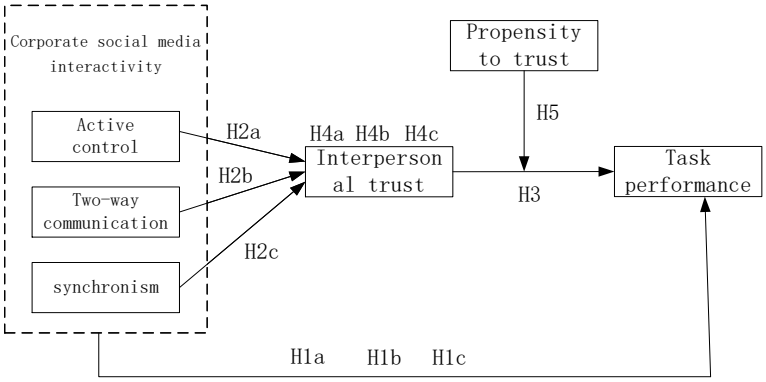

Figure 1: Theoretical model

Research Methodology

The research object of this paper is to select employees in various industries who can use corporate social media platforms in their work. The questionnaires cover more than 20 cities including Beijing, Shanghai, Shenzhen, Guangzhou, Henan, Shandong, Hebei and Shaanxi, and a total of 505 questionnaires are collected, of which 419 are valid, accounting for 82.97% of the total number of questionnaires collected. The descriptive statistics of valid questionnaires are shown in Table 1.

Table 1: Description of the statistical characteristics of the respondents.

Basic statistics	sort	Sample size	Account for	Sample size
sex	male	189	45.10%	419
	female	230	54.90%	419
age	30 and below	31	7.40%	419
	31-40	172	41.10%	419
	41-50	127	30.30%	419
	51 and above	89	21.20%	419
Working years	3 years or less	152	36.30%	419
	4 to 8 years	63	15.00%	419
	9 to 15 years	59	14.10%	419
	16 years and above	114	27.20%	419
Educational level	Junior college and below	81	19.33%	419
	Undergraduate course	220	52.50%	419
	postgraduate	108	25.78%	419
	Doctoral students and above	31	7.40%	419
The industry of the company	Industry (metallurgy, petrochemical, manufacturing)	10	2.40%	419
	Finance (Insurance, securities, investment)	48	11.50%	419

	Service industry (hotel, catering, entertainment, tourism, intermediary)	27	6.40%	419
	Commerce (Clothing, consumer goods wholesale, retail)	24	5.70%	419
	education	13	3.10%	419
	other	135	32.20%	419
Enterprise scale	Less than 100 people	172	41.10%	419
	101-300 people	95	22.70%	419
	301-500people	37	8.80%	419
	501-1000people	54	12.90%	419
	1001-3000people	58	13.80%	419
	More than 3001 people	175	41.80%	419
Time spent on corporate social media platforms at work	Use for 3 hours or more per day	282	67.30%	419
	Use for 1-3 hours a day	56	13.40%	419
	Use for 1 hour or less per day	81	19.30%	419

Reliability analysis

In this study, the main factors were measured in the form of scale, so Cronbach α coefficient was mainly used to test the reliability of the formal questionnaire. The reliability of all questionnaires (Cronbach α) was 0.943, indicating that the scale had high consistency. A total of 6 latent variables are involved in this paper, and their corresponding Cronbach's Alpha values are all greater than 0.7, indicating that the internal consistency of all variables in this questionnaire is good, and the obtained survey data has excellent reliability. The standardized factor loads of the measurement indicators in the model ranged from 0.682 to 0.825, all of which were greater than 0.40, indicating that the subject corresponding to each potential variable had high representativeness. At the same time, the mean variance extraction value AVE of each potential variable is greater than 0.5, and the combined reliability value CR is greater than 0.7, indicating that the aggregate validity of the scale is relatively ideal. See Table 2.

Table 2: Reliability and aggregation validity analysis of each scale.

Latent variable	Observed variable	Factor load coefficient	Cronbachs Alphacoefficient	Square extraction variance	Comprehensive reliability coefficient
Active control	AC1	0.803	0.942	0.562	0.836
	AC2	0.772	0.941		
	AC3	0.718	0.941		
	AC4	0.701	0.942		
Two-way communication	TC1	0.783	0.942	0.585	0.849
	TC2	0.78	0.941		
	TC3	0.763	0.941		
	TC4	0.733	0.941		
synchronism	SC1	0.807	0.942	0.601	0.818
	SC2	0.731	0.942		
	SC3	0.785	0.941		
Interpersonal trust	IT1	0.795	0.942	0.558	0.834
	IT2	0.766	0.941		
	IT3	0.712	0.942		
	IT4	0.712	0.941		
Propensity to trust	PT1	0.825	0.941	0.572	0.842
	PT2	0.722	0.941		
	PT3	0.742	0.941		
	PT4	0.731	0.941		
Task performance	JP1	0.805	0.941	0.554	0.861
	JP2	0.682	0.941		
	JP3	0.746	0.941		
	JP4	0.742	0.941		
	JP5	0.74	0.941		

Validity analysis

KMO and Bartley sphericity test

In this paper, six variables including active control, two-way communication, synchronicity, interpersonal trust, trust tendency and task performance were involved. KMO and Bartlett sphericity tests were conducted respectively, and the KMO value was equal to 0.945, which reached a very suitable level. The approximate chi-square distribution of Bartlett sphericity test was 6119.670, the degree of freedom was 378, and the significance probability value $p=0.000<0.05$ reached the significant level, indicating that the scale had common factors and was suitable for factor analysis. The results are shown in Table 3:

Table 3: KMO and Bartlett tests for all measurement items.

KMO sample appropriateness measure		**0.945**
Bartlett sphericity test	**Approximate chi-square**	6119.670
	Degree of freedom	378
	significance	0.000

Main effect analysis

In this paper, AMOS structural equation model is used to test the main effect. After controlling variables such as gender, age, working years, educational level, industry, enterprise size, and time spent on corporate social media at work, the main effect model is shown in Figure 4.1, and the path analysis of the model is shown in Table 4.

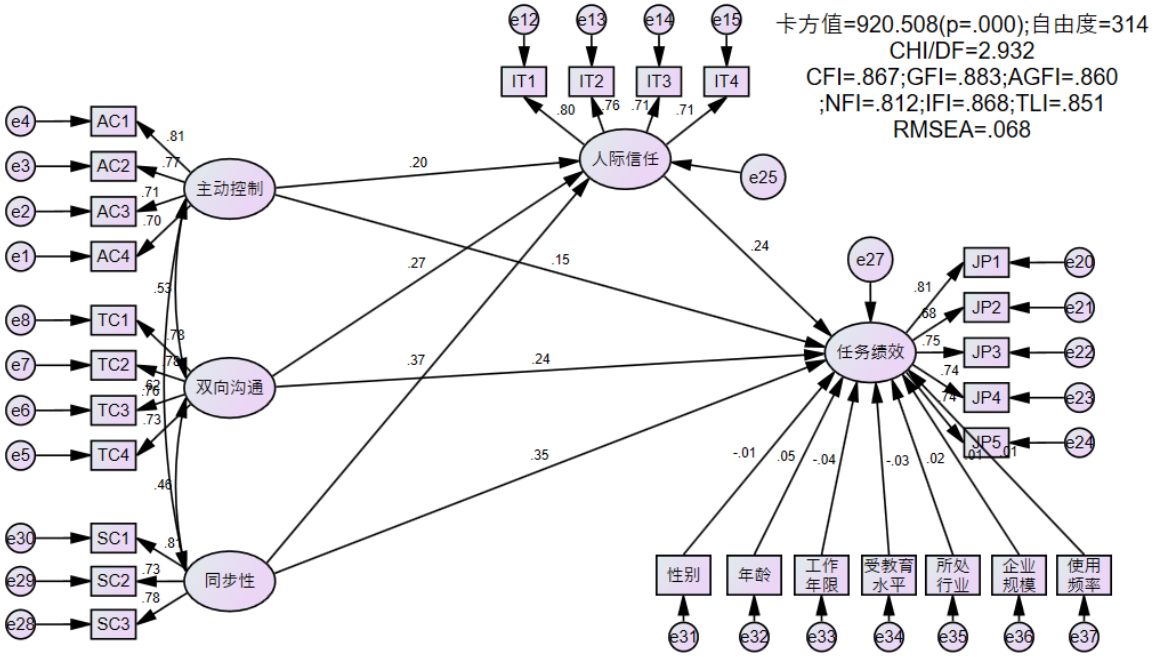

Figure 1: Structural equation model

Table 4: Test results of the total effect of the model

Path	Standard path coefficient	Non-standard path coefficient	S.E.	C.R.	*P*
Active control → Task performance	0.201	0.270	0.085	3.187	0.001
Two-way communication → Task performance	0.305	0.374	0.066	5.627	***
Synchronization → Task performance	0.442	0.476	0.068	6.983	***
Active Control → Interpersonal trust	0.204	0.289	0.101	2.862	0.004
Two-way communication → Interpersonal trust	0.274	0.351	0.077	4.546	***
Synchronization → Interpersonal trust	0.370	0.415	0.078	5.329	***
Interpersonal Trust → Task performance	0.213	0.204	0.059	3.447	***
Sex → Task performance	-0.007	-0.013	0.071	-0.185	0.853
Age → Task performance	0.056	0.063	0.039	1.589	0.112
Working years → Task performance	-0.044	-0.032	0.025	-1.259	0.208
Education level → Task performance	-0.033	-0.045	0.048	-0.927	0.354
Industry → Task performance	0.031	0.018	0.021	0.892	0.372
Enterprise size → Task performance	0.018	0.011	0.022	0.520	0.603
Time spent on corporate social media per day → Task performance	0.004	0.006	0.044	0.126	0.900

Note: * ** Indicates a significant level of $p<0.001$

As shown in Table 4.4, age has a significant effect on task performance after controlling variables such as gender, age, working years, educational level, industry, enterprise scale, and time spent on corporate social media at work. Controlling variables such as gender, working years, educational level, industry, enterprise size, and time spent on corporate social media at work have no significant effect on task performance. The main effect path is significant. Enterprise social media interactivity can positively affect task performance, that is, the higher the degree of enterprise social media interactivity, the faster the improvement of employee task performance. In the path "active control → task performance", the standard path coefficient is 0.201, reaching the significance level ($p<0.05$), that is, active control has a positive impact on employee task performance. H1a is assumed to be valid. In the path "two-way communication → task performance", the standard path coefficient is 0.305 and reaches the significance level ($p<0.05$), that is, two-way communication has a positive impact on employee task performance. H1b is assumed to be established. In the path "synchronicity → task performance", the standard

path coefficient is: 0.442, and reaches the significance level ($p<0.05$), that is, synchronicity has a positive impact on employee task performance. Suppose H1c is established; In the path "active control → interpersonal trust", the standard path coefficient is 0.204 and reaches the significance level ($p<0.05$), that is, active control has a positive impact on interpersonal trust, assuming H2a is valid. In the path "two-way communication → interpersonal trust", the standard path coefficient is 0.274 and reaches the significance level ($p<0.05$), that is, two-way communication has a positive impact on interpersonal trust, assuming H2b is valid. In the path "synchronicity → interpersonal trust", the standard path coefficient is 0.370 and reaches the significance level ($p<0.05$), that is, synchronicity has a positive impact on interpersonal trust, assuming H2c is valid. In the path "interpersonal trust → task performance", the standard path coefficient is 0.213 and reaches the significance level ($p<0.05$), that is, interpersonal trust has a positive impact on task performance. Hypothesis H3 is established.

Analysis of intermediary effect

In the process of testing the mediation effect, Amos software is used to test the mediation effect.

Table 5: Results of the mediation effect test of interpersonal trust

Path	Parameter	Effect	Lower	Upper	*P*	VAF	Mediating effect
Active control -> Interpersonal Trust -> Task performance	Indirect effect	0.066	0.012	0.151	0.013	24.30%	Partial mediation
	Direct effect	0.206	0.007	0.396	0.041		
	Total effect	0.272	0.077	0.458	0.006		
Two-way communication -> Interpersonal Trust -> Task Performance	Indirect effect	0.081	0.03	0.158	0.001	22.00%	Partial mediation
	Direct effect	0.288	0.141	0.440	0.000		
	Total effect	0.272	0.229	0.519	0.000		
Synchronization -> Interpersonal trust -> Task performance	Indirect effect	0.083	0.036	0.151	0.001	20.70%	Partial mediation
	Direct effect	0.318	0.191	0.462	0.000		
	Total effect	0.400	0.28	0.537	0.000		

As shown in Table 5, the mediating effect of interpersonal trust on the relationship between enterprise social media interactivity and task performance was tested when gender, age, working years, educational level, industry, enterprise scale, and duration of use of corporate social media at work were controlled. In the path "active control → interpersonal trust → task performance", interpersonal trust has a direct effect value of 0.206, an indirect effect value of 0.066, and a total effect value of 0.272. The confidence interval does not contain 0, $p<0.05$, and the mediating effect is significant. Assuming that H4a is valid, interpersonal trust plays a partial mediating role in the influence of active control on task performance. In

the path "two-way communication → interpersonal trust → task performance", interpersonal trust has a direct effect value of 0.288, an indirect effect value of 0.081, and a total effect value of 0.272. The confidence interval does not contain 0, $p<0.05$, indicating a significant mediating effect. Assuming H4b is established, the mediating effect accounts for 22%. Interpersonal trust plays a partial mediating role in the influence of two-way communication on task performance. In the path "synchronicity → interpersonal trust → task performance", interpersonal trust has a direct effect value of 0.318, an indirect effect value of 0.083, and a total effect value of 0.400. The confidence interval does not contain 0, $p<0.05$, and the mediating effect is significant. Assuming H4c is established, the mediating effect accounts for 20.7%. Interpersonal trust plays a partial mediating role in the effect of synchronization on task performance.

Adjustment effect analysis

The moderating effect of trust propensity on the relationship between interpersonal trust and task performance.

Table 6: Results of adjustment effect analysis.

	Model1	**Model2**	**Model3**
Constant	1.594**	0.955**	0.720**
	(6.856)	(4.261)	(3.121)
Sex	0.024	-0.028	-0.031
	(0.318)	(-0.413)	(-0.450)
Age	-0.018	0.012	0.022
	(-0.269)	(0.195)	(0.371)
Working years	-0.014	-0.017	-0.024
	(-0.336)	(-0.451)	(-0.639)
Educational level	-0.1	-0.108*	-0.122*
	(-1.797)	(-2.120)	(-2.429)
The industry of the company	0.004	0.02	0.024
	(0.197)	(1.018)	(1.242)
Enterprise scale	0.037	0.037	0.037
	(1.489)	(1.627)	(1.673)
Corporate social media usage time	0.008	0.017	0.017
	(0.180)	(0.403)	(0.417)
Interpersonal trust	0.557**	0.368**	0.387**
	(14.933)	(9.196)	(9.710)
Propensity to trust		0.363**	0.396**
		(9.007)	(9.699)
Interpersonal trust * Propensity to trust			0.134**
			(3.527)

	Model1	**Model2**	**Model3**
Sample size	419	419	419
Adjust R^2	0.358	0.464	0.48
Adjust R^2	0.346	0.453	0.468
F value	*F* (8410)=28.602	*F* (9,409)=39.407	*F* (10,408)=37.702
	p=0.000	*p*=0.000	*p*=0.000
$\triangle R^2$	0.358	0.106	0.016
$\triangle$*Fvalue*	*F* (8,410)=28.602	*F* (1409)=81.130	*F* (11408)=12.438
	p=0.000	*p*=0.000	*p*=0.000
Dependent variable: task performance			
Note1：* $p<0.05$ ** $p<0.01$			
Note 2: The t value is in parentheses			

As can be seen from Table 4.6, the moderating effect is divided into three models. Model 1 includes control variables and independent variables interpersonal trust. On the basis of model 1, Model 2 adds the trust tendency of regulating variables, and model 3 adds the interaction term on the basis of model 2.

As for model 1, the purpose is to study the impact of independent variable interpersonal trust on dependent variable task performance when gender, age, working years, educational level, industry, enterprise size, and time spent on corporate social media at work are controlled without considering the interference of moderating variable trust tendency. As shown in Table 4.6, the independent variable interpersonal trust presents a significant significance (t=14.933, p=0.000<0.05), indicating that interpersonal trust has a significant impact on task performance. The interaction terms of interpersonal trust and trust tendency were significant (t=3.527, p=0.001<0.05). It shows that when interpersonal trust has an impact on task performance, the influence amplitude of the moderator variable is significantly different when the trust tendency of the moderator variable is at different levels, and the interaction term and the independent variable have the same sign, so it is positive adjustment.

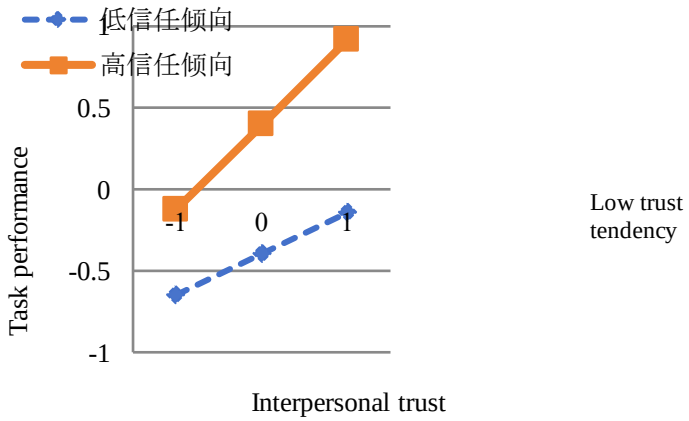

Figure 2: Adjustment slope diagram

As can be seen from Figure 2, the straight line shows an upward trend, so the main effect of interpersonal trust on task performance is positive, and the slope of the straight line is greater than the dashed line slope of the low trust tendency, so the effect is higher when the high trust tendency is higher, and the trust tendency positively regulates the impact of interpersonal trust on task performance. So let's say that H5 is true.

Conclusion and Recommendations

Based on the theory of media synchronization and social exchange, this study explores the impact of social media interaction on employees' task performance. The results show that the three dimensions of enterprise social media interactivity (active control, two-way communication, synchronization) can affect task performance through interpersonal trust.

According to this study, the three dimensions of social media interaction make employees' work transparent. Employees can choose when and what to do, dominate and control the content and form of work, and leaders or colleagues can give feedback and correct employees' work in time, effectively improving task performance.

The practical significance of this study lies in that it can effectively guide organizations how to give full play to the role of corporate social media, and can maximize its value for enterprise management and use. Specifically, the three dimensional characteristics of enterprise social media interaction, namely, active control, two-way communication and synchronization, can enable employees to strengthen interpersonal contact in the process of using enterprise social media platforms at work, improve employee satisfaction, and create enterprise value more efficiently.

The limitation of this study is that it only discusses the impact of three dimensions of enterprise social media interactivity on task performance from the perspective of interpersonal trust. In the future, it is possible to integrate social and work perspectives to further explore the impact of different types of enterprise social media.

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A Study on The Impact of Management Innovation on Business Performance: The moderating effect of Business Strategy

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Abstract

This study examines the relationship between managerial innovation, corporate strategy, and firm performance, particularly as Chinese firms cope with the rapidly changing digital economy environment. By using models and tools such as SPSS, AMOS, and the Boston Growth Matrix, the study analyzes the interrelationships among different variables, focusing on the interactions among managerial innovation (MI), business strategy (BS), and business performance (BP).

The main objectives of the study include:1. to understand how management innovation can help firms develop and gain competitive advantage under different types of strategies.

2. analyzing the moderating role of business strategy between management innovation and business performance.3. to explore the impact of five different strategy types on the relationship between management innovation and firm performance.

The results of the study show that management innovation has a positive impact on firm performance; that corporate strategy significantly moderates the impact of management innovation on firm performance; and that five strategic organizational forms (defensive, exploratory, analytical, reactive, and entrepreneurial) have different degrees of influence on the relationship between management innovation and firm performance. The Boston Growth Matrix is used as a theoretical basis for assessing how firms reallocate resources and for evaluating strategic decisions.

The study also provides recommendations for business managers, industry regulators and the government, including: managers should restructure their offline business models, create strategies that parallel online and offline operations, and integrate emerging technologies to improve efficiency; regulators need to promote external managerial innovation and assist SMEs in forming an internal innovation cycle; and the government needs to encourage the integration of the online and offline economy and monitor the truthfulness of corporate disclosures. The limitation of the study is that the data are mainly from service-oriented firms in China, and it is recommended that future research be extended to other industries and regions, as well as exploring in depth the impact of dynamic changes on managerial innovation and firm performance.

Keywords: Management Innovation, Corporate Strategy, Corporate Performance

Introduction

Under the premise of describing the background, significance and objectives of the study, this study further introduces the content and methodology of the study by reviewing the existing literature and theories, clarifies the research ideas and framework, and explores each variable in depth. The study uses SPSS 25.0, AMOS 24.0, Tableau and other statistical analysis software, and takes Chinese enterprises in the field of business services as samples, and conducts statistical description, correlation analysis, regression and other analyses through questionnaires, and finally arrives at relevant research hypotheses.

New challenges to the connotation of firm performance from the changing global economic environment

Fierce competition from emerging economies, changes in supply and demand, and the impact of the COVID-19 epidemic have made the global business environment full of uncertainty. The trend of integrating online and offline commerce has changed consumer behavior in the retail industry, pushing companies to actively adjust their strategies, optimize their business models, and expand their sales channels. In this process, enterprises are gradually accustomed to searching and consuming online, and this new business strategy called "O2O e-commerce" is becoming popular, which brings a new direction to enterprise management innovation and strategy development.

New requirements for the evolution of innovation management in the goal of enterprise performance improvement

As an important driving factor for exploring new opportunities, creating value and enhancing competitive advantage, innovation is getting more and more attention. Distinguished from technological innovation, management innovation helps to achieve efficient operations and strategic goals by introducing new ideas, processes and technologies that create innovations in organizational structure, business processes and human resources within the enterprise. However, there is still a lack of consensus in academic research on the relationship between the impact of management innovation and other types of innovation and their interaction with performance, so further empirical research is needed.

Corporate strategy development and deployment provides a new direction for performance management

The "experience curve" and "growth share matrix" proposed by the Boston Consulting Group provide an important theoretical foundation for corporate strategic management. It helps companies optimize their business portfolio through resource reallocation and strategic planning to maximize market share and growth rate. With the continuous evolution of business models and consumer habits, academics need to further clarify the relationship between management innovation and corporate performance, and study in depth the moderating role of strategy in the interaction between the two.

Importance of and problems faced by Chinese enterprises in transformation and upgrading

Chinese firms are facing tremendous development opportunities against the backdrop of drastic changes in systems, technologies and market environments, and a series of strategic reform issues have arisen. There are differences in the relationship between different strategies and corporate management innovation and performance, and the rational formulation of business strategies helps to enhance the moderating role of management innovation in corporate performance improvement. Therefore, based on the Boston Growth Matrix theory and a field survey of Chinese firms, this study attempts to verify the mediating role of business strategy between management innovation and performance from the perspective of key stakeholders.

Objective

1. to explore the mechanisms by which management innovation contributes to the development of firm performance under different corporate strategies: to understand how management innovation can help firms improve their competitive advantage and performance under various types of strategies.
2. to study the moderating role of corporate strategy in the relationship between management innovation and enterprise performance: to analyze how different types of corporate strategy affect the positive effect of management innovation on enterprise performance.
3. Examining the impact of five different types of strategic organizations on the relationship between management innovation and firm performance: examining how five types of strategic organizations, namely, defensive, exploratory, analytical, reactive and entrepreneurial, affect the interaction between management innovation and firm performance.

Literature Review

1. Management innovation

Definition and development: The concept of management innovation was first introduced by STATA in 1989, who argued that management innovation is the renewal of a firm's business philosophy, organizational structure, and management methods through the alignment of its existing resources.Birkinshaw et al. then further defined management innovation as a set of managerial practices aimed at improving efficiency and organizational development.

Theory and Empirical Evidence: Damanpour et al. point out that management innovation has a unique value different from technological innovation and should be considered as a separate type of innovation.Camison and Villar-Lopez emphasize the positive impact of management innovation on firm competitiveness, while Heij et al. find a positive link between management innovation and product innovation.

2. Business strategy

Theoretical framework: The Boston Growth Matrix model (BCG Matrix) is an important tool for analyzing and formulating corporate strategy, categorizing corporate business units into “stars”, “problems”, “cash cows” and “lean”. The BCG Matrix is an important tool for corporate strategy analysis and formulation, categorizing business units into “Stars”, “Problems”, “Cash Cows” and “Skinny Dogs”, which are used to guide the allocation of resources and strategic choices. The model emphasizes that firms should determine the strategic direction of different business units based on two dimensions: market growth rate and market share.

Types and Implications: Miles and Snow's strategy model categorizes the types of corporate strategies into defensive, exploratory, analytical and reactive. The formulation and selection of business strategies are influenced by factors such as internal capabilities, resource allocation and market environment, which have a significant effect on business performance and innovation.

3. Enterprise Performance

Definition and Measurement: Business performance generally includes both financial and non-financial aspects. Financial indicators cover profit, return on investment, etc., while non-financial indicators include market share, customer satisfaction, and innovation, etc. Richard et al. further subdivided corporate performance into three areas: financial, product, and shareholder return.

Performance Improvement: Firms improve organizational structure and resource allocation through strategic planning and management innovation to enhance firm performance.Feng et al. point out that performance improvement needs to take into account multi-dimensional factors, such as market share, financial return, and customer satisfaction.

4. Relationship between management innovation and enterprise performance

Relevant studies: Existing studies show that management innovation can improve organizational performance, but there are differences in the intensity, direction and significance of the impact across studies.Cerne et al. compared and found that the data from studies in Spain and South Korea showed a positive impact between management innovation and firm performance, but it was not significant in Slovenian studies.

Linkage between management and technological innovation: the study also found that there is a complementary effect between management innovation and technological innovation, and that the two work together to enhance the market competitiveness and overall performance of firms. ballot et al. found that the synergistic effect of the two is most evident in French firms.

5. The moderating role of corporate strategy in the relationship between management innovation and performance

Related research: strategy acts as a mediating variable that affects the positive effect of management innovation on firm performance.Rehman et al. point out that corporate strategy improves the implementation efficiency of management innovation by guiding the allocation of resources and the restructuring of business models.

Research Gap: Currently, academics have paid less attention to the moderating role of different strategy types in the relationship between management innovation and firm

performance, which is especially scarce in the Chinese business environment. Therefore, it is necessary to further explore the moderating influence of the five strategy types on the relationship between management innovation and firm performance through empirical research.

Research Methodology

The purpose of this study is to explore the relationship between management innovation, corporate strategy and firm performance and to gain insight into the moderating role of corporate strategy on the relationship between management innovation and firm performance. The following are the specific methods used in this study:

1. Research Design

Research Model: Based on existing theories of management innovation and corporate strategy, an integrated model is developed to examine the relationship between management innovation (MI), corporate strategy (BS) and business performance (BP) and to explore the moderating role of corporate strategy.

Research hypotheses: based on the research objectives, the hypotheses of the positive impact of management innovation on corporate performance and the moderating role of five different strategic organizations between management innovation and corporate performance are proposed.

2. Data Collection

Sample selection: the study was conducted on Chinese enterprises in the service sector, covering 27 large and medium-sized business enterprises, and random sampling method was used to collect sample data.

Survey instrument: questionnaires were developed based on the existing literature, including standardized scales for three aspects: management innovation, corporate strategy and corporate performance. The reliability of the questionnaire was measured using Cronbach's alpha coefficient and combined reliability (CR).

3. Data Analysis

Descriptive statistics: descriptive statistics of the basic information of the samples were conducted using SPSS 25.0 to clarify the characteristics and attributes of the samples.

Correlation analysis: correlation analysis was used to clarify the interrelationship between management innovation, corporate strategy and corporate performance in the research sample.

Regression analysis: using multiple regression models and moderating variables to test the moderating effect of corporate strategy on the relationship between management innovation and corporate performance.

Hypothesis testing: structural equation modeling (SEM) using AMOS 24.0 to test the research hypotheses and ensure the reliability of the results through robustness testing.

4. Technical Route

Data processing and model construction: based on the data statistical results and literature theories, five types of corporate strategies are included in the model to construct a comprehensive analytical framework of management innovation, corporate strategy and corporate performance.

Result analysis: through empirical analysis of data and interpretation of results, the mechanism of management innovation and corporate strategy on corporate performance is formed.

5. Research Limitations

There are geographical limitations in sample selection, covering only some enterprises in China's business sector, and the results have certain limitations

The research data are mainly obtained through questionnaires, and there may be subjective bias of the respondents.

This study mainly focuses on the business service sector and should be extended to other industries in the future to verify the role of different types of business strategies in different industries.

Through the above methodology, this study endeavors to reveal the mechanisms by which management innovation and corporate strategy affect corporate performance, and to provide empirical evidence for Chinese companies to formulate effective management and strategic planning.

Empirical Results and Data Analysis

This study aims to explore the relationship between management innovation, corporate strategy and firm performance, focusing on the moderating role of corporate strategy between management innovation and firm performance. The following are the main findings of the research results.

1. sample descriptive statistics

The sample firms of the survey are from 27 large and medium-sized business enterprises in the service sector in China, and the survey data reflect the diversity of the sample firms in terms of size, regional distribution and business scope.

The statistics of basic information show that these enterprises are representative in terms of the type of strategy, degree of management innovation and performance indicators.

2. Correlation analysis

The results of correlation analysis show that there is a significant positive correlation between management innovation, corporate strategy and corporate performance.

The correlation of each variable provides a preliminary basis for further validation of the research hypotheses.

3. **Regression Analysis**

Multiple regression analysis shows that management innovation has a significant positive effect on corporate performance, which validates the first hypothesis of the study.

The five strategy types (defensive, exploratory, analytical, reactive and entrepreneurial) have different degrees of moderating effects on the relationship between management innovation and firm performance.

4. Moderating effect analysis

Defensive and analytical strategies have a strong positive moderating effect on the relationship between management innovation and firm performance, showing that these two strategy types can enhance the positive impact of management innovation on firm performance.

The moderating effect of exploratory and entrepreneurial strategies also showed a positive correlation, but the effect was weaker.

Reactive strategies show the weakest moderating effect in this relationship, indicating that they have less impact on the relationship between management innovation and firm performance.

5. Robustness Test

To ensure the reliability of the findings, a robustness test was conducted and the results verified the stability of the model.

Further analysis shows that different strategy types have significant differences in moderating the relationship between management innovation and firm performance.

6 Conclusions and Implications.

The results of the study show that management innovation and corporate strategy have significant positive impacts on corporate performance, and different strategy types play different moderating roles in the relationship between management innovation and corporate performance.

Enterprises should choose strategies that match their organizational innovation capabilities and development goals according to their own resources and market environments in order to improve the positive effects of management innovation on enterprise performance.

This study provides theoretical support for enterprises to formulate management and strategic plans, and practical suggestions for improving enterprise performance and rationally promoting management innovation and strategy implementation.

Discussions

The purpose of this study is to explore the complex relationship between management innovation, corporate strategy and firm performance, focusing on the moderating effect of corporate strategy on the relationship between management innovation and firm performance. The results of the study are discussed below:

1. the positive effect of management innovation on firm performance:

The results of the study show that management innovation has a significant positive effect on firm performance. This is consistent with existing research, which suggests that by introducing new management styles, processes or concepts, firms are able to optimize internal processes, stimulate employee potential and improve overall efficiency.

In the context of the rapid development of the digital economy, management innovation can help enterprises adapt to market changes, create new business growth points for

them and improve their competitive advantages.

2. The moderating role of corporate strategy:

The study verifies the moderating role of corporate strategy in the relationship between management innovation and corporate performance. Different strategy types affect the positive effect of management innovation on firm performance in different ways.

Defensive and analytical strategies enhance the positive effect of management innovation on firm performance, emphasizing resource use efficiency and product quality; exploratory and entrepreneurial strategies also have a positive moderating effect, but their effect is weaker, probably because they focus more on business expansion and new markets.

Reactive strategies have the weakest moderating effect, reflecting the fact that such strategies are mostly reactive to market changes and less proactive in optimizing internal innovation processes, resulting in a less significant positive impact of management innovation on firm performance.

3. Theoretical and Practical Implications:

Through empirical analysis, this study further clarifies the interrelationship between management innovation, corporate strategy and corporate performance, which provides support for theoretical development. The study emphasizes that firms should fully understand their own resources, market environment and strategic positioning, and develop appropriate corporate strategies to maximize the positive effect of management innovation on firm performance.

In practice, corporate managers should integrate management innovation into overall strategic planning, fully explore the potential of defensive and analytical strategies, and reasonably balance resource allocation and business expansion.

4. Research limitations and future directions:

This study focuses on a sample of Chinese service-oriented firms, and the data are limited to this scope, which may lead to regional and industry-specific results.

There is also some subjective bias in the collection of questionnaire data and measurement of variables. Future studies may try to expand the sample scope to other industries or regions and use diverse data sources to validate the findings in different contexts.

Through the above discussion, this study summarizes the complex interaction between management innovation, corporate strategy and corporate performance, and points out the direction for future theoretical and practical research.

Conclusion

1.Positive effect of management innovation on enterprise performance: This study shows that management innovation has a significant positive effect on enterprise performance. By introducing new management styles, processes and concepts, firms are able to optimize internal resource allocation, stimulate employee potential and improve overall efficiency, thereby significantly enhancing firm performance. This finding is in line with existing research, which emphasizes that management innovation is an important factor in maintaining corporate competitiveness in a rapidly changing business environment.

2.Moderating role of corporate strategy: Corporate strategy plays an important moderating role in the relationship between management innovation and firm performance. Defensive and analytical strategies enhance the positive effect of management innovation on firm performance by emphasizing resource utilization efficiency and product quality; exploratory and entrepreneurial strategies also show a positive moderating effect, but it is weaker; reactive strategies have the weakest moderating effect on the relationship between management innovation and firm performance, reflecting their more passive strategic choices and delayed response to market changes.

3.Differences in the impact of strategy type on management innovation and performance: The study further reveals the different moderating effects of different strategy types in the relationship between management innovation and firm performance. Defensive and analytical strategies focus more on internal resource optimization and product quality improvement, while exploratory and entrepreneurial strategies place more emphasis on market expansion, business innovation and growth potential. Reactive strategies tend to passively adapt to external market changes, making it difficult to fully exploit the positive impact of management innovation on performance.

4.Theoretical and practical insights:

Enterprises should consider their own resources, market environment and strategic positioning to choose the appropriate type of strategy in order to fully utilize the potential of management innovation and promote sustainable growth in corporate performance.

Managers should integrate management innovation into the overall strategic planning and pay attention to the balance between resource optimization and market expansion when formulating corporate strategies.

5. Research Limitations and Future Directions: This study mainly adopts a sample of Chinese service-oriented enterprises, with regional and industry limitations. Meanwhile, the data were collected through questionnaires, which may have subjective bias. Future research should be extended to different regions and industries to verify the effects of management innovation and corporate strategy on corporate performance in different contexts. Further exploration of moderating variables in different contexts may also provide richer theoretical insights into this research area.

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The Model Development of Packaging Designs to Create Added Value for Pork Sausage Product

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Abstract

The objectives of this research were 1. to study basic product information to create added value for pork sausage products. 2. to develop a packaging model to create added value for pork sausage products, 3. to present a packaging model to create added value for pork sausage products, and 4. to survey consumer satisfaction towards packaging designs to create added value for pork sausage products. The sample group consisted of entrepreneurs, 2 lecturers, and 20 students. Interviews, focus groups, and questionnaires were used to collect data. Analyze data by using content analysis and descriptive statistics.

The research results found that

1. The original packaging is still a clear plastic bag because the entrepreneurs see it as convenient and cost-saving. Therefore, there is an idea to develop packaging, to shield and maintain product quality, prevent products from being damaged during movement, and also increase value. If the design is outstandingly beautiful, it can also stimulate and create interest in consumers.

2. The process of developing packaging designs to add value for pork sausage products has been designed in 3 aspects including packaging, brand, and label information.

3. Survey results of consumer satisfaction towards packaging design to add value for pork sausage products found that consumer satisfaction towards packaging design to create added value for pork sausage products was at a high level overall. If considering each item, it was found that the materials used can prevent contact with moisture or air, and have a high level of satisfaction. The next highest level was the completeness of information on the packaging can provide details to buyers very well, the structure of the packaging was appropriate for the packaging size, and the illustrations used on the packaging help create interest in the product, respectively.

Keywords: Packaging Design, Create Added Value, Pork Sausage Product

Introduction

Thailand has established a 20-year National Strategic Framework (2017 - 2036), especially the strategy for building competitive capabilities. This National Strategic Framework focuses on creating strength and added value of production in developing the manufacturing and service sectors. Moreover, it strengthens the production base and promotes small farmers towards sustainable and environmentally friendly agriculture. Meanwhile, the

direction of the 12th National Economic and Social Development Plan (2017-2021), National Strategy 2, Building Competitiveness, is in line with the Ministry of Education Strategy 2, Production and Human Resource Development. Plus, research and innovation that is in line with the needs of national development, issues of industrial potential development, generating income from tourism, sports and innovation, developing agricultural production potential, developing entrepreneurs and community economy, developing SMEs to international standards, and creating more competition among community entrepreneurs in the market by focusing on developing environmentally friendly products and packaging that are of high quality and can better meet consumer needs. The above points show that the government focuses on developing small entrepreneurs to have competitive capabilities, in product development is one way to increase competitive capabilities.

To generate additional income for the product, the development of packaging design is one way to create added value. Packaging design is therefore an important part. To design in line with consumer needs, the unique beauty that creates emotional value and mental value for consumers, packaging will be a stimulant for buyers. In particular, consumers' perspectives are different, causing consumers to look for unique packaging that suits them, along with other elements that influence the purchase of products. Bix, de la Fuente, Sunder and Lockhart (2009) suggested that consumers want to be able to easily identify a safe and affordable product that has arrived intact with maximum shelf life remaining, easily opened, dispensed, and stored and express frustration when designers do not consider their needs. Entrepreneurs in this research have interesting products which is pork sausage. This product is a famous product of Ubon Ratchathani Province. However, entrepreneurs still lack experience in product design and creativity to develop marketing promotions.

This research focuses on developing packaging design to create added value for pork sausage products and to create a unique identity for the product that is interesting and to generate income for entrepreneurs. It also leads to future success, such as entering the market. In addition to the benefits of increasing the value of the product, it also raises the standard of the product, aiming for the product to be accepted to create more purchasing trends.

Objective

1. To study basic product information to create added value for pork sausage products.
2. To develop a packaging model to create added value for pork sausage products.
3. To present packaging model to create added value for pork sausage products.
4. To survey consumer satisfaction towards packaging designs to create added value for pork sausage products.

Conceptual Framework

Research on the development of packaging designs to create added value for pork sausage products, with a review of the following literature Worapongpat et al. (2019), Boonrod, Rattanasupa and Narkphum (2020), Ngamwannakul (2021) and Bunliang (2018).

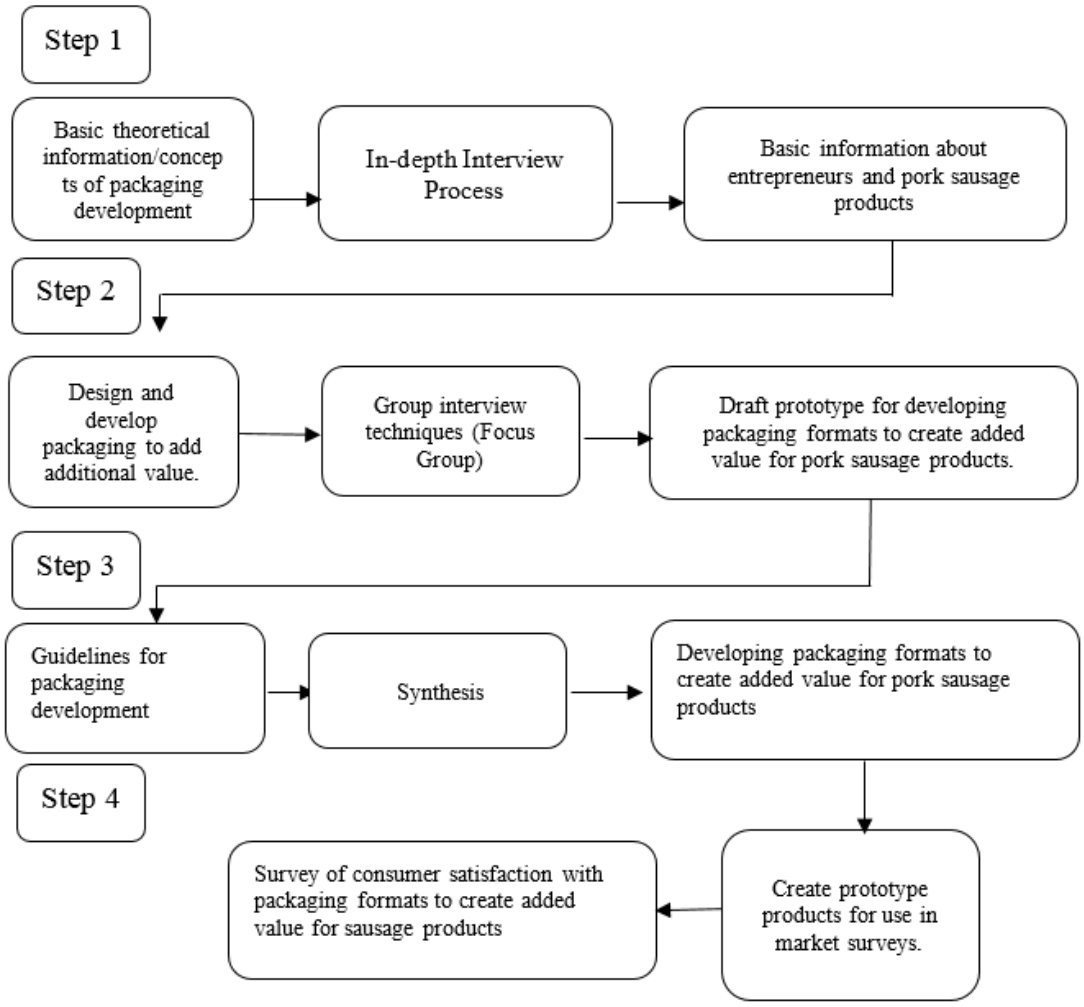

Figure 1: Research concept framework

Research Methodology

This research aims to develop packaging formats to create added-value pork sausage products for entrepreneurs. The researcher can define the scope of the research as follows.

Part 1 In-depth Interview

1. Population and sample

1.1 The population is entrepreneurs called "Amporn"

1.2 The sample group consisted of key informants, including entrepreneurs called "Amporn", 2 lecturers, and 20 students from the Marketing Program, Faculty of Business Administration and Management, Ubon Ratchathani Rajabhat University, totaling 23 people. The community's product was pork sausage, which did not yet have packaging for distribution. Therefore, a study was needed to develop packaging to create value for the product.

1.3 To access key information, this study was coordinated with product development experts. The research objectives were explained and consent was requested for an interview with an expert and an interview date was arranged.

2. Research tools

2.1 The questions are open-ended, created from the objectives, concepts of research, and basic information of entrepreneurs. The questions can be flexible according to the interview situation to build a relationship, which will lead to smooth data collection and will allow the informant to convey information as completely and truthfully as possible. It is divided into 3 parts: initiating a conversation, entering the topic of study, and closing the conversation.

2.2 An audio recorder is an instrument used for interviews and helps record data that the researcher did not have time to record. For accuracy and completeness, firstly, before recording every time, the researcher will ask for permission from the interviewee. Then, the conversation during the interview will be transcribed to be used as data for analysis and data presentation.

2.3 Camera is a tool for conducting interviews, it helps to record conversations and other related images for researchers to use in explaining the results of the study.

2.4 Pen and notepad are interview tools that help record during in-depth interviews.

3. Data collection method

After the questions were created following the research objectives, then the research team made an appointment with each informant. In the data collection process, the researcher chose to use in-depth interviews. To check the accuracy and content validity, the research instruments were presented to 3 experts. The results of the consideration of all qualified persons were used to calculate the IOC index. Semi-structured interview questions were used to obtain complete information that met the objectives. Moreover, in in-depth interviews, the interviewee can answer questions openly without limitation (Chantavanich, 2014), the in-depth interview period is between October and December 2023.

4. Data validation

When the data is obtained, the data is checked using the Triangulation technique. It is a process that uses various methods to check and analyze data, including Data triangulation, Theoretical triangulation, and Data collection method triangulation.

5. Data analysis

In the process of data analysis in qualitative research, the researcher has studied and applied the process of qualitative data analysis, which is analysis from the beginning of the research and proceeding until the end because it is a continuous process and needs to refine the research issues. The process is expressing opinions from three angles in the knowledge wheel, namely research issues or questions, theoretical concepts, and data or findings.

Part 2 Focus Group

This section is about the steps in designing and developing packaging designs. The details are divided into the following steps:

1. Population and sample

The population is entrepreneurs called "Amporn". The sample group consisted of key informants, including entrepreneurs called "Amporn", 2 lecturers and 20 students from the Marketing Program, Faculty of Business Administration and Management, Ubon Ratchathani Rajabhat University, totaling 23 people. The community's product was pork sausage, which did not yet have packaging for distribution. Therefore, a study was needed to develop packaging to create value for the product.

2. Research tools

The researcher observed and participated in the Data collection activity. Focus group discussion is another important tool that will lead to the design and development of environmental packaging. In addition, the researcher designed a prepared recording before participating in the discussion activity. After participating in the activity, the recording will be recorded to compare and verify the accuracy of various sources of information, such as observation data and group discussions. By recording the data, the researcher can check the completeness of the data and can add missing information at any time.

3. Data collection method

To design and development of packaging to create added value, the researcher collected opinions from focus groups which are entrepreneurs called "Amporn", 2 lecturers, and 20 students from the Marketing Program, Faculty of Business Administration and Management, Ubon Ratchathani Rajabhat University. Qualitative data collection was conducted during the focus group discussions, with the researcher acting as a participant observer. Notes and audio-visual recordings were taken by the team during the focus group discussions. The in-depth interviews were conducted between October and December 2023.

4. Data analysis

Data analysis will be a holistic analysis in the form of finding relationships between the study and the results leading to the conclusion of important variables in designing and developing packaging designs to create added value.

Part 3 Synthesis

In this step, the in-depth interview and focus group discussions are synthesized and interpreted to provide guidelines for developing packaging designs to create added value.

Part 4 Marketing survey

1. Population and sample

1.1 Population is the population of Ubon Ratchathani Province, numbering 1,869,806 people (The Bureau of Registration Administration, 2023)

1.2 The sample group was calculated using Cochran's (1977) calculation formula, resulting in a total sample group of 400 people.

2. Research tools

The consumer satisfaction assessment form for packaging is a rating scale, divided into 5 levels. It was developed from the study of theories and concepts of consumer satisfaction. It tested the content validity by using at least 3 qualified persons for consideration. Try out the test with 30 sample groups to test the Reliability analysis. The obtained questionnaires were tested for reliability by using Cronbach's alpha and the acceptable value was .70 or higher (Silpcharu, 2012).

3. Data collection method

After the questions were created according to the research objectives, the researchers proceeded to collect field data. In the data collection process, the researchers chose to use a satisfaction survey and collect data from a consumer needs questionnaire, which was a non-probability random sampling. The researchers determined the data collection area in Mueang District, Ubon Ratchathani Province.

4. Data analysis

Analyze quantitative data using descriptive statistics.

Research Finding

From the study of basic information on pork sausage products of the entrepreneurs, the analysis was performed by describing the steps of the research objectives and summarizing the research results.

1. Information on pork sausage products to create added value for entrepreneurs

Researchers studied pork sausage products, focusing on packaging to create value for entrepreneurs' products. It was found that Packaging is still a clear plastic bag because entrepreneurs see it as convenient and cost-saving. After all, it is sold only in nearby areas such as markets and general stores. If they go for other packaging, it will increase the cost and make it impossible to sell. It is a value-adding and marketing tool, if it is designed to be outstanding and beautiful, it can also stimulate and attract the attention of consumers.

2. The development of packaging design to create added value for pork sausage products, entrepreneurs have designed product packaging in 3 aspects: packaging aspect, brand aspect, and information display aspect on the label as follows:

2.1 Packaging aspect

2.1.1 Vacuum-sealed bag size 12x18 inches

2.1.2 Stand-up ziplock bag, size 15x24 inches

Figure 2: Traditional Pork Sausage Product Packaging

Figure 3: New Pork Sausage Product Packaging

2.2 Brand aspect

2.2.1 The brand name is “Naem Amporn” because it is a product that the shop produces itself. The shop name can also be sold to customers and customers already know the shop name to some extent. It can be eaten every morning and evening.

Picture 4: Brand name “ Nam Amporn ”

2.3 information display aspect

2.3.1 Specify the ingredients used in the product and the quantity of the product.

2.3.2 Specify the name and address of the manufacturer, along with a telephone number, for easy contact.

2.3.3 Specify the type of product “Pork Sausage”.

2.3.4 Display the production standard “GMP” to create credibility for consumers to know.

3. The presentation of packaging formats to create added value for pork sausage products is problematic because entrepreneurs still lack participation in promotion and development, and lack of knowledge in developing standardized packaging and safe packaging, which is important. Therefore, the researcher has developed by allowing entrepreneurs to participate in the development, making the entrepreneurs' products gain the trust of consumers.

4. The survey results of consumer satisfaction towards packaging designs to create added value for pork sausage products are shown in Table 1.

Table 1: Satisfaction with Packaging

Evaluation list	Mean	SD	Satisfaction level
Satisfaction with packaging			
1 The material used can prevent contact with moisture or air.	4.11	0.80	More than Satisfied
2 The structure of the package is suitable for the package size.	4.09	0.70	More than Satisfied
3 The structure can be easily opened.	3.62	0.89	More than Satisfied
4 The structure can be closed tightly to protect the product inside.	3.91	0.77	More than Satisfied
5 It can be opened to take out the product inside conveniently.	3.86	0.81	More than Satisfied
6 The use of colors on the packaging is related to the product wrapped inside.	3.74	0.70	More than Satisfied
7 The overall design is beautiful and interesting.	3.71	1.01	More than Satisfied
8 The illustrations used on the packaging help create interest in the product.	3.96	0.76	More than Satisfied
9 The information on the packaging can provide details to the buyer very well.	4.10	0.90	More than Satisfied
Overall	**3.90**	**0.85**	**More than Satisfied**

From Table 1, overall, consumer satisfaction with packaging design to create added value for pork sausage products is at a high level (mean = 3.90, S.D. = 0.85). When considering each item, it was found that the materials used can prevent contact with moisture or air with a high level of satisfaction (mean = 4.11, S.D. = 0.80). Next to are completeness of information on the packaging, which can provide details to buyers very well, with a high level of satisfaction (mean = 4.10, S.D. = 0.91)**,** the structure of the packaging is appropriate for the size of the package with a high level of satisfaction (mean = 4.09, S.D. = 0.70), and the illustrations used on the packaging help create interest in the product with a high level of satisfaction (mean = 3.96, S.D. = 0.76).

Discussion

From the research results summary, the development of pork sausage product packaging design is consistent with empirical data.

1. The most important thing to consider when developing packaging to create added value is the product itself. It must have its value, be outstanding, memorable, unique, and of high quality, with beautiful, tightly wrapped packaging. This is consistent with the research of Thanyasiri (2021) whose study of the analysis of OTOP product packaging development guidelines found that packaging should have a variety of shapes, appropriate to the characteristics of the product, should use environmentally friendly materials, and stick with a need of consumers. It is also consistent with the research of Punyawutpreeda and Wuthiphornsopon (2021) which studied product packaging design development to create added value for products of the Yai Cha community, Sam Phran District, Nakhon Pathom Province. It found that the product design should be developed to be unique to the group and to develop its distinctiveness. By expanding the channels for developing the fonts on the packaging, it must be easy to read, appropriate for the product, and able to create a character for the product. The pattern on the packaging should be unique, modern, and appropriate for the context of the product and culture.

2. The development of packaging designs to create added value for products, the researcher studied the principles, concepts, theories, and related research by developing the following designs: 1) packaging design 2) brand design, and 3) label display, which is consistent with the research of Naijarun, Meekrua-iam & Rodkaew (2022). It was found that product brand development must use stories and local wisdom. In this brand development, the issue of palm sugar production was used to tell the production process, using illustrations to simulate the lifestyle and marketing methods combined with storytelling through language and weaving wisdom to promote packaging that is beautiful, clean, and interesting. In addition, it is consistent with the research of Ketsripongsa, Parat and Butsalee (2022) who studied the product development of farmers in the Khao Phu Khao Volcano group in Ban Khok Muang, Charakha Mak Subdistrict, Prakhon Chai District to develop communities to cope with drought under climate change in Buriram Province. It was found that There were 4 new designs of branding and packaging for community products. The evaluation was conducted in 4 aspects: 1) packaging usage, 2) packaging style, 3) production suitability, and 4) promotion of distribution and safety. This research has allowed entrepreneurs, distributors, and consumers to participate in the development process, to present packaging designs that are appropriate for community products to obtain environmentally appropriate packaging designs that are outstanding and meet standards.

3. From the researcher's field visit, it was found that entrepreneurs' products could not control the quality and the packaging was not attention-grabbing and popular. Additionally, the

product did not show its identity. Most of them have 3 main problems: 1) The packaging is not attractive 2) Product preservation and 3) Product quality. Therefore, to create recognition, entrepreneurs should pay attention to brand design. This is consistent with the research of Ngernchan, Thawipithanun, Ngammeesri, Singthongchai, Sripinthusorn, and Tangnuanchan (2023), they studied the participation in the development of lotus product designs based on local wisdom in Thap Krit Subdistrict, Chumsaeng District, Nakhon Sawan Province. It was found that in developing the packaging format, in terms of product branding, most entrepreneurs want to develop packaging that has details of text, colors, and layout of elements in the branding. Moreover, Entrepreneurs use packaging that can maintain product quality for a long time, is easy to store, and must be easy to pack. In terms of branding, entrepreneurs and consumers want a brand that is easy to remember.

4. From the market survey of prototype packaging, it was found that the overall satisfaction of consumers towards the packaging design to create added value for pork sausage products was at a high level. When considering each aspect, it was found that the three aspects that received the highest satisfaction were: 1) the materials used can prevent contact with moisture or air, 2) the completeness of the information on the packaging can provide details to buyers very well, and 3) the structure of the packaging is appropriate for the size of the package. This is consistent with the research of Somwang, Jittimanee, Thongaram, and Julsawat (2022), who have developed a 5-day logistics packaging for fermented fish products of the Ban Tung Satharan Food Processing and Preservation Community Enterprise Group, Ban Mi District, Lopburi Province. It was found that packaging of processed and preserved food products are easy and convenient to pack fermented fish into packages, have a beautiful size and design that attracts attention, are strong and protect the product well during storage and transportation, fermented fish products are visible, easy and convenient for buyers, it has appropriate packaging costs, it has complete information on the package and can provide details to buyers very well.

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Suggestions

Suggestions for Applying Research Findings

1. Government agencies should promote and support projects by supporting budgets for learning activities, organizing training, and creating channels for organizing various activities to expand opportunities for other entrepreneurs.

2. Entrepreneurs should continuously use packaging to create brand recognition and packaging. In addition, entrepreneurs should expand their product distribution locations to other provinces or abroad.

Suggestions for Further Research

1. There should be research and product development studies to create a unique identity to promote tourism in the souvenir product category.

2. There should be a further study of online marketing channels, along with the introduction of technology to help increase distribution channels, such as e-commerce systems to help with ordering products, payment and delivery, and storing a database of purchases to increase external income.

3. Further research should be conducted on the cost accounting content.

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Evaluating the Efficacy of Augmented Reality Technology for COVID-19 Education and Knowledge Enhancement

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Abstract

The global COVID-19 pandemic has precipitated an unprecedented crisis, necessitating widespread travel restrictions and stringent social distancing measures. This health emergency has presented multifaceted challenges to contemporary society, highlighting the imperative for innovative educational solutions to disseminate crucial information about the virus and its ramifications. Augmented Reality (AR) technology emerges as a promising digital tool uniquely positioned to address these challenges, offering immersive and interactive learning experiences. In a recent study evaluating the efficacy of AR technology in COVID-19 education, researchers developed a bespoke augmented reality mobile application designed to impart knowledge about the virus. The study's primary objective was to gauge the impact of this educational tool on participants' learning outcomes through pre-and post-tests. Thirty participants were enlisted to interact with the AR application, yielding findings that demonstrated a significant enhancement in knowledge and comprehension of COVID-19 after its utilization. These results underscore the potential of AR technology as a potent educational tool in disseminating essential information about COVID-19. The interactive nature of AR facilitates deeper engagement and understanding among learners, offering promising avenues for enhancing public awareness and preparedness in navigating health crises. Further research in this domain is warranted to fully harness the potential of AR technology in addressing global health challenges.

Keywords: COVID-19, Augmented Reality, Health Crisis, Learning Outcomes

Introduction

Augmented Reality (AR) technology is both intriguing and widely utilized. It enables the integration of virtual objects into the real environment, facilitating real-time interaction (Martín-Gutiérrez et al., 2015)(Jiang et al., 2022). By seamlessly overlaying digital data and content onto the physical world, AR creates the impression of intricately embedded information, as intended by the creator. This extends the perception of information and

content beyond what is directly observable, transcending traditional limitations. When applied to education, particularly as a primary medium of instruction, AR transforms the learning experience from mundane printed materials into an engaging platform. Learners encounter a distinctive educational paradigm, fostering the integration of external knowledge into the classroom and motivating active engagement with lessons as dynamic entities.

In the context of this research, a three-dimensional AR application was developed to enhance public understanding of COVID-19 preventive measures. The application leverages AR to transform learning about the virus into an engaging, interactive platform. By utilizing AR, the project aims to increase public engagement and make critical information about COVID-19 prevention more accessible and compelling. This approach is particularly relevant in the New Normal era, where the public needs reliable information to navigate health guidelines and adapt to new ways of living. The use of AR has become more accessible, eliminating the need for specialized equipment and enabling easy usage on mobile devices(Alzahrani, 2020)(Garzón, 2021)(Avila-Garzon et al., 2021)(Arena et al., 2022). Given the widespread ownership of mobile devices, access to AR has significantly expanded (Pelet, 2017)(Avila-Garzon et al., 2021).

The COVID-19 (Coronavirus Disease 2019) pandemic has significantly impacted public health and societal well-being (Shi et al., 2020). Additionally, there have been challenges in accessing public services due to the societal changes brought about by the New Normal era. Response measures to mitigate the impacts of COVID-19 include detailed guidelines for proper practices, relying on accurate and trustworthy information dissemination. These measures aim to reduce public health burdens on service providers, especially medical personnel, who face increased workloads amid manpower shortages. Meanwhile, service recipients have been affected by the implementation of new service formats and procedures, following policies to prevent the spread of COVID-19. Every sector is striving to adapt to this crisis. The adoption of a New Normal lifestyle emphasizes health maintenance, social distancing, and the embrace of new ways of living, often leveraging technology. However, a segment of the population still lacks knowledge and understanding regarding preventive measures against the coronavirus.

This research project recognized the potential of using three-dimensional Augmented Reality (AR) technology to disseminate knowledge about COVID-19. By utilizing AR technology, the aim was to enhance engagement and facilitate the transmission of information regarding preventive measures against COVID-19, thereby making the acquisition of knowledge more intriguing and accessible to a wider audience.

Literature Review

COVID-19

In December 2019, there was a report of an outbreak of an unidentified cause of pneumonia in Wuhan City, Hubei Province, China. This pneumonia was later associated with the Huanan Seafood Wholesale Market and was named as a severe, acute respiratory syndrome-related coronavirus 2 (SARS-CoV-2), a beta coronavirus under the subgenus Sarbecovirus. The global spread of SARS-CoV-2 led the World Health Organization to declare a pandemic on March 12, 2020. The world has experienced significant repercussions from this pandemic, including human casualties, economic impacts, and increased adversity (Ciotti et al., 2020). The sudden severe acute respiratory syndrome caused by the SARS-CoV-2 virus strain 7 in humans was discovered in Wuhan City, Hubei Province, China, during the recent outbreak of pneumonia in January 2020 (Zhou et al., 2020)(Wu et al., 2020). The current

COVID-19 outbreak is considered a global emergency due to its rapid spread and high mortality rates (Yang et al., 2020). The number of individuals infected with the SARS-CoV-2 virus, the cause of severe acute respiratory syndrome (SARS-CoV-2), is increasing rapidly worldwide. COVID-19 patients may suffer from pneumonia (Zhu et al., 2020)(Huang et al., 2020), severe acute respiratory distress syndrome (ARDS), and multiple organ failure (Chen et al., 2020)(Wang et al., 2020). Generally, human coronaviruses OC43, NL63, HKU1, and 229E cause mild self-limiting diseases (Corman et al., 2018).

Augmented Reality

Augmented Reality (AR) is an environment created to simulate the real environment by utilizing digital image display components, including sound and other stimuli, through holographic technology. AR seamlessly combines the real and virtual worlds by enriching the real world with computer-generated virtual objects in real-time (Alzahrani, 2020)(Maulana, 2020)(Fan et al., 2020)(Iatsyshyn et al., 2020)(Avila-Garzon et al., 2021). According to the widely accepted definition, AR is considered a technology governed by three fundamental principles: the integration of real and virtual objects in a real environment, the alignment of real and virtual objects, and real-time interaction (Martín-Gutiérrez et al., 2015)(Arici et al., 2021)(Anuar et al., 2021)(Jiang et al., 2022)(Mendoza-Ramírez et al., 2023).

While computers connected to the internet allow us to be part of an interconnected world, the reality is that connectivity has expanded to other devices like smartphones, tablets, watches, and even glasses. This expansion allows us to receive information more naturally, in a way that's easy and swift. Indeed, we've broadened our view of reality by utilizing computers. Thanks to smartphones, the usage of Augmented Reality has increased, extending its scope to entertainment, marketing, tourism, education, and healthcare. The term 'Augmented Reality' also refers to a complex set of technologies that enable us to create three-dimensional images, construct new virtual worlds, and manage virtual objects. This is known as immersive virtual reality. When considering the increasing complexity of the technology used in Augmented Reality, it's categorized into different levels; Level 0: Physical World Hyper Linking involves using codes such as QR codes to link to related content like hyperlinks, images, text, sound, or standard videos. Level 1: Marker-Based AR uses geometric shapes like black and white square markers, often a simple and asymmetrical square shape, allowing the overlay of three-dimensional objects and recognition. Level 2: Markerless Augmented Reality enables overlaying data in physical world scenes triggered by images, objects, or people without markers, sometimes utilizing GPS technology. Level 3: Immersive Virtual Reality or Augmented Vision, the most intrusive level, replaces computer screens and mobile devices with glasses, lenses, or special sensors, providing a fully immersive experience in a three-dimensional world. This technology's development has revolutionized our understanding of reality, introducing a new way to experience and interact with the world.

Research Methodology

Conceptual Framework

This work can be summarized as follows:

Step 1: Data Acquisition: Collection of COVID-19 Content

The process begins with the acquisition of content related to COVID-19. This involves gathering relevant information, data, and resources that will form the basis of the AR experience.

Step 2: Feature Identification: Unity-Based AR Development

After collecting the content, the next step is to identify and define the features that will be integrated into the AR application. The development of this AR experience is carried out using Unity, a popular game development platform, to create an interactive and educational tool with the collected COVID-19 content.

Step 3: Evaluation: Application Testing by Participants

The developed AR application is then subjected to an evaluation process. This stage involves applying the AR tool to a group of participants, which includes both specialists (n = 5) and students (n = 30), totaling 35 participants. The goal is to assess the effectiveness and usability of the AR application within these groups. This step involves a comprehensive evaluation of the AR application through several key activities:

- Satisfaction: Usability Feedback from Participants

Following the evaluation, feedback is gathered from the participants regarding their satisfaction and the usability of the AR tool. This feedback is crucial in understanding the user experience and identifying areas for improvement. All 35 participants provide this feedback.

- Pre-Test and Post-Test

To measure the educational impact of the AR application, a pre-test and post-test are conducted. These tests are designed to evaluate the knowledge gain of the participants before and after using the AR application.

- Analysis of Relative Gain and Difference Scores

The final step involves analyzing the data collected from the pre-test and post-test. This analysis focuses on the relative gain and difference scores, which help to quantify the effectiveness of the AR application in improving the participants' understanding of COVID-19 content.

The process outlined in Figure 1 provides a concise summary of the work (Luangrungruang & Kokaew, 2022).

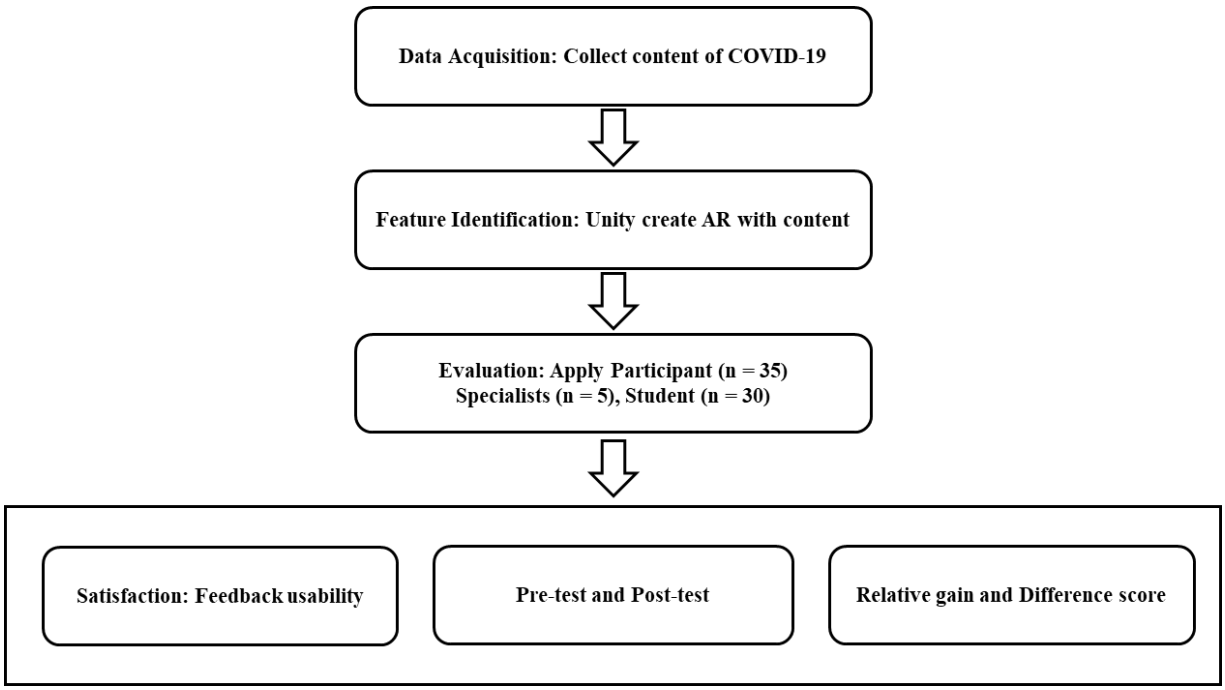

Figure 1: Flowchart of work

Figure 2 depicts the user interaction with the application using AR technology related to COVID-19. Upon launching the application, users access the main menu. Upon selecting the AR menu, the camera activates to search for and detect markers (marker images). Successful marker detection triggers the display of virtual objects. Users can navigate back to the main menu of the application while engaging in various activities. Exiting the application results in the complete cessation of all functionalities within the application.

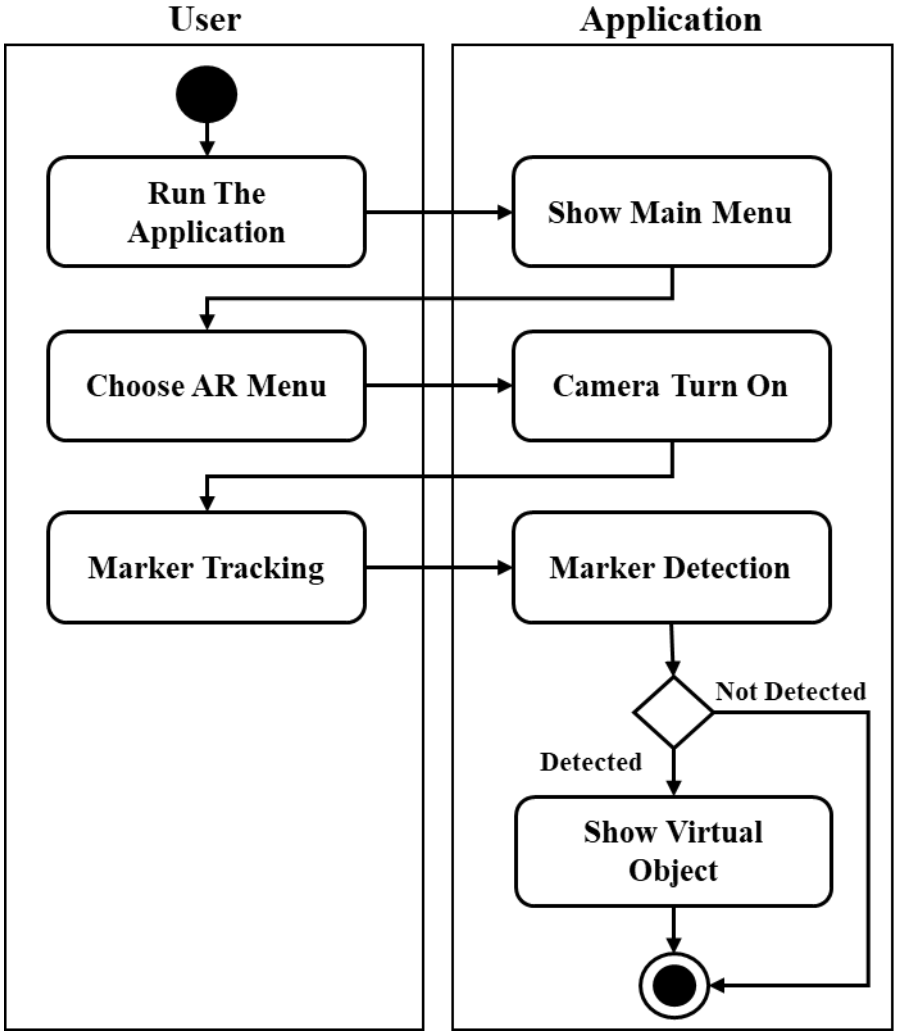

Figure 2: Application workflow diagram

The development outcomes of the COVID-19 educational application using AR technology consist of three components: the COVID-19 educational application, an evaluation of effectiveness by experts, and an analysis of user satisfaction. The application includes a set of 10 markers and encompasses both pretest and posttest assessments. The design of the Main Menu display serves as the foundation for introducing the application. It showcases the application's name and menu options, allowing users to navigate through various features. The Main Menu comprises six buttons: Scan AR, Guide, Pre-Test, Post-Test, About, and Exit application. Selecting the 'Scan AR' option opens the smartphone camera. Point the camera at

the marker to reveal the related 3D image. Detailed information about the model can then be accessed, as depicted in Figure 3.

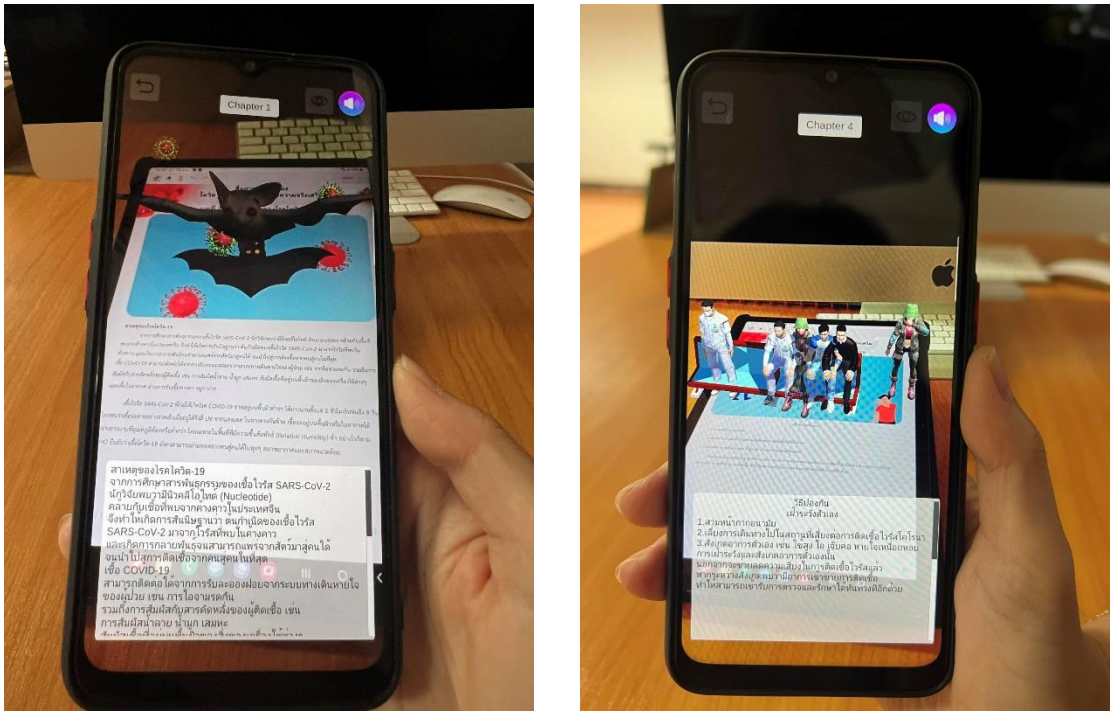

Figure 3: Example of providing AR information (animation and simulation)

Research Finding

The research findings indicate that using Augmented Reality (AR) technology to disseminate and communicate information can be highly effective. By integrating AR into educational tools, an interactive learning experience can be created, enhancing the understanding of presented information. This approach aims to make the dissemination of knowledge more engaging and accessible, providing users with a dynamic and visually appealing method for receiving and absorbing content.

Assessment by 5 specialists, individuals employed at Sakon Nakhon Rajabhat University, knowledgeable about augmented reality-based learning media, revealed that the aspect receiving the highest evaluation was the usability of the application, with an average score of 4.80, indicating a significantly high rating. The overall average score for all aspects of the COVID-19 educational application utilizing augmented reality technology on the Android operating system was 4.75, indicating a considerably high level shown as Table 1.

Table 1: Results of satisfaction assessment regarding the usage of the application

Evaluation	Average	S.D.	Interpretation of results
1. Content	4.72	0.35	Very Good
2. Design	4.72	0.39	Very Good
3. Usage aspect of the application	4.80	0.30	Very Good
Summary	4.75	0.22	Very Good

The statistical analysis of the data involves using mean and standard deviation. Testing the application's usability aligns with the objectives and employs questionnaires as a tool to measure user satisfaction. Result of Satisfaction Assessment for the COVID-19 Educational Application using Augmented Reality assessment by 30 students shown as Table 2.

Table 2: Results of satisfaction assessment regarding the usage of the application

Evaluation	Average	S.D.	Interpretation of results
1. Content	4.04	0.62	Good
2. Design	4.17	0.73	Good
3. Usage aspect of the application	4.29	0.67	Good
Summary	4.17	0.10	Good

From Table 2, the summary of satisfaction assessment results ranked each aspect in descending order based on the average scores given by 30 students from Sakon Nakhon Rajabhat University regarding the COVID-19 educational application using augmented reality technology on the Android operating system. The overall average satisfaction score was 4.17, indicating a good level.

The results indicated that the assessment of learning effectiveness was conducted by establishing learning hypotheses, calculating difference scores, and determining relative gains. The average post-learning score exceeded 50% of the total possible score, demonstrating a significant improvement in learning outcomes facilitated by the educational media.

Pre-tests and post-tests are essential tools for assessing learning effectiveness. The pre-test establishes the participants' baseline knowledge before the educational intervention, while the post-test measures the learning outcomes after the intervention. By comparing these results, educators can evaluate the effectiveness of the intervention and identify areas for further improvement. The results of the pre-test and post-test are presented in Table 3 as follows.

Table 3: Results of pre-test and post-test in learning outcomes

Student No.	Pre-Test	Post-Test	Student No.	Pre-Test	Post-Test
1	5	17	**16**	8	17
2	10	20	**17**	7	18
3	8	14	**18**	6	15
4	9	16	**19**	9	15
5	4	12	**20**	8	14
6	6	9	**21**	8	16
7	5	14	**22**	5	12
8	5	14	**23**	7	15
9	7	12	**24**	8	12
10	12	16	**25**	3	16
11	8	16	**26**	7	12
12	9	20	**27**	7	16
13	14	15	**28**	9	10
14	7	20	**29**	8	16
15	14	17	**30**	7	16

Figure 4 illustrates the difference scores, indicating the improvement in learning outcomes between the pre-test and post-test.

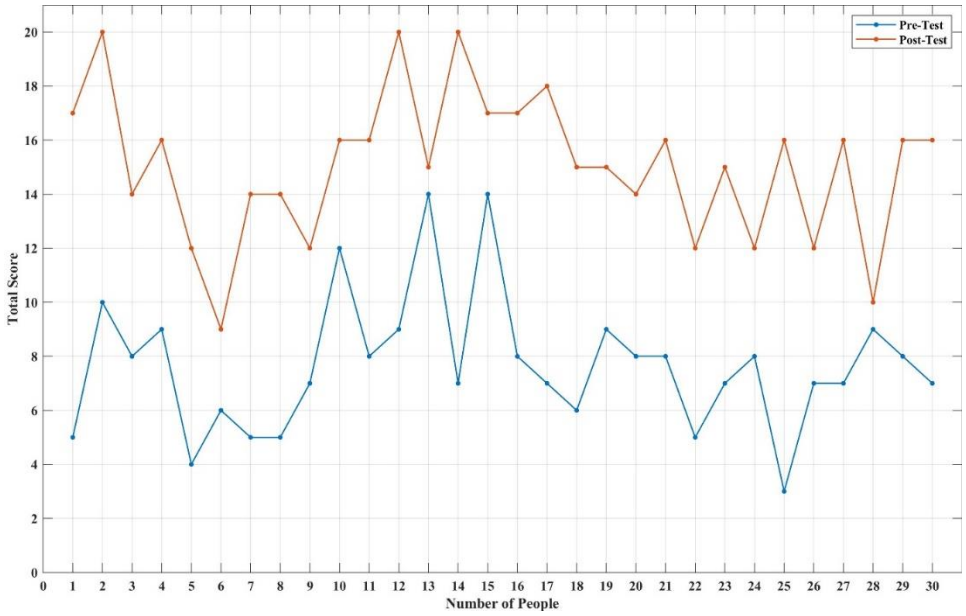

Figure 4: Comparative analysis between pre-test and post-test

Meanwhile, Figure 5 portrays the relative gain scores, providing an overview of the learning development (Kanjanawasee, 1990). The study exhibits enhanced learning outcomes that indicates that all 30 students demonstrated improved performance.

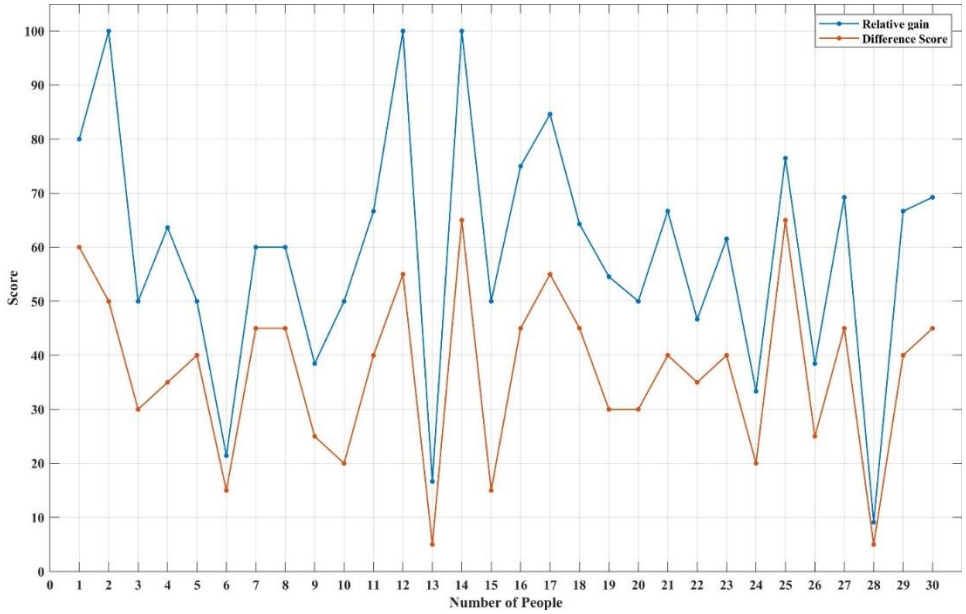

Figure 5: Comparative analysis between relative gain and difference score

Regarding the pre-test and post-test learning outcomes from a 20-question test, after the learning session using the COVID-19 educational application, it was observed that 29 students passed the criterion while one student did not. The average score after learning was 15.07, which is 75.33% of the total score, compared to the pre-test average score of 7.67, equivalent to 38.33% of the total score. When comparing the post-test scores against the 50% criterion, it was found that 29 students exceeded this benchmark, accounting for 96.67%. This outcome indicates that the COVID-19 educational application, as evaluated through the test, effectively enhanced the students' understanding and knowledge of COVID-19, aligning with the initial research hypothesis.

Discussion/Conclusion

Summarizing the results obtained from developing augmented reality (AR) learning aids for COVID-19, along with recommendations, the objective was to engage learners in wanting to explore COVID-19 and coronavirus-related information. Researchers proposed an educational tool using AR technology on Android devices to accurately and conveniently facilitate learning. This technology was utilized for its beneficial and creative nature.

To evaluate the efficacy, researchers developed and tested the program. Upon confirming the model's alignment with content, use of understandable language, and accuracy, the educational material underwent additional testing. Subsequently, experts assessed its effectiveness across three aspects: 1) media creation, 2) technology, and 3) application. The evaluation resulted in highly satisfactory ratings, averaging 4.75. Moreover, after using the AR-enhanced learning material, the experimental sample group reported a high satisfaction

level, averaging 4.17. From these results it can be stated that the AR application can be used easily by users so that it is expected to support future activities.

The learning outcomes of students at Sakon Nakhon Rajabhat University concerning COVID-19, utilizing augmented reality technology, significantly improved their knowledge and understanding. Pre-test scores averaged 7.67, while post-test scores averaged 15.07, reflecting an average difference of 7.40 points. The standard deviation for pre-test scores was 2.52 and 2.72 for post-test scores. The difference between post-test and pre-test scores averaged 3.19, indicating a significant improvement in learning outcomes. The relative scores of all students show an increase in their learning progress. These results align with the initial research hypothesis.

Suggestion

1. Extend the AR learning aids to cover a broader range of health-related topics beyond COVID-19, such as general virology, immunology, and public health measures.

2. Incorporate interactive elements such as quizzes, interactive 3D models, and virtual simulations to make learning more engaging.

3. Ensure the AR application is accessible to users with disabilities and is compatible with a wide range of devices, including those with lower specifications.

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Identifying the Needs of Chinese Business Students for Developing BELF Pedagogy

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Abstract

This study aims to explore the developmental needs of Chinese international business students in the context of Business English as a Lingua Franca (BELF) teaching methodology and investigate how to enhance their intercultural communication competence by developing tailored instructional materials. Conducted at Heilongjiang International University in China, the research adopts an explanatory sequential design, utilizing both qualitative and quantitative methods. Through needs analysis questionnaires administered to students and semi-structured interviews conducted with Business English teachers, the study delves into the nuanced requirements of students, aiming to provide essential guidance and insights for designing and implementing more effective BELF courses. The findings reveal diverse needs among Chinese students, particularly in English proficiency, business-specific knowledge, business communication skills, cultural awareness, and acculturation skills. In response to these needs, the study proposes a range of strategies, including integrating business-specific knowledge, enhancing English proficiency, cultivating business communication skills, fostering cultural awareness, promoting acculturation skills, and fostering positive attitudes towards intercultural communication. The research outcomes serve as valuable references for optimizing and developing Business English teaching materials, offering crucial theoretical support and practical guidance for enhancing Chinese students' competitiveness and international communication skills in international business.

Keywords: Business English as A Lingua Franca (BELF), Intercultural Communication Competence (ICC), Chinese International Business Students, Needs Analysis, Instructional Materials Development

Introduction

Business English as a Lingua Franca (BELF) is increasingly pivotal in the global business landscape. With the ongoing process of globalization, multinational corporations, international trade, and cross-cultural communication are experiencing unprecedented growth. In such a scenario, the language used in business activities must transcend cultural and linguistic barriers to achieve effective communication and collaboration. Particularly for China, a significant international trade and business hub, mastering Business English as a

Lingua Franca is crucial for enhancing the international competitiveness of individuals and enterprises.

However, Chinese students need help in the field of Business English education. Traditional business English teaching often focuses on language expression and imparting business knowledge but overlooks the cultivation of cross-cultural communication abilities. This has resulted in many Chinese students encountering communication barriers and cultural conflicts in actual business environments, impacting their career development and international communication skills. Therefore, the emergence of Business English as a Lingua Franca (BELF) teaching methodology tailored to Chinese students, emphasizing the development of cross-cultural communication skills, holds significant practical significance and far-reaching implications.

This study aims to explore the developmental needs of Chinese international business students in the context of Business English as a Lingua Franca (BELF) teaching methodology and investigate how to enhance their intercultural communication competence by developing tailored instructional materials. Against this backdrop, the study addresses the following two core questions: 1) What are the needs of Chinese students to develop BELF instructional pedagogy in a business domain? 2) How can BELF instructional materials be developed for Chinese students' intercultural communicative competence in business?

Literature Review

Intercultural Communicative Competence (ICC)

Intercultural Communicative Competence (ICC) encompasses linguistic, sociolinguistic, and discourse competencies and cultural insights, facilitating effective communication across diverse cultural contexts (Byram, 1997). It goes beyond information exchange, emphasizing critical engagement and self-reflection (Byram, 1997). ICC involves cognitive, behavioral, and affective dimensions, emphasizing effective intercultural communication (Fantini, 2019).

The Council of Europe defines ICC as identity, culture, and intercultural encounters constituted by attitudes, knowledge, understanding, and skills (Barrett et al., et al., 2013). Academic courses can cultivate ICC skills such as critical thinking, essential for navigating international business environments (Southwood & Van Heukelum, 2020).

Business English as a Lingua Franca (BELF)

Business English as a Lingua Franca (BELF) facilitates global business communication by prioritizing effective interaction over strict language standards (Seidlhofer, 2005). It accommodates diverse English proficiency levels and cultural backgrounds, emphasizing adaptability and practical communication skills (Kankaanranta & Planken, 2010). BELF has become integral to modern business, transcending national language boundaries and blending cultural perspectives (House, 2002). BELF is vital for global business interactions, emphasizing effective communication and cultural awareness.

BELF pedagogy

The study delves into BELF pedagogy in the Chinese context, focusing on methodologies like ESP, needs analysis, task-based teaching, and case studies (Robinson, 1989). BELF, a subset of ESP, prioritizes real-world needs, authentic materials, and intercultural awareness (Kankaanranta & Louhiala-Salminen, 2011; Martins, 2017; Klimova & Pikhart, 2020). It is a neutral, practical, culturally diverse mode of communication essential for global Business (Martins, 2017). Some researchers highlight the need for ICC integration in Business English education, stressing its importance in the global economy (Li & Dong,

2021; Jayasinghe & Weeraratna, 2022; Gu, 2023). BELF pedagogy emphasizes practicality, authenticity, and intercultural competence in preparing students for international business.

Needs Analysis in English for Specific Purposes (ESP)

Needs analysis in ESP is crucial for understanding learner requirements (Hutchinson & Waters, 1987). It ensures curriculum relevance and effectiveness (Belcher et al., 2011). The process considers subjective and objective learner needs (Avermaet & Gysen, 2006). Basturkmen (2010) highlighted its role in syllabus design, informing course content and approach. However, reliance on standardized materials can neglect individual learner needs (Cowling, 2007). Needs analysis facilitates the integration of language requirements into curriculum design (Hyland, 2006). Tran and Vo (2023) explored ICC needs among tourism students, emphasizing language challenges and cultural adaptability. Rai et al. (2023) surveyed language MOOCs focusing on ICC, highlighting the importance of soft skills in professional communication.

Task-based Language Teaching (TBLT)

TBLT, originating from Prabhu's 'Project' in 1979, focuses on tasks in the target language (Willis, 1996). It prioritizes meaning over form, aligning with a learner-centered approach (Ellis, 2003). TBLT involves open-ended tasks that engage learners in real-life language use (Ellis, 2003). It fosters student-centered, communicative teaching methodologies, promoting problem-solving and innovation (Ellis, 2003). In business English courses, simulated corporate environments can facilitate task-based learning, emphasizing intercultural awareness (Pullin, 2015). TBLT is transformative in language education, moving from traditional structured curricula to learner-focused, engaging approaches.

Gong and Luo (2003) emphasized TBLT's focus on real-world language activities, deconstructed into tasks for skill development. Pullin (2015) advocated incorporating intercultural competence in TBLT for BELF communication, suggesting tasks like simulated meetings and interviews. Yildiz (2019) highlighted TBLT's potential to enhance intercultural understanding in BELF contexts, proposing problem-based approaches. Cai and Lv (2019) stressed integrating ICC into the EFL curriculum using TBLT, promoting cultural knowledge and critical thinking. Xie (2022) examined the efficacy of TBLT in Business English courses, emphasizing student needs in communication skills and the method's effectiveness in enhancing motivation and autonomy.

Research Methodology

This study adopts a mixed-methods approach aimed at investigating the needs of Chinese business students in learning Business English as a Lingua Franca (BELF) and developing teaching materials to enhance their cross-cultural communication abilities. The research employs an explanatory sequential design, integrating quantitative and qualitative methods. Initially, quantitative data is collected through a needs analysis questionnaire comprising 49 detailed questions to assess students' needs and current status in Business English learning. The questionnaire is administered online using the 'Wenjuanxing' application to identify specific student requirements. Subsequently, qualitative data is collected through semi-structured interviews with six Business English teachers to gather their experiences and perspectives on BELF teaching methodology. These interviews in Chinese and English range from 10 to 30 minutes to gain deeper insights and contextualize quantitative findings.

Data collection comprises two phases: the quantitative phase involves descriptive statistics and regression analysis to analyze questionnaire data and identify patterns of student

needs. In the qualitative phase, data collected through semi-structured interviews and observations are analyzed using content analysis methods, including coding and thematic analysis, to provide contextualization and deeper insights into quantitative findings. Integrating quantitative and qualitative data ensures a comprehensive understanding of the demands for BELF teaching methodology and provides a basis for developing practical teaching materials. Additionally, the questionnaire and interview tools undergo validity and reliability testing to ensure data accuracy and credibility during the design process.

Validity and Reliability

The Cronbach's alpha was used for the calculation. The Cronbach's alpha values for the eight questions surpassed 0.7, indicating the effectiveness and reliability of this question set. As a result, researchers can confidently assert the validity of the questionnaire's structure. Additionally, the insights gained from semi-structured interviews corroborate the quantitative data from the questionnaire.

Table 1: Pilot Test Result

Question No.	Question Categories	Cronbach's alpha in Pilot Test	Internal consistency
1-6	Needs Regarding ICC	0.976	Excellent
7-16	Needs for Business-Specific Knowledge	0.975	Excellent
17-23	Perception of English Competence	0.975	Excellent
24-29	Needs for English Competence in their future work	0.975	Excellent
30-36	Needs for Business communication skills	0.975	Excellent
37-41	Needs for Cultural Knowledge	0.976	Excellent
42-44	Needs for Acculturation skills	0.975	Excellent
45-47	Needs for Attitude	0.975	Excellent

Research Findings

The findings of Question1:

Table 2: Different Needs Regarding ICC of the Chinese Students

Domains	N	Mean	Standard Deviation	Interpretation
1. Business Specific Knowledge	121	4.45	0.516	High
2. English competence	121	4.56	0.498	Very High
3. Business communication skills	121	4.33	0.568	High
4. Cultural knowledge	121	4.19	0.734	High
5. Acculturation skills	121	4.12	0.759	High
6. Attitude	121	3.96	0.831	High

The survey highlights the needs of Chinese students in developing Intercultural Communicative Competence (ICC). English proficiency emerges as paramount (M=4.56, SD=0.498), followed by a strong emphasis on Business Specific Knowledge (M=4.45, SD=0.516) and Business Communication Skills (M=4.33, SD=0.568). While Cultural Knowledge (M=4.19, SD=0.734), Acculturation Skills (M=4.12, SD=0.759), and Attitude towards Intercultural Communication (M=3.96, SD=0.831) are rated slightly lower, they remain crucial areas for attention. These findings stress the multifaceted approach needed to enhance ICC among Chinese students.

Business-Specific Knowledge (BSK)

Table 3: The Needs for Business-Specific Knowledge

Domains	N	Mean	Standard Deviation	Interpretation
1. Business negotiation	121	4.30	0.666	High
2. Recruitment	121	4.31	0.592	High
3. Business training	121	4.30	0.628	High
4. Business management	121	4.25	0.662	High
5. Business meetings	121	4.16	0.707	High
6. International Business	121	4.15	0.679	High
7. Business communications	121	4.25	0.674	High
8. Business travel	121	4.24	0.659	High
9. Products and Services	121	3.98	0.730	High
10. Business Marketing	121	4.07	0.743	High

Business-Specific Knowledge (BSK) assessment reveals significant needs across various domains. Mean scores ranging from 3.98 to 4.31 indicate high perceived needs, particularly in business negotiation, recruitment, training, and management. Similarly, business meetings, international business, communications, and travel are crucial areas needing attention. Although products/services and marketing scored slightly lower, they still represent significant needs.

Interviews with six teachers reinforce these findings, highlighting students' need for familiarity with international negotiation strategies, human resource management, and strategic planning models. Teachers also noted needing to improve their knowledge about products, services, and marketing. Addressing these gaps can better prepare Chinese students for the complexities of modern business environments and strategic challenges.

English Competence (EC)

Table 4: The Perception of English Competence

Items	N	Mean	Standard Deviation	Interpretation
1. Know the English vocabulary in the Business context well	121	3.62	0.788	High
2. Use grammatically correct English well	121	3.59	0.771	High
3. Understand what other people say in English well	121	3.41	0.760	Moderate
4. Understand what other people write in English well	121	3.62	0.887	High
5. Speak English fluently	121	3.19	0.778	Moderate
6. Speak English naturally	121	3.32	0.942	Moderate
7. Speak English clearly	121	3.34	0.509	Moderate

The analysis of participants' self-assessed English competence shows moderate confidence in vocabulary (M=3.62) and grammatical accuracy (M=3.59). However, proficiency in spoken (M=3.41) and written (M=3.62) English reveals room for improvement, especially in comprehension.

Teacher interviews support these findings, highlighting struggles with spontaneous speaking (Teacher 1), lower fluency (M=3.19), naturalness (M=3.32), and clarity (M=3.34). Teachers also noted a lack of vocabulary range and minimal exposure to authentic English environments (Teachers 2 and 3), emphasizing the need for immersive experiences and diverse vocabulary training. Additionally, gaps in training across all language skills were identified (Teacher 4), with pauses in conversations (Teacher 5) and difficulties in understanding complex texts (Teacher 6). While participants have a foundational grasp of basic English skills, there is a critical need for targeted training to enhance fluency, comprehension, and natural communication. Enhanced programs and practical speaking opportunities are essential to better prepare students for professional interactions.

Table 5: The Needs for English Competence in their future work

Domains	N	Mean	Standard Deviation	Interpretation
1. to write email	121	4.27	0.658	High
2. to write a report	121	3.98	0.719	High
3. when I present	121	4.19	0.745	High
4. in meetings	121	4.31	0.693	High
5. when I make telephone calls	121	4.03	0.836	High
6. when I make face-to-face communications	121	4.22	0.758	High

The analysis of English Competence (EC) in Table 4.5 highlights the high need for English skills in professional tasks. Participants emphasized significant needs for participating in meetings (M=4.31, SD=0.693), writing emails (M=4.27, SD=0.658), presenting (M=4.19, SD=0.745), and face-to-face communications (M=4.22, SD=0.758). There were also notable needs for making telephone calls (M=4.03, SD=0.836) and writing reports (M=3.98, SD=0.719). These findings underscore the essential role of comprehensive English proficiency in listening, speaking, reading, and writing skills in various work settings.

Business communication skills

Table 6: The Needs for Business Communication Skills

Domains	N	Mean	Standard Deviation	Interpretation
1. Collaboration skills	121	4.27	0.619	High
2. Clear and concise expression skills	121	4.53	0.518	Very High
3. Active listening skills	121	4.19	0.637	High
4. Presentation skills	121	4.33	0.663	High
5. Public speaking skills	121	4.43	0.497	High
6. Body language skills	121	4.22	0.701	High
7. Questioning skills	121	4.16	0.671	High

The analysis of Business Communication Skills in Table 4.6 highlights the critical need for proficiency across various dimensions in professional settings. Clear and concise expression skills (M=4.53, SD=0.518) and public speaking skills (M=4.43, SD=0.497) were rated highest, emphasizing precise verbal communication and persuasive presentation. Presentation skills (M=4.33, SD=0.663), collaboration skills (M=4.27, SD=0.619), and body language skills (M=4.22, SD=0.701) were also crucial, underscoring the importance of effective message delivery and interpersonal interactions. Active listening (M=4.19, SD=0.637) and questioning skills (M=4.16, SD=0.671) were slightly lower but still significant for fostering meaningful dialogue and understanding within teams.

Qualitative insights from teachers further support these findings. Teachers highlighted deficiencies in collaboration, clear expression, body language interpretation, public speaking, and active listening. They emphasized the importance of these skills for teamwork, rapport-building, and conflict management. There is a multifaceted need for comprehensive training in business communication skills. Targeted programs to enhance these skills can significantly improve individual performance and foster a more collaborative and effective professional environment.

Cultural Knowledge

Table 7: The Need for Cultural Knowledge

Domains	N	Mean	Standard Deviation	Interpretation
1. National culture	121	4.45	0.671	High
2. National History	121	4.41	0.703	High
3. Organizational culture	121	4.36	0.645	High
4. Values	121	4.46	0.592	High
5. Faiths	121	4.29	0.747	High

The analysis of Cultural Knowledge in Table 4.8 highlights critical needs in understanding diverse cultural aspects of business. Participants rated national culture (M=4.45) and values (M=4.46) as top priorities, emphasizing their importance for effective intercultural interactions. National history (M=4.41) and organizational culture (M=4.36) were also deemed essential. Knowledge of different faiths (M=4.29) was significant, stressing the need for cultural sensitivity and awareness of religious practices.

Teacher insights supported these findings, pointing to gaps in understanding cultural implications in branding, Western corporate structures, cultural subtleties, and historical contexts. Teachers also noted deficiencies in grasping cultural taboos and sensitivities. Addressing these gaps through targeted education and practical experiences is crucial for professionals to succeed in a globalized market, enhancing cultural competence and fostering respectful international business relationships.

Acculturation skills

Table 8: The need for Acculturation skills

Domains	N	Mean	Standard Deviation	Interpretation
1. Try to understand his/her opinion	121	4.41	0.628	High
2. Try to make him/her feel good	121	4.54	0.578	Very High
3. Try to respect his/her faith and national culture	121	4.44	0.644	High

The analysis of Acculturation Skills in Table 4.9 highlights a strong need for abilities that support effective cross-cultural interactions. Participants indicated high needs for making others comfortable (M=4.54, SD=0.578), understanding others' opinions (M=4.41, SD=0.628), and respecting faith and national culture (M=4.44, SD=0.644).

Teacher insights reinforce these findings. Teacher 1 noted difficulties with Western workplace norms, and Teacher 2 emphasized balancing cultural identity with integration. Teacher 3 highlighted the lack of experiential learning, such as cultural immersion programs. Teacher 4 identified a need for managing cultural conflicts, Teacher 5 pointed out assimilation challenges, and Teacher 6 stressed the importance of cultural empathy. These findings underscore the need for enhanced acculturation training, combining theoretical knowledge with

practical experiences. Addressing these gaps will help individuals navigate intercultural environments, build stronger relationships, and communicate effectively in diverse professional settings.

Attitude

Table 9: The Needs for Attitude

Domains	N	Mean	Standard Deviation	Interpretation
1. Positive	121	4.15	0.628	High
2. Confident	121	3.88	0.580	High
3. Patient	121	4.05	0.729	High

The analysis of attitudes for effective intercultural interactions in Table 4.10 highlights key attributes students prioritize. Positivity (M=4.15, SD=0.628) emerges as crucial for fostering mutual respect, while patience (M=4.05, SD=0.729) is essential for tolerance and adaptability. Confidence (M=3.88, SD=0.580) enables assertiveness in navigating cultural intricacies.

Teacher insights further reveal the need for encouragement to engage with diverse cultures (Teacher 1, 4) and the importance of assertiveness (Teacher 2, 5) and courage in addressing cultural differences (Teacher 3, 6). Additional support and training can enhance these attitudes, fostering more effective and confident intercultural interactions in diverse professional settings.

The findings of Question2:

To effectively develop Business English as Lingua Franca (BELF) instructional materials for Chinese students in the business domain, key strategies emerge from semi-structured teacher interviews:

Integration of Business-Specific Knowledge: Embed high-need business-specific knowledge into the curriculum, leveraging case studies to provide practical insights into real-life business scenarios.

Teacher 1: ".... When developing BELF instructional materials, it's vital to integrate high-needed Business-Specific Knowledge acquired through needs analysis survey... employ case study analysis to deepen students' comprehension and application of BSK. This method immerses them in real-life business scenarios, fostering critical thinking and problem-solving skills essential for success in diverse business contexts ...."

Enhancing English Competence: Focus on developing fluent spoken communication skills, along with practical skills such as writing effective emails and reports, participating in meetings, and making professional telephone calls.

Teacher 1: ".... including modules focused on developing fluent spoken communication skills, through conversational English practice sessions and speaking exercises tailored to business scenarios, empowers students to communicate confidently and fluently..."

Developing Business Communication Skills: Incorporate robust case studies to hone skills like collaboration, clear expression, active listening, and effective presentation while leveraging technology tools for modern business communication challenges.

Teacher 3: "... In crafting BELF instructional materials, a robust integration of case

studies serves as a cornerstone for developing Business Communication Skills.....By immersing students in real-world scenarios, case-based learning facilitates the honing of critical skills like collaboration, clear Expression, active Listening, presentation, public speaking, body Language, and questioning.... BELF instructional materials should prioritize fostering collaboration skills in business contexts, students are better prepared to navigate the intricacies of multicultural teams and the dynamic landscapes of modern business..."

Cultivating Cultural Knowledge: Integrate cultural knowledge modules to understand different national cultures, values, histories, and organizational cultures, essential for effective business communication.

Teacher 2: "... Incorporating cultural sensitivity and intercultural communication skills into BELF instructional materials is essential for effective business communication... including understanding various aspects of cultural knowledge.... "

Promoting Acculturation Skills: Include activities promoting empathy and perspective-taking to navigate intercultural encounters confidently, emphasizing practical application through intercultural case studies.

Teacher 2: "... By integrating activities that promote empathy and perspective-taking, students can navigate intercultural encounters with confidence and respect, enhancing their ability to communicate in global business environments..."

Fostering Positive Attitudes: Nurture positive attributes like confidence, patience, and openness towards cross-cultural communication, encouraging active listening, empathy, and adaptability in global business settings.

Teacher 5: "... BELF instructional materials should address attitudes towards cross-cultural communication from the perspective of nurturing positive attributes such as confidence, patience, and openness...It's crucial to design modules that encourage students to approach cross-cultural interactions with a sense of self-assurance and curiosity...By providing opportunities for students to practice active listening, empathy, and adaptability, they can develop the patience and resilience needed to navigate cultural differences effectively...Moreover, fostering an attitude of openness towards diverse cultural perspectives can enrich students' experiences and enhance their ability to collaborate successfully in global business settings..."

The development process should include comprehensive surveys and interviews to identify specific knowledge gaps and needs, balanced teaching emphasizing theoretical knowledge and practical application, and utilization of digital tools for interactive learning. Continuous feedback and assessment mechanisms ensure the refinement and improvement of BELF materials, ultimately enhancing students' business English competence for success in a global business environment.

Pedagogical Implications

The findings from this study offer profound implications for the pedagogy of Business English education, particularly for Chinese business students. Traditional approaches to teaching Business English often prioritize linguistic proficiency over intercultural competence, leaving students ill-prepared for the demands of global business communication. By adopting a Business English as a Lingua Franca (BELF) pedagogy tailored to the needs of Chinese students, educators can bridge this gap and better equip students for success in international business environments.

Business English curricula should closely reflect actual business scenarios, emphasizing application abilities and problem-solving skills. Flexible teaching methods and diversified assessment approaches, such as project-based learning and case analysis, are advocated to enhance students' comprehensive abilities and practical application skills.

Interdisciplinary integration and practical teaching should be emphasized to enable students to apply their knowledge and skills in diverse cross-cultural environments.

Governments and education departments should increase support and investment in Business English education, enhancing the quality of teacher training and teaching resources. Collaboration between schools/institutions and businesses is encouraged to integrate Business English education with actual business needs. Policies promoting student participation in cross-cultural exchanges and business practice activities can enhance their global competitiveness and employability.

Collaboration between education researchers, business domain experts, and policymakers can promote innovation and development in Business English education. This collaboration can enhance students' understanding of the demands of the business environment, provide them with practical educational resources and training opportunities, and facilitate knowledge exchange and integration across disciplines.

Conclusion and Recommendations

This study advances the scholarly discourse on Business English education by investigating the needs of Chinese business students within the framework of Business English as a Lingua Franca (BELF) pedagogy. In an era characterized by unprecedented globalization and interconnectivity, mastering practical communication skills, particularly in English, is paramount for individuals and enterprises.

The research unveils a gap in traditional Business English teaching methodologies, which often prioritize linguistic proficiency at the expense of intercultural competence. This oversight has left Chinese students ill-equipped to navigate the demands of cross-cultural communication in the international business arena. Through a research design, the researcher has illuminated the multifaceted challenges faced by these students and proposed targeted solutions to bridge this gap. By conducting needs analyses and engaging in qualitative dialogues with educators, the researcher has identified a spectrum of developmental needs for Chinese business students. These encompass not only the enhancement of English proficiency, particularly in oral communication and comprehension, but also the integration of domain-specific knowledge, refinement of business communication skills, cultivation of cultural awareness, fostering acculturation skills, and nurturing positive attitudes towards intercultural interactions.

Furthermore, the study transcends theoretical discourse by providing concrete strategies for developing tailored instructional materials and pedagogical approaches. By leveraging real-world business scenarios, task-based Language Teaching, case studies, and interactive learning experiences, BELF pedagogy is a potent tool for equipping Chinese business students with the requisite skills and knowledge to thrive in diverse international business contexts. Moreover, our research underscores the imperative of integrating digital technologies and establishing feedback mechanisms to ensure instructional materials' ongoing relevance and adaptability. This iterative process of refinement enhances the efficacy of BELF pedagogy and reflects a commitment to continuous improvement in response to the dynamic nature of global business communication.

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Development of A Strategy for Enhancing Business English Instructors' Professional Competency at Universities In Hunan Province, China

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Abstract

To cultivate business English talents to meet the needs of China's rapid economic development, it is urgent for universities to enhance professional competency of Business English instructors. This study aimed to develop a strategy for enhancing Business English instructors' professional competency at universities in Hunan province, China. Through a systematic literature review, the researcher developed a questionnaire to survey 191 Business English instructors' professional competency from 8 universities in Hunan province, China. Based on the qualitative and quantitative analysis, the research result was shown as follows: 1) Business English instructors' overall recognition of professional competence was at a high level, among which the recognition of attitudes was the highest level(M=4.14). 2) Business English instructors' professional competency had high positive correlation with knowledge, skills, attitudes. Knowledge, skills, attitudes had positive impact on Business English instructors' professional competence, among which the greatest impact was knowledge, the regression coefficient was 0.308. 3) A KSA strategy was developed and 7 experts validated the feasibility of KSA strategy for enhancing 39 Business English instructors' professional competence. 4)After the implementation of KSA strategy, in addition to the business practice skill was still at the moderate level, other dimensions have been greatly improved.

Keywords: Business English Instructors，Professional Competency, KSA (Knowledge, Skills, Attitudes), Strategy, China

Introduction

"Professional competence" comes from the West. Since the 1990s, professional competence has become an important issue in global education policies, practices, and research (Lin & Deng, 2016). International organizations and many countries or regions have successively constructed professional competence frameworks. The analysis of 18 professional competencies and their characteristics extracted from 29 global professional competencies frameworks not only reflects the important research results of the international community on 21st century, but also provided reference for policymakers to select 21st century core competencies and develop frameworks (Shi et al., 2016).

A series of standards related to instructors' professional competence have been issued at home and abroad. In 2002, the American Council on the Teaching of Foreign Languages (ACTFL) and the Council for the Accreditation of Educator Preparation (CAEP) jointly formulated "Criteria for Pre-service Training of Foreign Language Teachers". The European Commission has released the "Outline of Education for Foreign Language Teachers in Europe" (European Commission, 2021). The Ministry of Education and Science of the Education in United Kingdom issued the white paper "Teaching Quality", and the United States Department of Labor (2014) issued "Criteria for Business Teachers' Employment Qualifications", which provide important reference for Business English instructors' professional competence.

The Ministry of Education of China(2012) listed Business English major into the "Catalogue of Undergraduate Majors in ordinary Colleges and Universities". By 2021, there are 426 Business English undergraduate majors nationwide, with an enrollment of 40,000 students per year, about 160,000 students in the school totally. The Ministry of Education of China(2018) promulgated the "The China National Teaching Quality Standards for Foreign Language Majors at the bachelor's Level" (National Standards) which opened the prelude to the construction of Business English majors with Chinese specialty in the new period. As one of the 68 majors, Business English major was applicable to "National Standards", which was the only compound foreign language major, bring opportunities and challenges to construction of instructors and talent training mode. "National Standards" clearly stipulated the cultivation objectives of business English talents: Business English major aimed to cultivate talents with a solid English foundation, possessing an international perspective and humanistic literacy, mastering relevant basic theories and knowledge in linguistics, economics, management, and international commercial law, be familiar with the general rules and practices of international business, possessing the ability of English application, business practice, cross-cultural communication, and innovative thinking, being a versatile and applied talent, who can be capable of engaging in international business activities. In order to cultivate high-quality international composite talents that satisfy demands of the "National Standards", it was necessary for universities to have instructors who had good professional competence.

The quality, standard, and effectiveness of any education program mainly depends up on the standards of instructors, the role and responsibilities, while the effectiveness of instructors relies on realizing educational objectives and excel in the process of teaching and learning (Darling-Hammond &Youngs, 2002; Capel et al., 2019). As business English was a newly developed major in recent years, many instructors were transformed from English majors. They did not have much experience and research in terms of professional direction and knowledge in business, and their knowledge structure and content are too shallow and narrow (Zheng, 2022). The educational background of Business English instructors was mainly composed of English and business-related majors. Most of instructors have strong English skills, but lack of business knowledge. Some instructors with business related background have rich practical experience, but lack of English skills and effective educational theories and professional competence, which leads to the lack of instructors' competence. Therefore, universities should strengthen the training of Business English instructors, enhance the professional competence of Business English instructors, and cultivate outstanding Business English instructors who keep pace with the times(Zhang & Guo, 2018).

Since the Business English major was approved in 2012, undergraduate universities in Hunan Province have set up Business English majors. However, at present, the Business English major's instructors in universities like that of most universities in China. Most of the instructors engaged in business English teaching were traditional English instructors. Some instructors did not have a good understanding of how to cultivate business English talents, and

their practical teaching ability was limited, so their professional competence needed to be improved. Business English, as a new compound foreign language major, the research on the improvement of the professional competence of Business English instructors couldn't be ignored. Enhancing instructors' professional competence was the key to meeting the demands for business English talent cultivation and run the major well.

Objective

1. To assess the current level of Business English instructors' professional competency in Hunan province, China.
2. To determine to what degree the factors impact on Business English instructors' professional competency in Hunan province, China.
3. To propose and implement a strategy for enhancing Business English instructors' professional competency in Hunan province, China.
4. To evaluate Business English instructors' professional competency before and after implementing the strategy.

Literature Review

KSA Model

Knowledge, Skills, and Attitudes (KSA) were considered part of the three domains of educational styles of learning activities (Senge, 2000). Benjamin Bloom was the person who connected this to the learning process. He believed that knowledge referred to the cognitive process of mental skills. Attitudes were related to emotional areas and skills (psycho-motor processes of manual or physical skills) that deal with feelings or emotions (Anderson et al., 2000)

Instructors' competence was the key to effective and high-quality teaching. According to the Oxford English Dictionary, competence refers to the ability, skills, and strength that a person possesses to perform a predetermined task. To determine the effectiveness of learning outcomes in any educational system, instructors' competence was measured using the Knowledge, Skills, and Attitudes (KSA) model. The study revealed that there was a strong and positive association among all the determinants of instructors competency, that was knowledge, skills and attitudes. (Parveen, Nazir, & Zamir, 2021).

According to Boyatzis (2008), competency could be a trait or skill, motivation, or may include a person's self-image, social role, or the body of knowledge. Competence includes the necessary factors for achieving significant results in a specific job or job role in a particular organization. The success factor was the combination of knowledge, skills and attitudes (more historically known as KSA) described in specific behaviors and excelling in these jobs or job roles (Spencer & Spencer, 1993). In recent years, the term "competency" has been coined by Haddouchane et al., (2017) as certified competence in a specific subject area acquired through study in a profession that can be evaluated. Wongnaa and Boachie (2018) advocated using the KSA model to define professional competencies as a foundational step for making job descriptions, designing career-oriented training, and teacher evaluation.

1.Professional Competency

An instructor's professional competency was the necessary professional ability for teaching. These include knowledge, skills, attitudes, and other attributes (Tigelaar et al., 2004). Professional competence is often defined as the level of integration of knowledge, skills and attitudes (Stoof et al., 2002; Tigelaar et al., 2004). In this regard, instructors need to demonstrate mastery of the required knowledge, skills and attitudes according to their professional needs (Zhu & Wang, 2014).

Some foreign scholars have also conducted research on the modules and classifications of professional competence. For example, Maria (2011) proposed five professional competence's definitions and reasons of each competence, including systematic thinking skill, predictive skill, normative skill, strategic skill, and interpersonal skill. Marilyn et al (2012) claimed that a multinational research team launched the transnational study programmer "Assessment and Teaching of 21st Century Skills Project" (ATC21S) in 2009. Based on a comparative analysis of 12 professional competence frameworks, a consensus framework was proposed in 2012, covering 10 aspects of professional competence: creativity and innovation, critical thinking, problem solving, decision-making, learning, meta-cognition, communication, cooperation, information skill, ICT skill, local and global citizenship, life and vocational skill, personal responsibility, and social duty.

Factors Affecting Business English Instructors' Professional Competency

De Villes (1986) claimed that competence included knowledge, skills, and individual accomplishment. Competence was an important component of Business English instructors because it could help Business English instructors enhance their individual qualities and offer knowledge and techniques in the teaching process. So, Business English instructors should have enough abilities to help them succeed in the teaching process. To achieve teaching objective, Business English instructors needed to identify important indexes to understand the foundation capability, understand the concepts of interrelated subjects, use the idea of knowledge in daily life, ask and answer questions based on material to raise student's learning motivation. (Pahrudin et al., 2016; Himawan, 2016; Trilling & Fadel, 2009).

Umiyati (2017) stated that the professional ability of instructors was clearly manifested in their mastery of academic and content related to the studying process. While mastering the essence of academic content, Business English instructors were also demanded to grasp courses in their field. In this case, instructors should understand the subject and textbooks, as well as the scientific ideas, ways, and structures related to the materials taught. Technological competence among instructors involved in the capability to use technology as a teaching tool in the class and contains multiple technologies such as operation technique, applying tools to analyze statistics, combining online information with operation multimedia resources (Tambunan, 2014). Sa'ari et al. (2005) pointed out that instructors' understanding of information technology can also affect their abilities in the area of information technology.

2.Strategy for Enhancing Instructors' Professional Competency

Every university desired to have accurate positioning and occupy niche markets, developing a strategy to adapt the niche to university advantages is extremely important (Hamel & Prahalad, 2005). Bertschy et al. (2013) found that the strategies of instructors' professional competence included two models. The first was the "Curriculum, Sustainability, Competence, Teacher Training (CSCT) model". The second model pointed to learning as preparation for the future education for sustainable development (ESD), which showed the development of instructors' careers to meet the needs of future students. In order to improve and develop instructors' professional competence, the research showed that principals seem to implement

strategies in the form of "supervision". The success of a strategy largely depended on leadership's ability to build commitment, connect the right strategy, and vision, and manage the resources to support strategy implementation (Amari, 2013).

with the rapid development of Business English major, more and more researchers paid attention to Business English instructors, and their sources and requirements were discussed more and more. In addition, in order to help the development of Business English instructors, many researchers have proposed methods or strategies for professional development of Business English instructors. Bao (2019) pointed out two models for the development of Business English instructors. The first is the collaborative model, in which instructors cooperate with peers to make full use of their respective advantages and complete teaching activities together. Instructors can also learn from peers through classroom observations and further analytical discussions. The other is self-directed development, that is, instructors tap their own potential, realize self-learning according to their own needs, and self-reflect through their own teaching process. In addition to these two modes, Yuan (2009) proposed a third mode of training, including language training and professional training. This model requires regular training of instructors. Guo (2015) proposed a new teacher development model of "discipline development + professional skills + professional ethics".

Research Methodology

Participants

In this study, 191 Business English instructors from 8 universities were selected as the target research participants in Hunan province, China. 191 participants come from first-class undergraduate and application-oriented major as well as top two private universities in Hunan province, China.

The proposed strategy was implemented in Hunan International Economic University to enhance Business English instructors' professional competence. 39 Business English instructors in this university were used as participants. The implementation time from August, 2023 to January, 2024. The results of strategy implementation were used for discussion in this study.

Questionnaire Design

Through the systematic literature review of recent sources and structured interview from Business English experts and instructors, the questionnaire was constructed in this study. In order to ensure the validity of questionnaire, the researcher invited 5 experts to validate questionnaire items and measurement according to IOC system, Exploratory Factor Analysis (EFA) were conducted to ensure feasibility of questionnaire.

There were 44 questions in this questionnaire. The questionnaire consisted of four parts: The first part was demographic information, mainly including Business English instructors' gender, teaching years, professional title, education background, major of highest degree. The second part was knowledge dimension, which included language knowledge, business knowledge, pedagogical knowledge, and information technology knowledge. In this dimension, there were 18 items, language knowledge and business knowledge had 4 items prospectively, pedagogical knowledge and information technology knowledge had 5 items prospectively. The third part was skills dimension, which included language skill, teaching skill, scientific research skill and practical skill. In this dimension, there were 17 items, language skill and teaching skill, scientific research skill had 4 items respectively, and practical skill had 5 items. The fourth part was attitudes dimension, which included cognitive concept,

teaching emotion and perceptual control. In this dimension, there were 9 items, cognitive concept, teaching emotion and perceptual control had 3 items respectively.

In this study, the researcher adopted quantitative method and qualitative method. Specific data collection methods were used according to every research objective, including content analysis, structured interview, Exploratory Factor Analysis (EFA) , Mean, standard deviation, multiple regression, 360-degree interview, Paired samples t-test.

Research Findings

For Research objective one: To assess the current level of Business English instructors' professional competency in Hunan province, China.

For this objective, Mean and Standard Deviation were used to assess the current level of Business English instructors' professional competency in Hunan province, China. Table 1 showed the current level of Business English instructors' professional competency in Hunan province, China.

Table 1: The Current Level of Business English Instructors' Professional Competency

Dimension	Mean	SD	Interpretation
Knowledge	3.52	.59	High
Skills	3.42	.39	Moderate
Attitudes	4.14	.50	High
Language Knowledge	3.29	.24	Moderate
Business Knowledge	2.95	.13	Moderate
Pedagogical Knowledge	3.80	.04	High
Information Technology Knowledge	3.87	.93	High
Language Skills	3.73	.86	High
Teaching Skills	3.37	.58	Moderate
Scientific Research Skills	3.37	.81	Moderate
Business Practice Skills	3.27	.64	Moderate
Cognitive Concept	4.19	.77	High
Teaching Emotion	4.09	.77	High
Perceptual Control	4.10	.76	High
Professional Competence	3.66	.25	High

As can be seen from Table 1, the Mean value of attitudes was 4.14, which indicated the level of Business English instructors' attitudes was highest. The level of Business English instructors' skills was lowest (M=3.42, SD=0.39). The level of Business English instructors' knowledge was relative high.

For Research objective two: To determine to what degree the factors impact on Business English instructors' professional competency in Hunan province, China.

For this objective, multiple regression was used to determine to the degree of factors impact on Business English instructors' professional competency in Hunan province, China.

H1: The knowledge, skills and attitudes have significant impact Business English instructors' professional competency at universities in Hunan province, China.

H1.1: The knowledge, skills and attitudes have significant impact Business English instructors' professional competency at universities in Hunan province, China.

Table 2: Correlation Analysis of Factors Impact on Business English Instructors' Professional Competency

orrelation actor	11 Dimensions										
nfluence actor	K	K	K	TK	S	S	RS	RS	C	E	C	usiness English PC
nowledge	.582**	.461**	.666**	.452**	.116*	.271**	.220**	.302**	.065**	.018**	.062**	.866**
kills	.268**	.119**	.430**	.035**	.494**	.510**	.594**	.585**	.036**	.005**	.022**	.670**
ttitudes	.041**	.031**	.002**	.001**	0.001**	.118*	0.046**	.015**	.724**	.734**	.403**	.333**
usiness English PC	.511**	.406**	.563**	.394**	.339**	.365**	.369**	.399**	.254**	.216**	.159*	

Note: Business English PC= Business English Professional Competence
LK=Language Knowledge BK=Business Knowledge
PK=Pedagogical Knowledge ITK= Information Technology Knowledge
LS= Language Skill TS=Teaching Skill
SRS=Scientific Research Skill BPS=Business Practical Skill
CC=Cognitive Concept TE=Teaching Emotion PC=Perceptual Control

According to the correlation analysis results in Table 2, it can be seen that business English instructors' professional competency had high positive correlation with knowledge, skills, attitudes.

Table 3: Multiple Regression Analysis of Factors Impact on Business English Instructors' Professional Competency

imensions	Influence Factor		^{2}	R^2			Sig.
anguage Knowledge	Knowledge		.341	.331	.203	.566	<0.001
	Skills				.119	.038	0.564
	Attitudes				.092	.037	0.530
usiness Knowledge	Knowledge		.219	.206	.954	.493	<0.001
	Skills				0.230	0.080	0.260
	Attitudes				0.072	0.032	0.622
edagogical Knowledge	Knowledge		.475	.466	.043	.588	<0.001
	Skills				.509	.193	<0.001
	Attitudes				0.020	0.010	0.858
nformation	Knowledge		.2	.2	.830	.524	<0.001

Technology Knowledge			31	18			
	Skills				0.416	0.177	0.013
	Attitudes				.005	.003	0.965
Language Skill	Knowledge		.253	.241	0.148	0.101	0.146
	Skills				.167	.535	<0.001
	Attitudes				0.024	0.014	0.827
Teaching Skill	Knowledge		.276	.264	.077	.078	0.254
	Skills				.699	.476	<0.001
	Attitudes				.121	.105	0.092
Scientific Research Skill	Knowledge		.357	.347	0.035	0.025	0.699
	Skills				.254	.606	<0.001
	Attitudes				0.098	0.061	0.299
Business Pract	Knowledge		.347	.337	.087	.079	0.225

ical Skill	Skills				.905	.553	<0.001
	Attitudes				.001	.001	0.988
ognitive Concept	Knowledge		.527	.520	.086	.065	0.239
	Skills				0.018	0.009	0.867
	Attitudes				.107	.724	<0.001
eaching Emotion	Knowledge		.539	.532	0.019	0.014	0.791
	Skills				0.035	0.018	0.739
	Attitudes				.118	.734	<0.001
erceptual Control	Knowledge		.168	.155	0.107	0.082	0.259
	Skills				.087	.045	0.538
	Attitudes				.608	.403	<0.001
rofessional ompetence	Knowledge		.975	.974	.308	.713	<0.001
	Skills				.2	.373	<0.001

					4 0		
	A ttitudes				.1 6 0	.32 0	< 0.001

In Table 2, the results of multiple regression analysis showed that knowledge, skills, attitudes had positive effect on Business English instructors' professional competence, among which the knowledge had the greatest impact on Business English instructors' professional competence, and the regression coefficient is 0.308. Secondly, skills had a greater impact on Business English instructors' professional competence, and the regression coefficient is 0.240. Attitudes had a low impact on Business English instructors' professional competence, and the regression coefficient is 0.160.

Language knowledge, business knowledge, pedagogical knowledge and information technology knowledge had positive effects on knowledge. Language skills, teaching skills, scientific research skill and business practical skill had positive effect on skills. Cognitive concepts, teaching emotion and perceptual control had positive effect on attitudes.

For research objective three: To propose and implement a strategy for enhancing Business English instructors' professional competency in Hunan province, China.

For this objective, based on descriptive findings from the level of Business English instructors' professional competence and correlation and regression analysis, the researcher conducted 3 steps for the development and implement of a strategy.

Step 1: The researcher developed a strategy for enhancing Business English instructors' professional competency in Hunan province, China.

Based on the results of correlation and regression analysis, the researcher developed a KSA strategy model for enhancing Business English instructors' professional competence, which was shown in Figure 1.

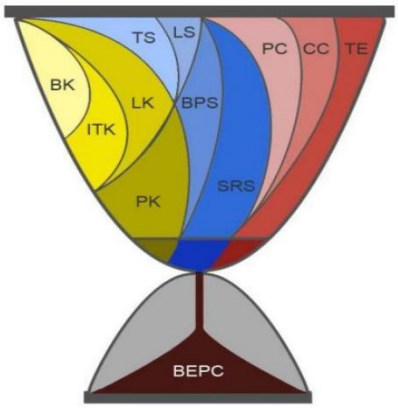

Figure 1: A KSA Strategy Model for Enhancing Business English Instructors' Professional Competence

This KSA strategy model was presented in an hourglass shape, which was divided into three factors in the top half, BEPC (Business English Professional Competence) was in the down half. The order of three factors was to plan according to the degree of factors that affect the professional competence of Business English instructors, which was knowledge, skills and attitudes. Only with all these three factors can the professional competence of Business English instructors be improved.

Three colors represented three factors in the Figure, the first part was yellow part, which was knowledge. Based on correlation analysis, PK (Pedagogical Knowledge), LK (Language Knowledge), BK (Business Knowledge) and ITK (Information Technology Knowledge) had correlation with Business English instructors' knowledge. The corresponding position and order of 4 dimensions related to the degree of affecting Business English instructors' knowledge. Based on the result of regression analysis, PK can mostly affect Business English instructors' knowledge, so, this order was PK, LK, ITK and BK.

The second part was blue part, which was skills. Based on correlation analysis, SRS (Scientific Research Skill), BPS (Business Practical Skill), TS (Teaching Skill) and LS (Language Skill) had correlation with Business English instructors' skills. The corresponding position and order of 4 dimensions related to the degree of affecting Business English instructors' skills. Based on the result of regression analysis, SRS can mostly affect Business English instructors' skills, so, this order was SRS, BPS, LS and TS.

The third part was the red part, which was attitudes. Based on correlation analysis, TE(Teaching Emotion), CC(Cognitive Concept) and PC(Perceptual Control) had correlation with Business English instructors' attitudes. The corresponding position and order of 3 dimensions related to the degree of affecting Business English instructors' attitudes. Based on the result of regression analysis, TE can mostly affect Business English instructors' attitudes, so, this order was TE, CC, and PC.

Step 2: The strategy would be checked and validated by 7 experts with rich research and management experiences in the English and educational administration field.

The KSA strategy has been checked and validated by 7 experts. All experts are professors or have doctoral degree, who has at least 20 years working experiences in the English-related and educational administration field. They also have rich teaching, research and management experiences and achievements. Thus, they have enough ability to validate the strategy and these experts' validation played a critical role before implementing the strategy into practice.

Step 3: The strategy was implemented in Hunan International Economics University in Hunan province, China.

Based on the KSA strategy model, the researcher developed an implement plan for enhancing Business English instructors' professional competence. The strategy was implemented in 3 steps, step 1 was to enhance Business English instructors' knowledge, the researcher implemented 4 training activities. Step 2 was to enhance Business English instructors' skills, due to the level of Business English instructors' skills was relative weak in the Business English instructors' professional competence, the researcher implemented different activities for enhancing each dimension of skills. For enhancing Business English instructors' scientific research skill, training was implemented firstly. And then, three activities were implemented, such as : cooperate with applying for research project, curriculum development, developing textbook. For enhancing Business English instructors' business

practical skill, the researcher provided opportunities for Business English instructors to enterprises and encouraged them to guide business practice projects. For enhancing Business English instructors' teaching and language skill, the researcher implemented training, teaching seminar and teaching competition. Step 3 was to enhance Business English instructors' attitudes, the researcher implemented 1 training activity. The detailed contents of strategy implementation were shown in Figure 2.

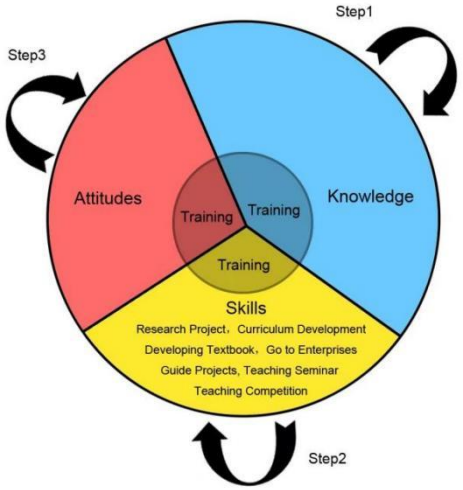

Figure 2: The Detailed Contents of Strategy Implementation

For research objective four: To evaluate the Business English instructors' professional competence before and after implementing the strategy in Hunan International Economics University in Hunan province, China.

For this objective, firstly, after implementing the strategy, the researcher retested Business English instructors' professional competence. A paired samples T-test to check the pre-test and post-test results of Business English instructors' professional competence. Secondly, the researcher reported the effect of strategy from 360-degree feedback, such as: the feedback from Business English instructors, teaching supervisors, students, and enterprises.

H2: There's significant difference between Business English instructors' professional competencies before and after the researcher implemented a strategy for enhancing Business English instructors' professional competency in Hunan International Economics University.

The researcher used paired sample T-test to assess Business English instructors' professional competency after implementing the strategy. The results was shown in the following table, which indicated Business English instructors' professional competency in Hunan International Economics University was improved

Table 3: The Paired Sample T-test of Business English Instructors' Professional Competence with Pre-test Questionnaire and Post-test Questionnaire

	Mean	SD	t	P
Pre-test Business English instructors' professional competence - post-test Business English instructors' professional competence	-0.172	0.142	7.532	<0.001***

N=39，***p<0.001.

The data in Table 3 showed that after the implementation of the strategy, Business English instructors' professional competence has been significantly improved.

Moreover, related report come from the 360-degree feedback, such as: the feedback from Business English instructors, teaching supervisors, students, and enterprises. All the feedback proved the effectiveness of the strategy implementation.

Discussion

Factors that Affect Business English Instructors' Professional Competency

Through the systematic literature review, this study concluded that the factors that affect the professional competence of Business English instructors were knowledge, skills and attitudes. Business English instructors' knowledge contained language, business, pedagogy, and informational technology. Business English instructors' skills contained language, teaching, research, and practice. Business English instructors' attitudes contained cognitive concept, teaching emotion, perceptual control.

Through the expert validation of questionnaire and the exploratory factor analysis method determined that the factors affecting the professional competence of Business English instructors were knowledge, skills, and attitudes once again. The principal component analysis method was carried out to analyze 11 principal components. The analysis results showed that there was an internal relationship between all variables, and the relationship between each principal component and the original variable could be clarified. Moreover, the correlation coefficient between each question in the questionnaire and the principal component is greater than 0.5, which can be regarded as the composition of the principal component. Then, the maximum variance method is used for analysis. The analysis results showed that all the questions corresponding to the principal component are correct.

In a word, It was reasonable and feasible to conclude that affect the factors of Business English instructors' professional competence were knowledge, skills and attitudes.

Current Level of Business English Instructors' Professional Competency in Hunan province, China.

Through the questionnaire survey of 191 Business English instructors from 8 higher universities in Hunan province, China. This study found that the score of Business English instructors' attitudes was the highest(M=4.14), indicating that Business English instructors' attitudes is very positive. Ulug et al., (2011) claimed that instructors' positive attitude impacted students' learning motivation, attitude towards school and homework, students' self-confidence, and thus affect the development of students' personality. It was found that

instructors' positive attitude had a positive effect on students' individuality and life performance.

In terms of knowledge, this study found that the Mean score was 3.52, which ranked the second level among the three influencing factors. From the results of data analysis, business knowledge of Business English instructors was relatively weak (M=2.95). In addition, the Mean score of Business English instructors' language knowledge was 3.29. Business knowledge and language knowledge were less than 3.5, indicating that Business English instructors' professional competence were at a moderate level. In the literature review, some researchers done research on the professional competence of Business English instructors, they mentioned the importance of business knowledge for Business English instructors and pointed out business knowledge of Business English instructors was shortage and the language knowledge of Business English instructors with business education background was shortage. For example, Wang & Ge(2016) claimed that business knowledge is interdisciplinary knowledge for foreign language teachers, and the mode of compound Business English major is "English + business", which teaches business knowledge in English and improves English skills in business knowledge. Therefore, instructors need to have both language knowledge and business knowledge. It is not very easy to enhance Business English instructors' business knowledge in the short time. Especially, it was also not very easy for Business English instructors with business education background to enhance their language knowledge.

In terms of skills, this study found that the Mean score was 3.42, which ranked the weakest level among the three influencing factors. From the results of data analysis, the level of business practice skill of Business English instructors was weakest (M=3.27). Except for language skill, business practice skill, teaching skill and scientific research skill were at the moderate level.

About Business English instructors' business practice skill, Karatsiori M(2016)claimed that Business English instructors need to have industry experience and business practical skill . Before the implementation of strategy, Business English instructors' business practice skill was in the moderate level. Through cooperating between Business English instructors and enterprises, Business English instructors have achieved some results. However, due to the short implementation time of the strategy and the impact of the evaluation of Hunan International Economics University by the Ministry of Education, the university did not allow instructors to take temporary job training and other activities in enterprises from August 2023 to January 2024. So, the business practice level of Business English instructors was still in the moderate level.

About Business English instructors' language and teaching skill, which applied good teaching methods in the class and improve the effectiveness of teaching. Business English instructors should focus on cultivating basic skills and adapting to the characteristics of each student (Pahrudin et al, 2016; Himawan, 2016; Trilling & Fadel, 2009). Under the fierce competition in the cultivation of talents, Business English instructors must have integrated teaching skill of a blend of language and disciplinary content, cross-cultural foreign language teaching skill, critical thinking of language teaching skill (Hu &Sun, 2006). Thus, it was necessary and important for Business English instructors to improve teaching skill.

About Business English instructors' scientific research skill, Business English was an interdisciplinary subject, and the scope of scientific research projects can be language, business, or a combination of language and business. However, for Business English instructors with a short teaching experience, they had less scientific research experience and less achievements after taking good account of teaching tasks. It was also difficult for qualified Business English instructors to apply for high-level scientific research projects. After the

implementation of this strategy, the researchers organized training activity to provide Business English instructors with some guidance for scientific research, broaden their ideas for scientific research, and the instructors also obtained some gratifying results. However, due to the short time for the implementation and evaluation of the strategy, if there was more time in the future, it was suggested to give Business English instructors more opportunities to attend some high-grade academic conferences in the industry outside the university and encourage instructors to report topics together with experts outside the school, learn from each other and make progress together.

Extent to Knowledge, Skills and Attitudes Influence Business English Instructors' Professional Competency in Hunan province, China.

Professional competence was often defined as the level of integration of knowledge, skills and attitudes (Stoof et al., 2002; Tigelaar et al., 2004). In this study, the conceptual framework was based on KSA model. KSA, as an educational model, aimed to identify design education disciplines by decomposing them into manageable factors. Three factors could be divided according to different aspects of control design education: knowledge, skills and attitudes. Professional competence was the integration of knowledge, skills and attitudes, $PC=(K+S)^A$ (Chu, 2016). Knowledge was made up of facts, such as information obtained in education and teaching. Skills referred to the executive ability necessary to complete certain tasks and jobs. Attitudes were personal characteristics such as creativity, productivity, and confidence (Kunter et al., 2013).

From these studies, it could be seen that the factors affecting instructors' professional competence were usually putting knowledge first place. According to the results of regression analysis in this study, knowledge, skills, attitudes, among which knowledge dimension had the greatest impact on Business English instructors' professional competence, and the regression coefficient was 0.308. Secondly, skills had a greater impact on Business English instructors' professional competence, and the regression coefficient was 0.204. Attitudes had a low impact on Business English instructors' professional competence, and the regression coefficient was 0.160.

Therefore, the sequence of factors affecting Business English instructors' professional competence in this study was consistent with the framework of this paper. First was knowledge, second was skills, and finally was attitudes. According to the results of data analysis, the overall attitudes of Business English instructors was good.

Conclusion

This research took 8 universities as a research object in Hunan province, China. The research objective was to assess the current level of Business English instructors' professional competency and determine to what degree the factors impact on Business English instructors' professional competency, propose and implement a strategy for enhancing Business English instructors' professional competency, finally, evaluate the effectiveness before and after implementing the strategy in Hunan province, China. According to every research objective, the brief conclusions were summarized as follows:1) Business English instructors' overall recognition of professional competence was at a high level, among which the recognition of attitudes was the highest level(M=4.14). The Mean score of knowledge was 3.52, which ranked the second position in three dimensions. The level of skills was 3.42, which was the lowest level. 2) Business English instructors' professional competency had high positive correlation with knowledge, skills, attitudes.The results of multiple regression analysis

showed that knowledge, skills, attitudes had positive effect on Business English instructors' professional competence, among which the knowledge had the greatest impact on Business English instructors' professional competence, and the regression coefficient was 0.308. Secondly, skills had a greater impact on Business English instructors' professional competence, and the regression coefficient was 0.240. Attitudes had a low impact on Business English instructors' professional competence, and the regression coefficient was 0.160. 3) Based on the results of correlation and regression analysis, a KSA strategy was developed for enhancing Business English instructors' professional competence. The feasibility of KSA strategy was checked and validated by 7 experts. 4) After the implementation of the strategy of this study, 39 Business English instructors were surveyed again, in addition to the business practice skill, which was still at the moderate level, the other dimensions had been greatly improved.

Acknowledgments

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Environmental Sustainability: An Exploration of Thai Passengers' Green Behaviors Applying Value-Attitude-Behavior Theory

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Abstract

This study aims to illustrate the influence of biosphere value on ecological attitude and also biosphere value on Thai passengers' green behavior. The ecological attitude is also tested as a mediator between biosphere value and Thai passengers' green behavior, which findings found limited in a Thai context. From the mentioned objectives of the study, the value-attitude-behavior (V-A-B) theory was employing to determine that ecological attitude plays a role as the mediator between biosphere value and Thai passengers' green behavior. Using a quantitative method, data was collected from 225 participants via a structured questionnaire with purposive selection technique to international passengers at Suvarnabhumi Airport, and the Partial Least Square Structural Equation Model (PLS-SEM) was subsequently analyzed by using SmartPLS4 software to test the hypotheses. The findings reveal that biosphere value directly impacts both ecological attitude and Thai passengers' green behavior when traveling by air whereas the attitude acts as a partial mediator between value and behavior.

Keywords: Environmental Sustainability, Biosphere Value, Ecological Attitude, Green Behaviors

Introduction

The average global temperature for 2023 wass measures to be 1.2°c above the average of the pre-industrial period with forecast that it will be one of the Earth's hottest years on record (Madge, 2022). Scientists have been admitted climate change is one of the most serious issues for humanity and that the concentration of GHGs has been rising steadily as a result of human activities, primarily the burning of fossil fuels and changes in land use which leads to increase global temperatures (UN, n.d.). The Global Carbon Project reported that Global carbon dioxide emissions from fossil fuels have increased by 1.0% in 2022 with a new record high of 36.6bn tonnes of CO2 (GtCO2). It also stated that the increase in fossil emissions in 2022 has been primarily driven by a strong increase in fuel emissions as global travel continues to recover from the Covid-19 pandemic (Hausfather,2022).

To help reduce the carbon emission from air transportation, The ICAO sets a Basket of Measures to Mitigate Climate Change policy which leads to reduce fuel consumption in aviation. The policy consists of 1) Aircraft Technology and Standard 2) Air Traffic Management and Operation 3) Sustainable Aviation Fuels and 4) Carbon Offsetting and

Reduction Scheme for International Aviation (CORSIA) (ICAO, 2019). Gössling & Dolnicar (2023) found that the achievement of carbon mitigation involves not only the ICAO but many different parties such as aircraft manufacturers, airlines, airports which provide products and services; the government and its green policies; last but not least, the individual's green behavior. Upon the concept that everyone on earth should participate in greenhouse gas reduction, individuals can diminish co2 emission on the earth's climate by the lifestyle choices they make and by their support of emissions-reducing policies (Bernard et al., 2022).

Although the air transport section plays a critical role in co2 emissions and other environmental damages, it seems to be only limited researches in Thailand on passengers' traveling green behavior. To fill with the gap, this research then aims to illustrate the voluntary mitigation action from Thai passengers in flying green. There are several studies indicated that ecological attitude turns into ecological behavior. Moser (2015) suggested that consumers care for the environment reflect the environmental attitudes in their green purchasing behavior. Ecological attitude also contributes direct and immediate impact on pro-environmental behaviors as previously found by Paswan et al. (2017) and Jakucionyte-Skodiene et al. (2022). However, Wyss et al. (2022) stated that ecological attitudes are more predictive of ecological behavior when personal costs are low or environmental benefits are high.

In several environmental studies, values have been tested and shown to have a strong impact on environmental attitudes which, in turn, strongly influenced behaviors (Kim et al., 2020). Walsh et al (2021) investigated business travelers' attitudes and their sustainable travel behavior found that values influence (although at different levels) the sustainable attitudes and behavior. According to Homer & Kahle (1988), in the value-attitude- behavior theory "the influence should theoretically flow from abstract values to midrange attitudes to specific behaviors". To investigate Thai passengers' green behavior when traveling by air in this study, the V-A-B theory, based on the notion that the influence of values on specific behavior is mediated by attitudes toward the behavior, will be applied.

Objectives/Research Questions: Thai passengers' green behavior by air in this research is hypothesized to be influenced by eco-system value which has ecological attitude as a mediator. The study consequently aims to explore both the impact of biosphere value upon ecological attitude and the impact of biosphere value upon Thai passengers' green behavior. Additionally, the ecological attitude as a mediator will also be tested.

Three research questions were put forth:

1) Does biosphere value directly influence Thai passengers' green behavior?

2) Does biosphere value directly influence ecological attitude?

3) Does ecological attitude play a mediating role between biosphere value and Thai passengers' green behavior?

Literature Review

Biosphere Value:

According to Cambridge Dictionary, value is "the beliefs people have, especially about what is right and wrong and what is most important in life, that control their behavior." Weber (1905/1958), defined that value not only playing an important role in sociology, psychology and anthropology but also being used to explain the individuals' motivational bases of attitudes and behavior. When thinking of values, individuals think of what are important to their lives for everyone has hold numerous values with various degrees of importance (Schwartz, 2012). According to Bouman et al. (2018), there are four values concerning individual beliefs and behaviors: biosphere value, altruistic value, egoistic value and hedonic value. Among those

values, biospheric is considered to be individuals concern for environment, hence this paper will target on such value.

The biosphere value particularly applied to predict Individuals' green behaviors and reflect the importance of how people care about nature and the environment. Biosphere value promotes benefits for the environment and the more individuals embrace biosphere value, the more they tend to perform pro-environmentally action (Jans et al., 2018 & Bouman et al., 2018). Van der Werff and Steg, 2016 found in their study that Individuals' biosphere values shown directly strong impact on ecological attitudes, intentions and behavior. A study of green purchase behavior in Hong Kong revealed that value strongly influenced their attitude towards environmental issues which in turn effected positively on behavior (Cheung, 2019). Based on the above findings, this study then would like to investigate such determinant in Thai context. Hence, the following hypotheses were formulated.

H1: Biosphere value directly influences Thai passengers' green behavior.

H2: Biosphere value directly impacts on ecological attitude.

Ecological Attitude

In psychology, an attitude refers to individuals' feelings towards someone or something which can be favorable or unfavorable, like or dislike which turn into an influence over behaviors. Attitudes are defined as a learned tendency to evaluate people, things, issues, objects positively or negatively, however, the evaluations can also be uncertain at times (Cherry, 2018). Ecological attitude is an individual's tendency to be aware and care for the natural environment which is positively related to daily pro-environmental behaviors, according to Hawcroft & Milfont (2010). Bleidorn et al. (2021), ecological attitude impacts consumers' environmental friendly behaviors over time and across individuals with different demographic and psychological backgrounds. In an investigation of green purchasing, there is a positive and significant relationship between green attitude and green purchasing behavior (Amoako et al.,2020).

Supporting the VAB model, Milfont et al. (2010) revealed their finding in the cross-cultural study in Brazil, New Zealand and South Africa that environment friendly attitude played as a fully mediator between value and ecological behavior. A study of Shin et al. (2017) stated that biosphere value influences willingness to pay more for an organic menu (green behavior) via ecological attitude. One of the results from the food waste research is revealed that the sustainable value has a strong effect on waste reduction behavior whereas attitude played as mediator which turned into descending order when eating out at restaurants (Kim, 2020). Hence, the following hypothesis was formulated.

H3: Ecological attitude plays as a mediator between the relationship of biosphere value and Thai passengers' green behavior.

The value-attitude-behavior theory has been involved in various environmental studies to predict the green behavior. Kim et al. (2021), studied sustainability crowd funding initiative, revealed that value has substantial impacts on attitude and that attitude are found to have positive impacts on participation. Han et al. (2019) indicated that value and attitude are essential in illustrating individuals' eco-friendly behavior when studying the eco-cruise purchasing intention. According to Homer and Kahle (1988) value-attitude-behavior hierarchy model, value influence behavior via attitudes which means that attitude plays a mediating role on value and behavior. The frame work below has been put forth in Fig. 1:

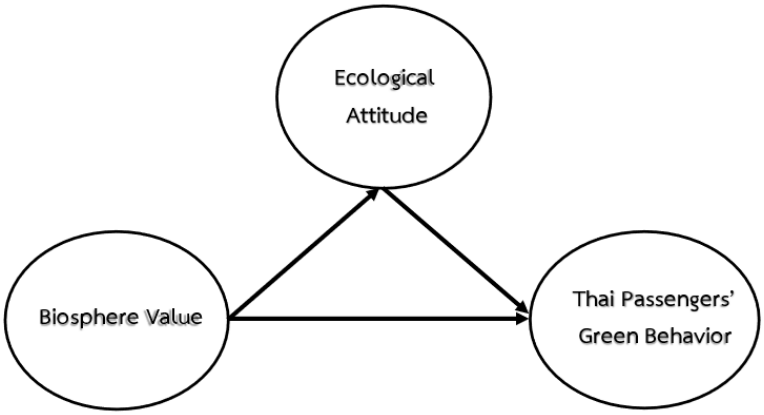

Figure no. 1: Research Framework

Research Methodology

Participants and procedure

The target sampling for this study were Thai passengers who have experienced flying commercial airlines, specifically on an international flight. Following the recommendation of Hair et al. (2011), minimum sample size estimation method in PLS-SEM is the "10-times rule" method which builds on the assumption that the sample size applied on an empirical study should be greater than 10 times. According to 18-item measurement, then data will be collected at least 180 respondents, however, by using purposive sampling technique, there were 225 participants joined the face to face interview via questionnaire at Suvarnabhumi Airport.

The questionnaire was developed based on a review of the literature. It was validated using Index of Item – Objective Congruence (IOC) technique by three professors in the field before being trialed with 30 samples. The Cronbach's Alpha Coefficient obtained from the data for this set of questionnaires is 0.748. All items were measured using a 5-point Likert scale ranging from "1 - strongly disagree" to "5 - strongly agree".

Measurement

Biosphere Value is measured by 6 items developed by Shin, Y. H., Moon, H., Jung, S. E., & Severt, K. (2017):

1.I believe it is important to harmonize with other species and nature.
2. I prefer to fit into nature rather than control nature.
3. I like to protect the environment.
4. I anticipate preserving nature.
5. I believe in protecting natural resources.
6. I consider the balance of nature is delicate and easily upset.

Ecological Attitude is measured by 5 items Shin, Y. H., Moon, H., Jung, S. E., & Severt, K. (2017):

1. It is important to me that the products I use don't harm the environment.
2. I consider the potential environmental impact of my actions when making many of my consumption decisions.
3. I am concerned about wasting the resources of our planet.
4. I would describe myself as environmentally responsible.

5. I am willing to be inconvenienced in order to take environmentally sustainable actions.

Thai passengers' green behavior is measured by 7 items used in the research of Praneetham (2018):

1. I pack my baggage with light weight stuff to reduce aircraft fuel consumption.
2. I choose to fly with the airlines which invest in new engines and high technology aircraft to help reducing carbon dioxide emissions and noise pollution.
3. I choose to fly with airlines which use bio fuel to mitigate co2 emission.
4. I am pleased to donate or pay more money to offset carbon I made when flying.
5. I avoid charging my cell phone or any devices' batteries to save aircraft energy.
6. I reuse the plastic glass when on board to save our earth.
7. I avoid using the airlines' blanket to reduce the laundry affecting the environment.

PLS- SEM Analysis

The research was tested by employing the Partial Least Squares Structural Equation Model (PLS-SEM). The developed conceptual model was drawn in SmartPLS4 software, which calculated and assessed various parameters. These included item loading, reliability, and validity tests using a measurement model evaluation; whereas the structural model assessment evaluated the influence of independent variables upon dependent variables and also examined the mediator.

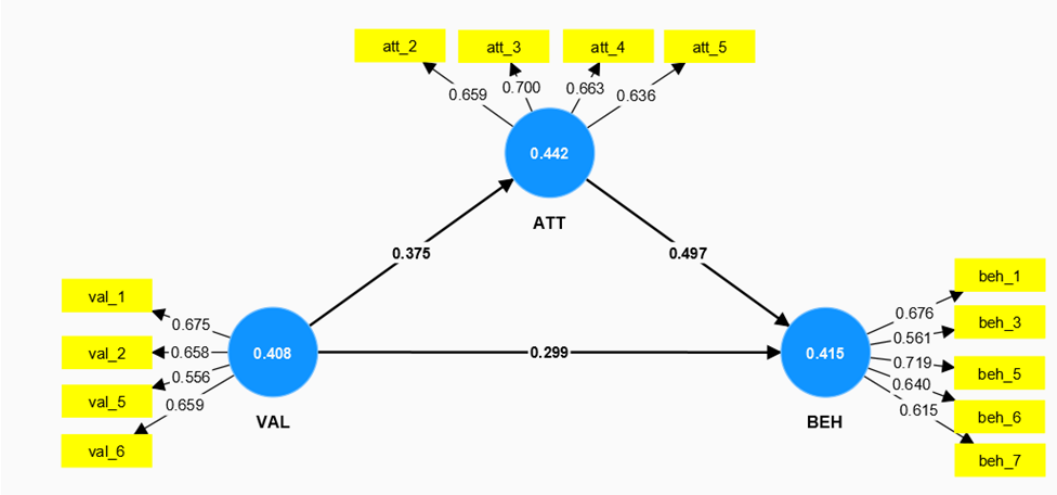

Figure no. 2: Structural Model using Consistent Pls Algorithm

Measurement Model Evaluation

In the PLS approach, there is an outer model evaluation for reliability measurement, whereas an inner model evaluation is incorporated to measure validity. Table no. 1 shows the outer loading values from 0.262 - 0.677, which are acceptable at 0.5 while those with less than 0.5 should be deleted (Chin, 1998; Hair et al., 2011). However, Henseler et al. (2009) explained that the value of outer loading between 0.4 and 0.7 should be considered before withdrawal. In this study, the cut-off value is taken for outer loading at 0.5 or greater. The composite reliability (CR) of each construct in the measurement is accepted for confirmatory purposes at a value higher than 0.7 (Hair et al., 2011) All indicators in this study are displayed in table no.1 while

those with value of AVE less than 0.5 according to the specific construct of Hari et al., 2011 will be deleted as shown in table 1.

Table 1: Construct Reliability and Validity

Latent Variables	Indicator Variable	Cronbach's Alpha	Outer Loading	Composite Reliability	AVE
Biosphere Value (VAL)	val_1	0.750	0.622	0.705	0.507
	val_2		0.638		
	val_3*		0.485		
	val_4*		0.262		
	val_5		0.549		
	val_6		0.620		
Ecological Attitude (ATT)	att_1*	0.780	0.498	0.749	0.574
	att_2		0.611		
	att_3		0.657		
	att_4		0.649		
	att_5		0.578		
Passengers' green behavior (BEH)	beh_1	0.787	0.629	0.788	0.550
	beh_2*		0.485		
	beh_3		0.583		
	beh_4*		0.441		
	beh_5		0.677		
	beh_6		0.633		
	beh_7		0.582		

Note: *deleted items (outer loading < 0.5)

The √AVE values represent the discriminant validity (Fornell-Larcker, 1981). Table 2 shows that each latent variable does not interrelate, since the value of each construct is higher than the others as shown in table no. 2.

Table 2: Discriminant Validity (Fornell – Larcker Criterion)

Variable	ATT	BEH	VAL
ATT	0.665		
BEH	0.609	0.644	
VAL	0.375	0.485	0.639

Note: ATT = Ecological Attitude, BEH = Passengers' Green Behavior,VAL = Biosphere Value

Structural Model Assessment

The structural model assessment is the testing of Multicollinearity which can mislead the findings due to the corelated between or among the variables. According to Hair et al. (2011) independent variables in the model are not correlated with one another, showing no multicollinearity when the VIF value is no greater than 5.00 as shown in table no. 3.

Table n3: VIF testing result (independent variables)

Variables	VIF
val_1	1.126
val_2	1.167
val_5	1.266
val_6	1.248
att_1	1.069
att_2	1.192
att_3	1.215
att_4	1.193
att_5	1.128

Note: VAL = Biosphere Value, ATT = Ecological Attitude

The assessment includes coefficient determinant (R^2), path coefficient (ß), t-statistics and significance level respectively. The R^2 value at 0.240 for ATT means that The biosphere value can predict ecological attitude for 24.00 %. The R^2 value at 0.448 for BEH means that the biosphere value and ecological attitudes can predict Thai passengers' green behavior for 44.80 %, which is displayed in table no. 4.

Table 4: coefficient determinant (R^2)

Dependent Variables	R^2	R^2 Adjusted
ATT	0.240	0.236
BEH	0.448	0.442

Note: ATT = Ecological Attitude, BEH = Passengers' Green Behavior

Research Finding

Hypothesis Testing

The path coefficient (ß) demonstrates the strength of an effect from independent variables to dependent variables. The value of the path coefficient must be higher than 0.10 with a significant level less than 0.05 and t - statistics should be higher than the critical value at 1.960. With the PLS-SEM approach, the algorithm and bootstrapping process calculate standard errors, constructs confidence intervals, and performs hypothesis testing. All of the mentioned values are shown in table 5.

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Table 5: Path coefficient, t-statistics, and P-value

Hypothesis	Impact of independent upon dependent variable	ß	T value	P value	Hypothesis
H1	VAL----------›BEH	0.299	5.763	0.000	Accepted
H2	VAL----------›ATT	0.375	4.764	0.000	Accepted

Note: VAL = Biosphere Value, ATT = Ecological Attitude, BEH = Passengers' Green Behavior

The inner model shows that VAL has the strongest impact on ATT (0.375), followed by BEH (0.299). The hypothesis path between VAL and BEH is significant with P-value at 0.000, whereas the hypothesis path between VAL and ATT is significant with P-value at 0.000 as well. In conclusion, VAL are significant statistical predictors for both BEH and ATT.

According to the research framework, ATT takes a role as a mediator between VAL and BEH, Wong (2015) explains that for mediation analysis, the 2 - step procedures has been implemented by the bootstrapping approach: (a) the significance of direct effect is investigated without the mediator (ATT) in the model (Figure no. 3); (b) the significance of indirect effect is examined with the mediator (ATT) in the model (Figure no. 4.) This 2 - step procedure has been carried out twice as to test the third hypothesis (H3).

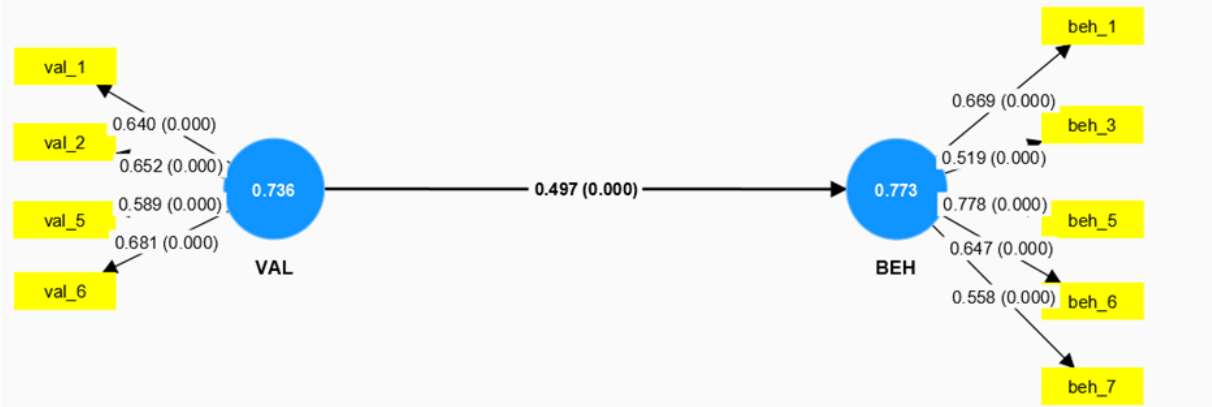

Figure 3: 1st step approach without mediator (VAL to BEH)

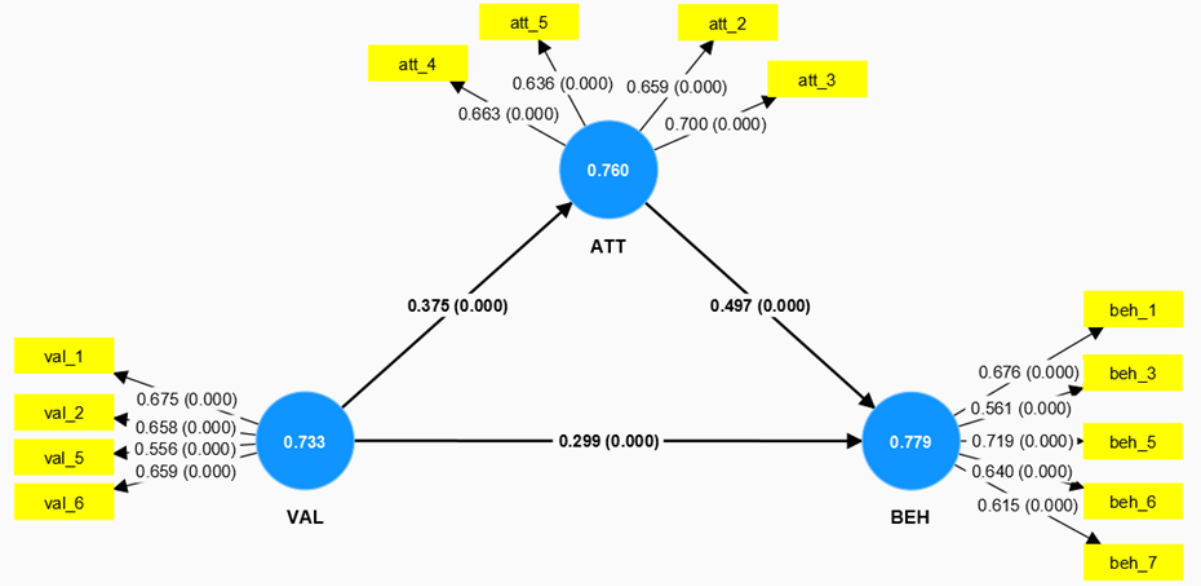

Figure 4: 2nd step approach with mediator (ATT as mediator between VAL to BEH)

Table 6: Mediation Analysis

H	Procedure	Path	ß	Indirect effect	Stdev.	Total effect	VAF	T value	P value	Hypothesis
H3	Step1: Direct effect w/o mediator	VAL--->BEH	0.497	n/a				7.938	0.000	Accepted
	Step2: Indirect effect w. mediator	VAL--->BEH	0.299	n/a		0.375	0.496	8.071	0.000	
		VAL--->ATT	0.375	0.186	0.038					
		ATT--->BEH	0.497							

Note: VAL = Biosphere Value
ATT = Ecological Attitude
BEH = Passengers' Green Behavior

Hair et al. (2011) recommended that the specific variable will be a partial mediator when VAF value exceeds 0.20 while it will be fully mediator when VAF value is greater than 0.80. According to table 6 above, the effect of VAL on BEH via ATT has the VAF value at 0.496 which implies that ATT performs partial mediator to VAL on BEH (H3).

Discussion/Conclusion

This current study explores the direct impacts of biosphere value upon ecological attitude Thai passengers' green behavior when traveling by air, and also to investigate the relationship when the ecological attitude acts as a role of mediator. The biosphere value has the strongest impact (ß = 0.375) on ecological attitude, which is in accordance with the research using VAB theory that value on active transport has a positive effect on attitude toward walking and biking (Kim et. al, 2022). The biosphere value directly effects (ß = 0.299) upon Thai passengers' green behavior which is in line with Amalia et al. (2021) demonstrated that both biosphere value and environmental attitude significantly impacted on the green purchase intention leading to behavior. Besides, Govaerts et al. (2023), studied the Norwegian consumers' behavior revealed that Biospheric values directly influenced attitude whereas attitude significantly affected the consumption of seaweed food products.

Furthermore, the ecological attitude performs a vital role as a partial mediator (VAF=0.496) in the relationship between biosphere value and Thai passengers' green behavior. This is in agreement with the study of Lee et al. (2019) applying VAB theory reveal that hedonic values influence the Purchase Intention which turned to be one's behavior through hedonic attitudes. According to Anuar et al. (2021), the green value and attitude had a significant influence on sustainable transportation engagement. In addition, attitude played a mediating role in the relationship between green value and sustainable transportation engagement. Furthermore, from the study of first year students' sustainable consumption Bosnia and Herzegovina using value-attitude-behavior theory, it demonstrated that the relationship between personal values and sustainable consumption practices is mediated only by pro-environmental attitudes (Činjarević et. al, 2022)

This research examined the impact between biosphere value upon ecological attitude and Thai passengers' behavior when traveling by air. The findings from this study will be of advantages to airlines and administration concerned with their environmental sustainability schemes hereafter. Airlines should encourage their passengers to travel with less emission by promoting the biosphere value and ecological attitude, for it significantly impacts on Thai passengers' green behavior. Airlines and organizations concerned should enhance Thai passengers' willingness to behave environmentally by deploying incentives plan. As the ecological attitude also conducts a partial mediator between biosphere value and Thai passengers' behavior environmental concern, governmental policy-making to build up the green attitude among Thai people should be implemented correspondingly.

Suggestions

Research Limitation

There are some limitations in this research.

1. The purposive selection technique took place at only Suvarnabhumi airport which may limit the respondents to those who are most likely to travel on international routes.

2. As a result of all research questionnaire used in this study are close-ended, we cannot get the information in-depth from the informants.

Future Research

Possibilities for future research can be:

1. Besides the VAB Model, other researches can apply other theories or models to assess passengers' green behavior when traveling by air.

2. Mixed methods should be incorporated for gathering more in-depth data.

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A Study on the Relationship between Leadership Style and Organizational Creativity in SMEs: Based on the Mediating Role of Knowledge Management

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Abstract

This thesis conducts systematic research and analysis on leadership style, knowledge management and organizational creativity, and constructs a relatively rigorous theoretical model. And with 378 SMEs as the research object, we conducted an empirical study and found that transformational leadership and transactional leadership have a significant positive impact on organizational creativity, and knowledge acquisition and knowledge application have a significant positive impact on organizational creativity. Knowledge acquisition and knowledge application can partially mediate between transformational and transactional leadership on organizational creativity. This dissertation offers suggestions for the selection of leadership styles as well as knowledge management to provide insights into the organizational creativity of SMEs.

Keywords: Organizational Creativity, Leadership Style, Knowledge Management

Introduction

According to the United States magazine Fortune, the average lifespan of SMEs in the United States is close to seven years, while the average lifespan of SMEs in China is 2.5 years. This shows that the vitality of SMEs is generally weak in both developed and developing countries. Organizational creativity is of great significance to SMEs, which can promote continuous innovation, enhance competitiveness, promote staff development, improve corporate image, enhance economic efficiency, and promote teamwork, and it is one of the key factors for SMEs to maintain their competitive advantages. Many scholars have given research views on organizational creativity and its impact on the development of SMEs.

This thesis examines and breaks through the previous use of facilitating factors by studying organizational creativity from multiple perspectives, putting forward the corresponding hypotheses from leadership style and knowledge management, and constructing a theoretical model with leadership style as the independent variable, knowledge management as the mediator variable, and organizational creativity as the dependent variable.

Literature Review

Scholars have come to two conclusions when studying the direct impact of transformational leadership on organizational creativity: one is that transformational leadership can positively affect organizational creativity, and the other is that there is a U-shaped relationship between transformational leadership and organizational creativity. Most scholars (Gumusluoglu, 2009; Zhang et al. 2011; Hu Hong et al. 2012; Sun Yonglei et al. 2016; Sun Yonglei and Lei Peili, 2018) hold the first view that transformational leadership is an important antecedent variable of organizational creativity and can increase organizational creativity output. The number of scholars insisting that there is a U-shaped relationship between transformational leadership and organizational creativity is small, and representative scholars include Eisenbeiss and Boerner (2010), who argued that organizational creativity can be promoted when the level of transformational leadership is either low or high; and that organizational creativity is lowest when the level of transformational leadership is moderate.Bass and Avolio (1994) (1994) concluded that transformational leadership consists of four dimensions: visionary motivation, intellectual stimulation, personalized care, and idealized intervention.Bass et al. (2003) adapted the dimensions of transformational leadership based on previous research and proposed that it consists of a combination of visionary motivation, intellectual stimulation, personalized care, idealized intervention, and charisma. Through a large number of empirical studies, Li Chaoping and Shi Kan (2005) developed a scale applicable to the Chinese context, which was considered to contain virtue demonstration, vision motivation, leadership charisma, and personalized care, which was verified to have good reliability and validity through validated factor analysis, internal consistency analysis, and hierarchical regression analysis.Palmer and Short (2008), in their study of the role of vision pointed out that leaders should see vision as an important source of strategic management of the organization, and transformational leaders, by describing the developmental vision to their employees, allow employees to see the future of the organization and understand their own value, which in turn makes them willing to accomplish this vision through their efforts. Western scholars (Van Knippenberg, D., et al., 2013) pointed out that the more personalized caring behaviors leaders give to their subordinates, the more their subordinates' satisfaction with their work will be improved and the creativity of the organization will be enhanced. Li Chaoping and Shi Kan (2005) pointed out that the virtues and character of transformational leaders can set a good example for their subordinates, and through their words and deeds, they can drive and influence the performance of employees in the workplace. The charisma dimension of transformational leadership can boost the morale of employees and enhance subordinates' sense of identification with the leader. As Wang (2012) points out, the more charismatic a leader is, the more employees recognize him or her, which in turn leads to higher levels of employee engagement in the workplace and ultimately to higher levels of team creativity.

Hypothesis 1: Transformational leadership positively affects organizational creativity
Hypothesis 1-1: Virtue demonstration positively influences organizational creativity
Hypothesis 1-2: Visionary motivation positively affects organizational creativity
Hypothesis 1-3: Leadership charisma positively affects organizational creativity
Hypothesis 1-4: Personalized care positively affects organizational creativity

Compared to transformational leadership style, the relationship between transactional leadership and organizational creativity has been relatively less researched due to the fact that scholars generally believe that transactional leadership is always emphasizing on exchange, where employees give only to get paid, and that this behavior can have a great inhibiting effect on creativity (Oke, Munshi and Walumbwa, 2009). However, there are also studies that have come up with different results, Whittington et al. (2009) argue that transactional leadership style can also promote the generation of innovations, except that such leadership behaviors tend to promote incremental nature of improvements in the firms. Pieterse et al. (2010) point out that under transactional leadership style, the limitations of the organization are only the more novel ideas, and the more pragmatic ones will be promoted. innovation. Sun Yonglei and Song Jing (2015) also argue that transactional leadership style is conducive to creativity that is more practical and in line with market needs. In terms of the measurement dimensions of transactional leadership, Bass (1995) argued that transactional leadership is a two-factor structure, including contingent rewards and exception management. Avolio and Bass (2004), after more than 10 years of empirical research, gradually refined transactional leadership behaviors into four dimensions, namely, contingent rewards, active exception management, passive exception management, and laissez-faire management. Chinese domestic scholars basically integrated based on this criterion, with Yao Yanhong (2008) proposing the 4 factors of relational support, doing nothing, typical modeling, and middle-of-the-road approach. Chen Wenjing and Shikan (2014) argued that transactional leadership in the context of Chinese culture includes the four dimensions of contingent rewards, contingent punishment, process monitoring, and expected inputs. Contingent rewards are basically the same as Bass's connotation of contingent rewards and payoffs, and the opposite of contingent rewards is contingent punishment, and contingent rewards and contingent punishment have enriched the content of western contingent rewards and payoffs. The contingent rewards and contingent punishment in transactional leadership make employees understand that they will be rewarded or incentivized accordingly when they achieve the desired results, and they will be punished accordingly when they fail to achieve the desired results. In this process, it is particularly important for transactional leaders to assess the results of work objectively and fairly so that the compensation or rewards are more reasonable. Process monitoring in transactional leadership, through the adoption of active interventions, to monitor the work process of employees and timely correct the deviation in the work of employees. Expected inputs of transactional leadership, through inviting employees' families to have a party, improving the working environment, increasing the treatment of important employees, etc., to increase the sense of belonging of employees and improve the creativity of the organization. The way of doing things in which transactional leaders communicate beforehand, monitor during the process, and reward afterward is the very embodiment of being responsible for the organization and respecting the employees. When employees feel respected, cared for and treated fairly, they are willing to put in the same effort as a reward to the leader. Therefore, the positive impact of transactional leadership on organizational creativity is significant.

Hypothesis 2: Transactional leadership positively affects organizational creativity
Hypothesis 2-1: Process monitoring positively influences organizational creativity
Hypothesis 2-2: Expected input positively affects organizational creativity
Hypothesis 2-3: Contingent rewards positively affect organizational creativity
Hypothesis 2-4: Contingent Punishment positively affects organizational creativity

The mediating role of knowledge management

In recent years, more and more scholars have realized the important role of knowledge management on organizational creativity. Knowledge management is to enhance organizational performance and value creation through the activities of acquiring, creating, selecting, sharing, applying, and updating, and in numerous studies, knowledge acquisition and knowledge application are two important activities. Many studies have shown that knowledge acquisition positively contributes to organizational creativity (Nonaka and Takeuchi, 1995; Gold, Malhotra and Segars, 2001). Knowledge acquisition can increase the heterogeneity and diversity of corporate knowledge, which can help companies to solve inherent problems, cope with change and environmental uncertainty, and promote divergent thinking among employees, which in turn promotes organizational creativity (Liao and Marsillac, 2015).Sullivan (2011) and others argued that in the process of business management operations, knowledge acquisition can provide organizational creativity enhancement to produce a positive effect. According to Liu, Xinmei and Bai Yang (2013), after the organization acquires knowledge, the absorption and transformation of knowledge have an important impact on the level of organizational creativity and organizational innovation performance. Knowledge alone is not enough, it needs to be applied (Griffith & Sawyer, 2010), so the process of utilizing knowledge becomes more important. Lynch and West (2017) argue that knowledge application is positively related to organizational creativity and has the strongest positive impact on organizational creativity when the market is highly volatile. For the measurement of knowledge management activities, different research scholars at home and abroad have their different measurement standards. Lane, Koka and Pathak (2006) used three question items to measure the knowledge acquisition and knowledge application of the enterprise respectively. Park (2006) proposed a process scale containing four dimensions, namely knowledge acquisition, knowledge transfer, knowledge application and knowledge protection.

Hypothesis 3: Knowledge management positively affects organizational creativity
Hypothesis 3-1: Knowledge acquisition positively influences organizational creativity
Hypothesis 3-2: Knowledge application positively affects organizational creativity

Knowledge acquisition has been found to have a mediating effect between other organizational variables and organizational creativity, and Politis (2002) explored the role of knowledge acquisition between transformational leadership and organizational performance using a sample of large Australian technology industries. Zizhen Geng, Xinmei Liu, and Chenhui Yang (2012) found that strategic orientation affects organizational creativity both directly and indirectly through knowledge acquisition. Honghui Miao (2019) stated that knowledge acquisition partially mediates between transformational leadership, transactional leadership, and organizational creativity, and knowledge application mediates between transactional leadership styles and employee innovation performance.Gowen et al. (2009) oriented to the U.S. health care industry and conducted a study on two knowledge management processes, knowledge acquisition, and knowledge application, and found that transformational leadership promotes knowledge management, while knowledge application mediated the relationship between transformational leadership and organizational creativity.

Hypothesis 4: Knowledge Acquisition Mediates Between Transactional Leadership and Organizational Creativity

Hypothesis 4-1 Knowledge acquisition mediates between process monitoring and organizational creativity

Hypothesis 4-2 Knowledge Acquisition Mediates Between Expected Inputs and Organizational Creativity

Hypothesis 4-3 Knowledge acquisition mediates between contingent rewards and organizational creativity

Hypothesis 4-4 Knowledge acquisition mediates between contingent punishment and organizational creativity

Hypothesis 5: Knowledge acquisition mediates between transformational leadership and organizational creativity

Hypothesis 5-1 Knowledge acquisition mediates between virtue demonstration and organizational creativity

Hypothesis 5-2 Knowledge acquisition mediates between visionary motivation and organizational creativity

Hypothesis 5-3 Knowledge acquisition mediates between leadership charisma and organizational creativity

Hypothesis 5-4 Knowledge acquisition mediates between personalized care and organizational creativity

Hypothesis 6: Knowledge application mediates between transactional leadership and organizational creativity

Hypothesis 6-1 Knowledge application mediates between process monitoring and organizational creativity

Hypothesis 6-2 Knowledge application mediates between expected inputs and organizational creativity

Hypothesis 6-3 Knowledge application mediates between contingent rewards and organizational creativity

Hypothesis 6-4 Knowledge application mediates between contingent punishment and organizational creativity

Hypothesis 7: Knowledge application mediates between transformational leadership and organizational creativity

Hypothesis 7-1 Knowledge application mediates between virtue demonstration and organizational creativity

Hypothesis 7-2 Knowledge application mediates between visionary motivation and organizational creativity

Hypothesis 7-3 Knowledge application mediates between leadership charisma and organizational creativity

Hypothesis 7-4 Knowledge application mediates between personalized care and organizational creativity

Research Methodology

All the questionnaires were collected within 20 days, and the validity of the questionnaires was evaluated, excluding invalid questionnaires and retaining only the valid questionnaires for research and analysis. In the process of actual operation, a total of 1512 questionnaires were distributed, 1214 questionnaires were returned, with a recovery rate of 80.3%, excluding the invalid questionnaires, 1088 valid questionnaires were returned, with a validity rate of 89.6%.

The measurements regarding organizational creativity in this paper mainly draw on the 5-item organizational creativity scale developed by Lee and Choi (2003). The measurement of transactional leadership mainly draws on the 4-factor model of contingent rewards, contingent punishment, process monitoring, and expected inputs proposed by Chen Wenjing and Shi Kan (2014), which contains 28 question items. For the measurement of transformational leadership, the research of Li Chaoping and Shi Kan (2005) was mainly adopted, which contains 4 dimensions of virtue demonstration, vision motivation, leadership charisma, and personalized care, with a total of 26 question items, and the scale has been subjected to validated factor analysis, internal consistency analysis, and hierarchical regression analysis, which indicated good reliability and validity. For the measurement of knowledge management, Park's (2006) findings were adopted, which were mainly considered in the dimensions of knowledge acquisition and knowledge application, with a total of 14 items. The variables were all measured in this thesis using a five-point scale with 1=strongly disagree and 5=completely agree.

From the results of the reliability analysis, it can be seen that reliability coefficients of each variable are greater than the general standard of 0.7, so the questionnaire designed in this study has a relatively good credibility.

The results show that the KMO test value, all of which are greater than 0.70, which indicates that the questionnaire is suitable for factor analysis. The results of the Bartlett's test of sphericity show that the test of sphericity for all variables of significance are less than 0.050, so the validity structure is good.

Empirical Results and Data Analysis

Correlation analysis

This study uses Pearson correlation analysis, which is needed to verify whether the variables involved in this study are correlated with each other. If it passes the statistical significance test, it means that there is a significant correlation between the variables; providing a statistical basis for the next regression analysis.

	1	2	3	4	5	6	7	8	9	10	11
Contingent reward	1										
Contingent punishment	.461**	1									
process monitoring	.309**	.354**	1								
Expected input	.490**	.466**	.438**	1							
Virtue demonstration	.397**	.375**	.461**	.497**	1						
Vision Motivation	.517**	.333**	.368**	.408**	.361**	1					
Leadership harisma	.595**	.580**	.413**	.535**	.445**	.454**	1				
Personalized care	.377**	.364**	.314**	.405**	.394**	.358**	.496**	1			
Knowledge acquisition	.558**	.566**	.395**	.592**	.437**	.474**	.643**	.481**	1		
Knowledge application	.551**	.463**	.421**	.489**	.457**	.480**	.566**	.531**	.590**	1	
Organizational creativity	.510**	.485**	.465**	.539**	.484**	.465**	.584**	.521**	.578**	.569**	1

Note: ** Significantly correlated at the .01 level (bilaterally)

The results of the correlation analysis in the above table show that the Pearson correlation coefficient values between the 11 latent variables used in the survey of this study are all above 0.1 and the corresponding significant P-values are all less than 0.05 of the statistical standard of significance, indicating that the correlation coefficient is statistically significant, so it can be sufficiently illustrated that the 11 latent variables used in the survey have a significant correlation between the two.

Path hypothesis testing

In the use of AMOS software path analysis theory to test the results of the established model, the general standard for the critical ratio of t-value should be at least greater than the standard of 1.96, because when the t-value is greater than 1.96, it happens to be that the P-value is also less than the level of significance of 0.05, and if the t-value is less than 1.96, the significance of the P-value does not reach the level of significance.

Table 2: Path Factors

Hypothetical path			**Standardized path factor**	**S.E.**	**C.R.**	**P**
Organizational creativity	<---	Contingent reward	0.074	0.034	1.974	0.048*
Organizational creativity	<---	Contingent punishment	0.091	0.041	2.309	0.021*
Organizational creativity	<---	Process monitoring	0.126	0.031	4.225	***
Organizational creativity	<---	Expected input	0.11	0.038	2.908	0.004**
Organizational creativity	<---	Virtue demonstration	0.095	0.04	2.947	0.003**
Organizational creativity	<---	Vision motivation	0.077	0.033	2.445	0.014*

Organizational creativity	<---	Leadership charisma	0.114	0.04	2.67	0.008**
Organizational creativity	<---	Personalized care	0.163	0.027	5.149	***
Organizational creativity	<---	Knowledge acquisition	0.103	0.044	2.349	0.019*
Organizational creativity	<---	Knowledge application	0.117	0.037	3.027	0.002**

Note: ***P<0.001, **P<0.01, *P<0.05

The standardized path coefficient of virtue demonstration on organizational creativity is 0.095 (t-value = 2.947, p = 0.003 < 0.01), the standardized path coefficient of Vision Motivation on organizational creativity is 0.077 (t-value = 2.445, p = 0.014 < 0.05), the standardized path coefficient of leadership charisma on organizational creativity is 0.114 (t-value = 2.67, p = 0.08 < 0.01), and the standardized path coefficient of Personalized Care on organizational creativity is 0.163 (t-value = 5.149, p = 0.000 < 0.001). It indicates that hypotheses H1, H1-1, H1-2, H1-3 and H1-4 are valid.

The standardized path coefficient of contingent rewards on organizational creativity was 0.074 (t-value = 1.947, p = 0.048 < 0.05), the standardized path coefficient of contingent punishment on organizational creativity was 0.091 (t-value = 2.309, p = 0.021 < 0.05), the standardized path coefficient of process monitoring on organizational creativity was 0.126 (t-value = 4.225, p = 0.000 < 0.001). p=0.000 < 0.001), and the standardized path coefficient of expected inputs on organizational creativity is 0.11 (t-value = 2.908, p=0.004 < 0.01). This indicates that hypotheses H2, H2-1, H2-2, H2-3 and H2-4 are valid.

The standardized path coefficient of knowledge acquisition on organizational creativity is 0.103 (t-value = 2.349, p = 0.019 < 0.05) and the standardized path coefficient of knowledge application on organizational creativity is 0.117 (t-value = 3.027, p = 0.002 < 0.01). It indicates that hypotheses H3, H3-1 and H3-2 are valid.

Mediation effect test

In this study, the Amos software was used to analyze the test of whether there is a significant mediating effect between the variables in the data, and the Bootstrap method was used to select the 95% confidence intervals, and then the 5000 rotational iterations built into the software were used to calculate the test of mediating effect. The upper and lower bounds of the 95% confidence intervals and the significance P-value in the table of results are observed to determine whether there is a significant mediation effect.

Table 3: Bootstrap Method Mediation Effect Test

Intermediary path	Estimate	Lower	Upper	P
Contingent Reward - Knowledge Acquisition - Organizational Creativity	0.012	0.002	0.031	0.022
Contingent Punishment - Knowledge Acquisition - organizational creativity	0.023	0.002	0.051	0.034
Process Monitoring - Knowledge Acquisition - Organizational Creativity	0.001	-0.005	0.01	0.605
Expected Input - Knowledge Acquisition - Organizational Creativity	0.026	0.002	0.057	0.034
Virtue Demonstration - Knowledge Acquisition - Organizational Creativity	0	-0.008	0.007	0.945
Vision Motivation - Knowledge Acquisition - Organizational Creativity	0.01	0.001	0.026	0.025
Leadership Charisma - Knowledge Acquisition - Organizational Creativity	0.023	0.002	0.055	0.032
Personalized Care - Knowledge Acquisition - Organizational Creativity	0.011	0.001	0.027	0.026
Contingent Reward - Knowledge Application - Organizational Creativity	0.025	0.008	0.049	0.003
Contingent punishment - Knowledge Application - Organizational Creativity	0.01	0.002	0.027	0.011
Process Monitoring - Knowledge Application - Organizational Creativity	0.012	0.003	0.027	0.004
Expected input - Knowledge Application - organizational creativity	0.009	0.001	0.027	0.025
Virtue Demonstration - Knowledge Application - Organizational Creativity	0.01	0.001	0.024	0.017
Vision Motivation - Knowledge Application - Organizational Creativity	0.014	0.004	0.031	0.003
Leadership Charisma - Knowledge Application - Organizational Creativity	0.012	0.001	0.033	0.027
Personalized Care - Knowledge Application - Organizational Creativity	0.029	0.009	0.052	0.004

As can be seen through the above table, the indirect effect values of the mediating path (virtue demonstration-knowledge acquisition-organizational creativity) and (process monitoring-knowledge acquisition-organizational creativity) are 0 and 0.001, respectively, and the 95% confidence upper and lower intervals are one positive and one negative, containing 0, and the significance P-value is greater than the criterion of the significance level of 0.05, which indicates that the mediating effect is significantly absent, so that the hypotheses proposed by the present study, Hypothesis 4-1 and Hypothesis 5-1 are not valid;

In addition to this, in the other mediation paths, the value of the indirect effect is a maximum of 0.029, the 95% confidence upper and lower intervals are positive and do not contain 0, and the significance P-value is less than the criterion of 0.05 at the significant level, which indicates that the mediation effect is significantly present. Therefore, hypothesis 4-2, hypothesis 4-3, hypothesis 4-4, hypothesis 5-2, hypothesis 5-3, hypothesis 5-4, hypothesis 6-1, hypothesis 6-2, hypothesis 6-3, hypothesis 6-4, and hypothesis 7-1, hypothesis 7-2, hypothesis 7-3, and hypothesis 7-4 proposed in this study are all valid. Overall, it appears that Assumption 4, Assumption 5, Assumption 6, and Assumption 7 are valid.

Conclusion and Recommendations

Further expansion of sample coverage. This study has met the research requirements despite the fact that it has met the research requirements in terms of the number of samples. However, it is slightly insufficient in terms of sample coverage and representativeness. Relative to the number of SMEs in Shandong Province, the sample size of this study is still small, which to a certain extent affects the significance level of the research results. The correctness of the results of this study can be further verified by enlarging the sample size or corrected in subsequent studies to make the research results more convincing. Meanwhile, some studies have shown that regional culture will have some influence on the results. It is hoped that in the follow-up study, the sample can be expanded to cover the region and a comparative study of different regions can be done so that the results of the study can be more relevant.

Further comparative study on the mechanism of the impact of different leadership styles on organizational creativity. Although the relationship between transformational and transactional leadership is both related and different, the path of influence on the outcome variables is definitely different for the parts that differ between the two leadership styles. It is important to explore how the two leadership styles exert their influence effects in the same organizational scenarios in the spirit of getting to the bottom of the problem. Meanwhile, in this paper, transformational leadership and transactional leadership are mainly selected as the typical representatives of leadership styles in Chinese SMEs, and existing studies have shown that the leadership styles of Chinese business leaders present a kind of mixed characteristics (Wu, Chunbo, Cao, Yangfeng and Zhou, Changhui, 2009). Therefore, the interaction effects of different leadership styles can be further explored in future studies.

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The Power of Data Systems for Driving Problem Solving on Spatial Poverty in Sisaket Province

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Abstract

This research aims to develop and enhance a comprehensive system for verifying household poverty data across Sisaket province. The study emphasizes the participation and acceptance of the data by stakeholders at both the community and local levels, employing Participatory Action Research (PAR) method. The target areas include two districts: 1. Mueang Sisaket District and 2. Huai Tap Tan District. The target groups are 24 local administration organizations (LAOs), the Community Development Department (CDD) in Mueang Sisaket District and Huai Thap Than District, the Sisaket Provincial Social Development and Human Security Office. The analysis was conducted through a process of interpretation for content analysis, synthesis, and antithesis. The developed system, named the Sisaket Equity System (SES), serves as a Central Data System for Sisaket Province, supported by the Provincial Poverty Elimination and Development Committee (PPEDC). The system focuses on managing data and changing situations, reporting issues in six dimensions: 1. health, 2. living conditions, 3. education, 4. incomes, 5. access to government services, and 6. other aspects. It also reports on vulnerable household groups, improves data verification, and the application of the data for practical use. A memorandum of understanding was signed for data verification, data collection, and the use of the Sisaket province database system with the Sisaket Provincial Community Development Office. The direct beneficiaries include the Community Development Department, the Provincial Social Development and Human Security Office, and the PPADC that use the data for comprehensive and accurate planning and problem-solving.

Keywords: data system, solutions for solving spatial poverty problems, data system management

Introduction

Solving poverty problems is a complex challenge which requires great efforts since the problems usually have several related dimensions whether on incomes, education, health and infrastructures. For this reason, solving poverty problems has to use integrated approach covering various aspects such as promoting economic growth to generate works and incomes, education investment and skill development in order to escape from poverty, building health system and thorough social protection, promotion of gender equality and infrastructure investment along with giving significance to environment sustainability as well as having good

governance. Besides, based on the information and management of new challenges, cooperation among stakeholders is also necessary (S Dhinesh, Babu, 2022; United Nations Economic and Social Commission for Western Asia, 2023; M., Sharath, Chandra., et al, 2020).

Solving poverty problems is a complex challenge requiring great sources and efforts since problem issues are related to several dimensions, whether they be education, health, and infrastructures. Therefore, solving poverty problems has to use integrated approach covering several aspects such as promotion of economic growth to generate works and incomes, investment on education and development of skills in order to escape from poverty circle, building health system and thorough social protection, promotion of gender equality and investment on infrastructure along with giving significance on environment sustainability as well as having good governance. Apart from this, cooperation among stakeholders based on the information and management of new challenges is also necessary (S.Dhinesh, Babu, 2022; United Nations Economic and Social Commission for Western Asia, 2023; M., Sharath, Chandra, et al, 2020)

In 2019 the TPMAP Information System reported that Sisaket province ranked number 10 as the poor province. The province, therefore, stipulated an integrated agenda to solve the problem of socially disadvantage people and help the poor covering five dimensions, namely: 1) economic security, 2) education and necessary skills, 3) health status, 4) quality of livelihood, and 5) access to assistance services and social participation, using the TPMAP household data-base. The province has integrated cooperation from every network partner by holding the meetings of Administration Center for Poverty Elimination and Development of Every Generation at the provincial level together with creating an MOU among 12 ministries and one organization and announcing the provincial agenda with two forms of driving mechanisms, namely, the Administration Center for Sustainable Poverty Elimination and Development of Every Generation at the provincial and district levels in 22 centers with 206 operation teams and 119 mentor teams. The task force committee on sustainable poverty elimination and development of all generations on each dimension consists of 93 organizations chaired by a vice provincial governor with main agencies directly responsible for the five dimensions to develop recording skills and TPMAP system, MSO logbook, survey, analyze and classify the target families using ASRE Principles: Attitude, Skill, Resource and Exit. Budget and projects among network agencies should be integrated with the aim for assistance at three levels: survival, sufficiency and sustainability following the model “Si City People, Having Deep Love, Sharing and Having Equal Happiness at Sisaket”, enabling a sustainable self-sufficiency through occupational promotion following the Economy Sufficiency Philosophy in order to elevate the quality of life, and share plant seeds. Every family is a food warehouse store, and every village is a food sharing center, supporting the family for food security through the activities “This house has love, growing vegetables, having products, people loving one another, having unity, couple with Khok Nong Naa. Sisaket province also driving the provincial agenda to decrease the gap, increase quality of peoples’ life by integrating with the network agencies both within and outside the province using Sisaket Rajabhat University as an academic monitoring agency (Sisaket Provincial Office for Public Relations, 2023).

Sisaket Rajabhat University has continuously received support fund for doing research since 2023 from the management agencies of development fund at the area level (MDA) to conduct a research to solve the poverty problem using the poverty platform strategy consisting of 1) accurate information system, 2) delivery assistance, 3) developing innovation for solving poverty problems, and 4) making policy/plan (Kitti Satjawattana, 2021). This has been participated by all sectors in Sisaket province in investigating genuine causes of the poverty,

searching for locations of the poor people, collecting the data of the poor on five aspects (human capital, physical capital, finance capital, natural resources capital, and social capital), and systemizing the poverty data of Sisaket province (Practical Poverty Platform-PPPconnext). Currently, the results of the data analysis based on 21,372 families with 106,684 family members have been stored and reported on the following website: (http://www.ppaos.com/ppaos33/frontend/web/index.php?r =site/stat01&y=2566&p=, since 18 March 2024. Additionally, a study of working mechanism in the area on driving poverty problem solving, the delivery of assistance system for four groups of the poor (suffering group, difficulty group, livable group, and happy group) has also been reported to the related agencies for problem solving together.

In 2019, the results of the study has significance towards solving poverty in three aspects, namely: 1) solving poverty problems must have a clear and reliable information database, 2) solving poverty problems must have the process of bringing the information for establishing community's participation which is a concreate mechanism for solving the problems under the community fund covering five dimensions, and 3) solving poverty problems has connected and integrated with problem solving plan from the sub-district, district and province levels (Sahutsa Ponnil and others, 2023). In 2021, a research re-examined 100% poor families based on the list in TPMAP, in 18 sub-districts/municipalities in Mueang Sisaket Municipality using the process of co-re-examination with the community leaders. It was found that 692 families were missed out from the list of collected 2,760 families with 11,242 members (Sahutsa Ponnil and others, 2022), the information of which showed that it did not cover the whole assistance provided.

Presently, the agency having the mission on solving poverty problem in Sisaket province has had different information database, namely: ThaiOM, TPMAP, MSO logbook and Jorporthor (basic essential needs). It was found that the information in the system was not identical and that the information utilization for running the activities, planning for problem solving with separation and discontinuity as well as duplication in setting the budget. As to enhance the efficient system and mechanism in transferring assistance to the related agencies in Sisaket province to have the information ready for administrators in decision making, being able to correctly and accurately connect the database to external agencies, the Central Data Center should be developed and managed by a participatory basis, and be in line with Sisaket province context.

Objective

To develop and alleviate the system of reaching and re-examining the household data of the poor all over Sisaket province by means of participation and data acceptance by the network agencies both at the community and area levels.

Frame Work of the Study

This study employed a participatory action research with two target districts, namely 1) Mueang Sisaket district, and 2) Huai Thap Than district. The target groups that joined the activity were 24 local administration organizations (LAO), Community Development Office (CDO), Mueang Sisaket district, Huai Tha Than district, Sisaket Office for Social Development and Human Security, (SDHS), and the Committee of the Provincial Administration Center on Sustainable Poverty Elimination and Development of Every Generation Using the Sufficiency Economy Philosophy.

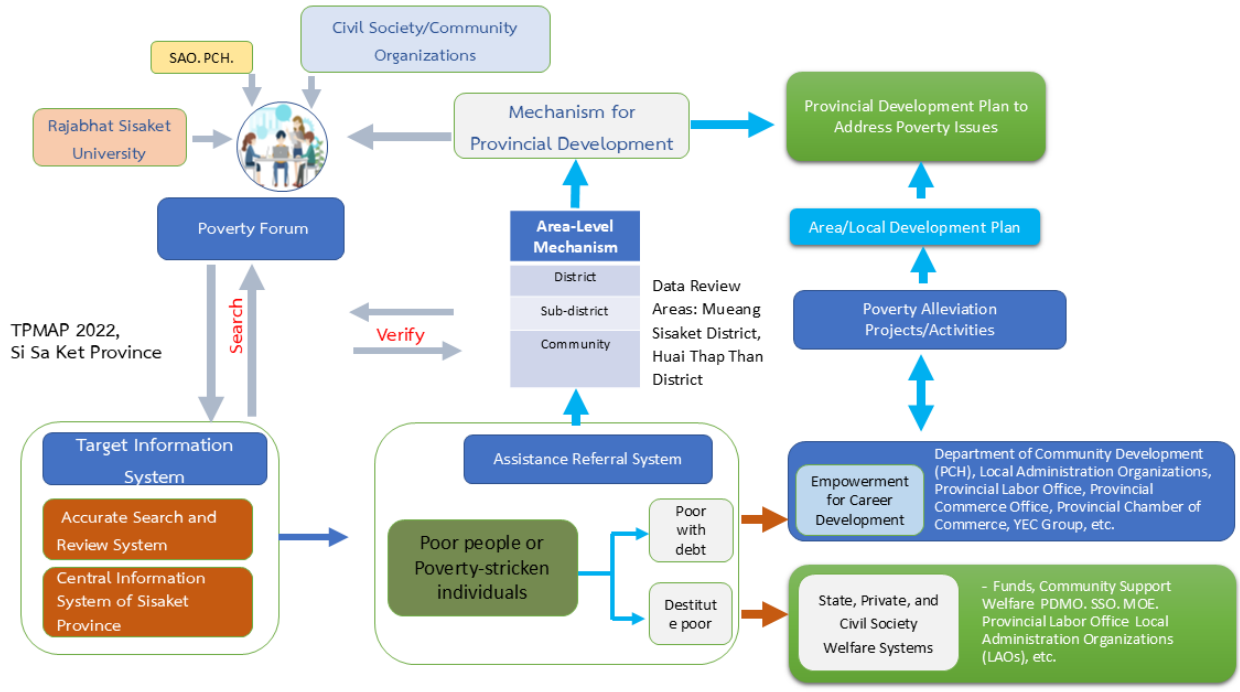

Figure 1: Research Framework
Source: Adapted from Kitti Sajjawatanakul

Literature Review

1. Roles of Network Agencies Related to Solving Poverty Problems

The roles of the network agencies relevant to solving poverty problems and those related to the study to drive innovations to solve poverty problems consisted of 11 agencies, namely: 1) the Provincial Office, having the role of transforming the national strategy into the provincial strategy in the area, and develop an administrative database system; 2) Community Development Office, having the role of making and developing a standard system for community development, the system and mechanism in enhancing learning process, knowledge management, occupation, saving, and management of community fund, supporting and developing community data system, promoting utilization and community information services; 3) Provincial Social Development and Human Security Office having the role as a

national mechanism that supports and coordinate, connect with every network sector for people security of life as well as welfare services and protection; 4) Local Administration Organizations having the role as supporters of peoples' participation in local development, natural resources management; 5) Provincial Office for Commerce having the role of laying the guideline and suggestions in organizing trade regulations, marketing, promoting and developing and solving problems on trade economy, product marketing and services; 6) Provincial Office for Agriculture having the role in providing the information on agriculture, disseminating knowledge on agriculture and providing a mobile agricultural clinic, registering agriculturalists/issuing agriculturalist certificates; 7) Institute for Skill Development having the role of developing working skills and potentials for labor groups; 8) Provincial Agriculture Council having the role of developing and enhancing strength to agriculturalists and agricultural organizations in the province, coordinating the policy among agriculturalist organizations, agriculturalists, research institutes, education institutes and government agencies; and 9) Provincial Chamber of Commerce having the role of collecting statistics, disseminating trade news, conducting researches on trade and economy, and promoting tourism industry; 10) Civil Society Organization, community organizations, institute for community development having the role for driving urban communities to solve poverty problems; Sisaket Rajabhat University, a higher education institute in Sisaket having the mission in locality development in line with solving spatial poverty problems, being the provincial knowledge and wisdom source. Previously, the university has continuously cooperated with both government and private sectors, and has accepted trust being a committee in driving poverty problem solving in Sisaket province for 10 terms.

2. Concepts for Sustainable Livelihood in Sisaket Province

Sisaket province has four concept for sustainable livelihood (DFID, 2000).

1) Concept on livelihood assets consists of 7 aspects of the poor families, namely: human capital, natural capital, money capital, physical capital, social capital, cultural and wisdom and welfare capital (Sahutsa Ponnil and others, 2022).

2) Concept on transforming structures and processes which affect choosing ways of living consisting of two minor parts: structures and processes of the structure, namely (1) government sector referring to functioning agency, that is local administration organization, Ministry of Interior, Provincial Social Development and Human Security Office, Community Development Department, Provincial Public Health Office, Institute for Skill Development, District Committee for Life Quality Development, etc. (2) Private Sector, business agencies having readiness in investment with the community in producing and selling the product at the process level, being the driving section of the structure: (1) process of making harmonious development plans at the community, sub-district, district, and provincial levels; (2) process of making Big Database for solving poverty problems correctly and accurately.

3) Concept on vulnerability context and uncertainty referring to natural disaster (flood, drought) Covid 19 pandemic which brought about unemployment, shortage of incomes, and increase in the number of the poor.

4) Concept on livelihood strategies, survival strategies for the poor in Sisaket has two ways: 1) bringing the capital on resources, culture and wisdom to create occupation and incomes, 2) using the social capital to help and support one another in the community such as *Phapah* merit making, incoming funds for the poor in the village.

3. Collaborative Governance

Collaboration is a process the administrator or authority in an organization connects with the others in the organization or other organizations to work together, share knowledge, information, skills and motivation in order to achieve the goal together. Collaboration is very important in the organization because it brings about efficient work, builds innovation, solves complex problems and sustainably develops the organization (Katzenbach, J.R., & Smith, D.K. (1993); Lencioni, P. (2002); Hackman, J.R. (2011).; Dyer, W.G., Dyer, J.H., & Dyer, W.G. (2013), including connecting with others in decision making (Shrum, W., Genuth, J., & Chompalov, I. (2007). Creating spatial collaboration could be done in two manners: (1) establish formal collaboration through a governing order in case the province is a policy driver by making an invitation letter to agencies of equal level requesting for cooperation to be cooperation networks, and 2) establish informal collaboration through the network made from seminars, coffee council meetings, and meeting of practitioners, which constitute personal relations and informal coordination among agencies. Studies show that the mechanisms in driving collaboration for solving complex poverty problems require both formal and informal collaboration for the policy to be operated and to achieve the goal of the policy (Phimlikid Kaewhanam et al., 2021).

4. Development of Database System

To manage an organization with highest efficiency by using least resources, with utmost benefits, having right information, rapidity, being up-to-date, significance for both government and private administrators in decision making to solve problems in time, the data information will be used for operation plans, being the navigation compass that leads the organization to achieve its aims. To have such data, it requires a systematic, reliable process of data analysis by means of whole-organization participation (Sahutsa Ponnil, 2021) and design of database for data collection, browsing, up-dating, and data collection in an appropriate structure (Elmasri, R., & Navathe , S.B. (2015); Coronel, C., Morris, S., & Rob, P. (2015).

The step of system development, system development life cycle:SDLC of the data system has been divided into five steps, namely: 1) system planning, 2) system analysis, 3) system designing, 4) system development, and 5) maintenance (Opart Iam-siriwong, 2012).

Research Methodology

1.Target Group

The target group consisted of 24 local administration organizations (LAO), Community Development Office (CDO), Mueang Sisaket District Office, Huai Thap Than District Office, Sisaket Provincial Office for Social Development and Human Security (SDHS), and Committee of the Provincial Administration Center on Sustainable Poverty Elimination and Development of Every Generation Using the Sufficiency Economy Philosophy.

2.Research Instruments

This study employed a participatory action research by means of the following activities.

- Hold a meeting in order to explain the process of re-examining of the household data of the poor at the provincial and district levels, back ground and significance of the searching and re-examining of the data for poverty solving, creating the shared target to bring the data into the system for solving poverty problem at the provincial level and forwarding for assistance.

- Set up a stage or platform for re-examining, data of the 100% poor using a participatory process with the stakeholders in 24 subdistricts.
- Select the personnel for data collection, data managers and data recorders in 24 sub-districts.
- Analyze the data system on household poverty at the area level.
- Analyze the situations, problems, needs, implementation of the data information in each level and ideas of related people at the provincial level.
- Hold the meeting to develop management models of the database at the sub-district level.
- Hold the meeting to try out the database system and evaluate the implementation of the system of the related people at the provincial level.
- Train the administrators on implementation of the system at the sub-district level.
- Hold the meeting to present the database system of the relevant people at the provincial level, and explain how to connect the data for the benefits of the provincial offices.

3.Data Analysis

The issues were concluded by means of interpretation for content analysis with three steps: 1) investigate related literature and theories, and guidelines (Thesis), 2) specify steps of the operation, analyze, co-synthesize, and 3) summarize the step of operation, examine the steps from the theories, and explain antithesis.

Research Findings

The Mechanism of Cooperation Network in Driving the System of Data Development to Solve Poverty Problems and Forwarding for Assistance

The mechanism of cooperation network in driving the poverty problem solving in Sisaket province has set up the Administration Center for Sustainable Poverty Elimination and Development of Every Generation following the Economy Sufficiency Philosophy and such a center at the district level, including the spatial operation team in the area to deal with poverty problems and develop every generation based on the designated standard and philosophy with emphasis on appropriate adjustment to geographical condition and resources in each area. The operation is divided into five dimensions of poverty, namely: economic security, 2) education and necessary skills, 3) health, 4) life quality, and 5) access to services, assistance and participation in the society.

The process of development has three main steps, namely, survival, sufficiency and sustainability. However, the important problem is following up the overall result of operation of each sector, particularly the result of assisting poor families or the spatial vulnerable groups taken care by the network agencies that usually perform only their own missions. When the assistance was completed, the data would be reported to the provincial level at the Administration Center for Sustainable Poverty Elimination and Development of Every Generation.

However, there were problems on following up the information from other sectors and integration of assistance together resulting in discontinuity of poor family assistance. Additionally, the main agencies in the area such as local administration organizations lacked of the feedback, particularly the time of assistance and details of the assistance.

Sisaket Rajabhat University has established cooperation networks, signed MOU with the Provincial Office for Community Development for developing the data collection system which has developed the collecting personnel at the sub-district level (Community Development Network) including how to collect, record, and analyze the data, certify the data and forward the information for assistance to the disadvantaged people on five dimensions, including following-up and re-examining the information for improving the report and forwarding the information to the meeting at the spatial level and the district level respectively.

Figure 2: Cooperation network operations to develop a data collection system

Important Mechanism in Cooperation with the Network in Driving the Data System:

1.Following Up Overall Results: It is necessary for enhancing the system in following up the operation on giving assistance to the poor families continuously and efficiently such as following up the assistance which would be improved to suit the people's needs in each area.

2.Data Collection: Data collection and recording are important for data analysis and a suitable and efficient operation plan.

3.Building Cooperation among Agencies: To have a data and resources integration in assisting among relevant agencies such as local administration organizations and Sisaket Provincial Community Office.

4.Innovation Technology Development: Using technology for data collection and information communication can decrease complexity and increase operation efficiency.

5.Establishing Enhancing Cooperation Mechanism: Establishing the system for enhancing cooperation among agencies and social groups can enhance sustainability in solving poverty problems and efficiently develop people of every generation.

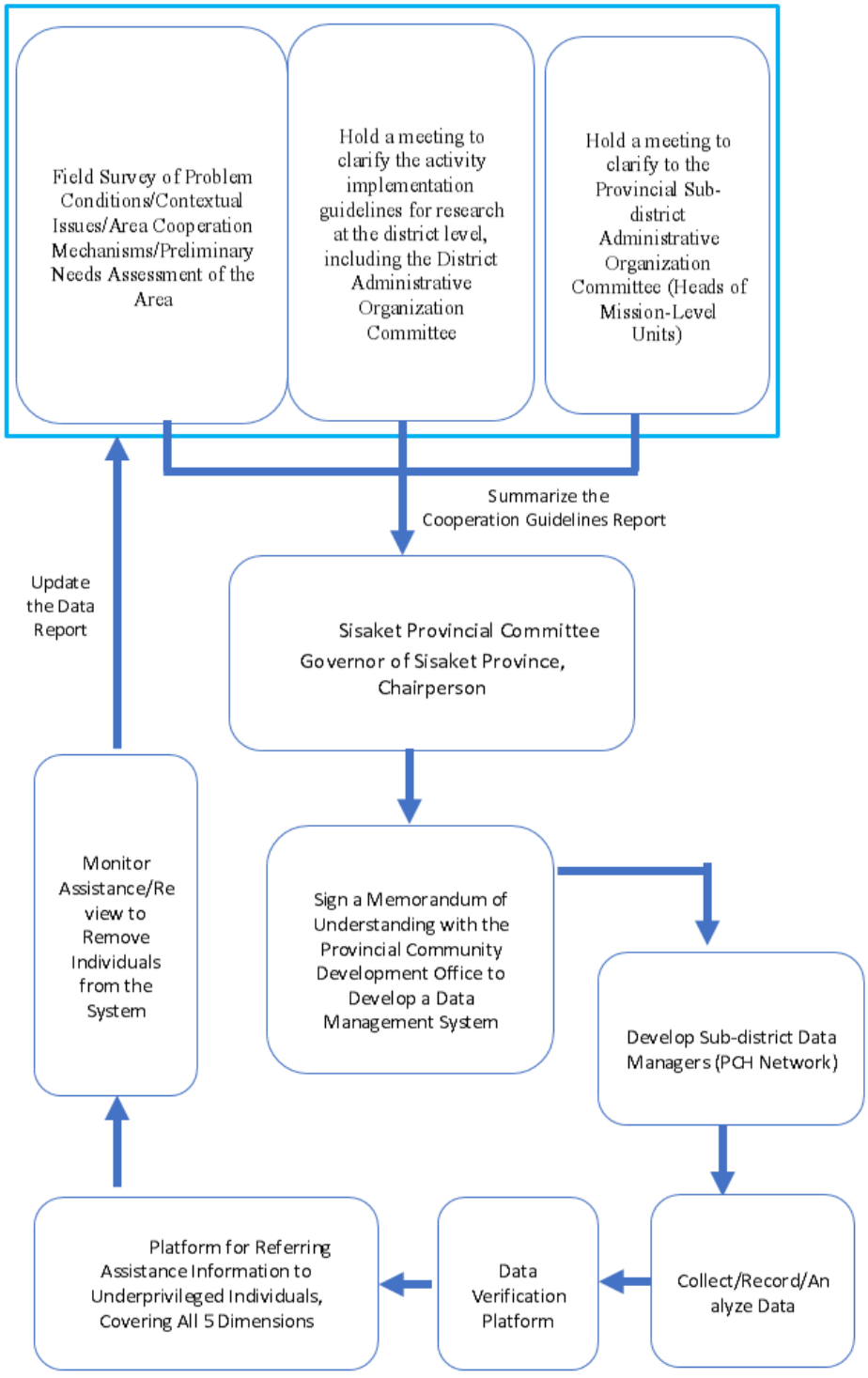

Figure 3: Mechanism for Building Cooperation in Sisaket Province and Referral of Assistance in Sisaket Province

Mechanism of Establishing Cooperation and Forwarding Assistance in Sisaket Province Searching and Re-examining the Data on Poor Families all over Sisaket through Participation and Acceptance of the Data and Network in the Community and Spatial Levels

The starting point of successes in solving poverty problems came from the right and accurate data originated from the acceptance of each other in the area, the process of searching and re-examining of the 100% poor people derived with accurate data and the efficiency of forwarding for assistance consisting of four steps, namely: 1) investigate the context/prepare spatial readiness, 2) data collection, 3) data analysis, and 4) forwarding the data for assistance.

1) Investigate the context/prepare spatial readiness

On readiness of preparation and building understanding at the administration level for poverty problem solving in Sisaket, this study has administered the meeting at two levels to build understanding as well as ask for cooperation from the relevant people.

(1) The committee meeting was held at the provincial and district levels with the governor, chiefs of the related provincial government agencies to explain the research plan and request for suggestions and cooperation when visiting the area to collect data, with emphasis on building understanding on the work and the aim of the study. The meeting is important in establishing support from the highest administrators of the province as for the operation would be done smoothly and efficiently.

(2) Th committee meeting was held at the spatial agency level at each sub-district administration organization with participation of sub-district leaders in Mueang district, sub-district committee on life quality development in Mueang district, chiefs of government agencies in Sisaket, representatives of the Provincial Administration Organization (PAO) and representatives of the local administration organizations (LAO). The meeting aimed at explaining the operation plan of the research in details and requesting for cooperation when visiting the area. Participation of the local administrators is important in driving the policy and plans to the related agencies in truly solving poverty problem.

The meeting at the two levels is the to establish a firm basis in building cooperation and support from every related sector with the aim to have efficient operation and be able to have concrete poverty problem solving in Sisaket province.

Figure 4: The meeting at the two levels is the to establish a firm basis in building cooperation and support

Creating understanding and readiness of preparation in the area for re-examining the data of the poor in Sisaket was done through the meeting explaining the objectives, data collection, and utilization of the data of which the participants were village headmen, sub-district chiefs, representatives of local administration organizations (LAO), and community

leaders. This meeting employed the concept of sustainable livelihood framework as the framework for analysis of the problems and poverty situations in the area. This concept helps define the poor people and specify clearly the causes of poverty. At the meeting, the participants joined in examining the list of poor families from the database TPMAP (Thai People Map and Analytics Platform) by adding up or decreasing the lists of the target groups. Improvement of the data must be approved by the meeting to assure that the current data are correct.

Additionally, questionnaires were also distributed, method of data collection, and process of choosing the data collector, who received trust from the area so that he would be able to get access to elaborate information efficiently and reliably, were also discussed.

The purposes of all the operations were to build understanding and participation from the related people in the area in order to use the data and have accurate data analysis, being able to be used for operation plan in solving the poverty problems in Sisaket effectively.

Figure 5: The meeting explaining the objectives, data collection, and utilization of the data of which the participants were village headmen, sub-district chiefs, representatives of local administration organizations (LAO)

2) Data Collection

The data collection for the study employed a survey form from the central part developed for use in every province, the items of which consist of seven parts: Part 1 being the family data (humancapital, namely, skill, knowledge, labor ability and quality, leader potential, and good health) with 17questions; Part 2 being physical data and public utilities (physical capital, namely, facilities, infrastructure and tools or production machines) with 16 questions; Part 3 being economy foundation (finance capital,namely, money savings applicable for circulation) with 6 questions; Part 4 being natural resources and disasters (natural resource capital, namely, soil, water, air, forest, biodiversity) with fourquestions; Part 5 being social support system (social capital, namely, network groups, civil society, membership as well as household and social relations) with 10 questions; Part 6 being opinions towards problems and impacts from Covid -19 with 3 questions; and Part 7 being opinions towards suggestions with 3 questions. The data collectors have been chosen are residents in the area who have reliability and the local poor people have trust to give information, such as village headmen, public health village volunteers, volunteers for social development and human security. Prior to the data collection, the research team organized a training program to build understanding of the instrument and method of data collection to have the complete and correct data. After storing and checking the data, the data recorders consisting of 25 people in the research team would

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bring the data to the PPPconnext processing system (the management unit on the capital for spatial development (MSP), 2023) to summarize the data analysis on a quantity basis.

Figure 6: Data collection with sample groups in the target area

3) Data Analysis

The results of data analysis of the poor families from the PPPconnect system, showed five average capitals on five sides, namely: human capital, physical capital, finance capital, resources capital, and social capital. Classification of the poor was put into four groups, report of the name list Group 1 forwarded for assistance of the poor rapidly or forward to Group 2 or Group 3 for promoting and occupation development by bringing the classified list of the poor for the meeting with the sub-district administration organization, village headmen, sub-district chiefs, and people with significant roles in sub-district area, listening to additional information and suggestions from the network agencies in the area , and analyze the marketing possibility.

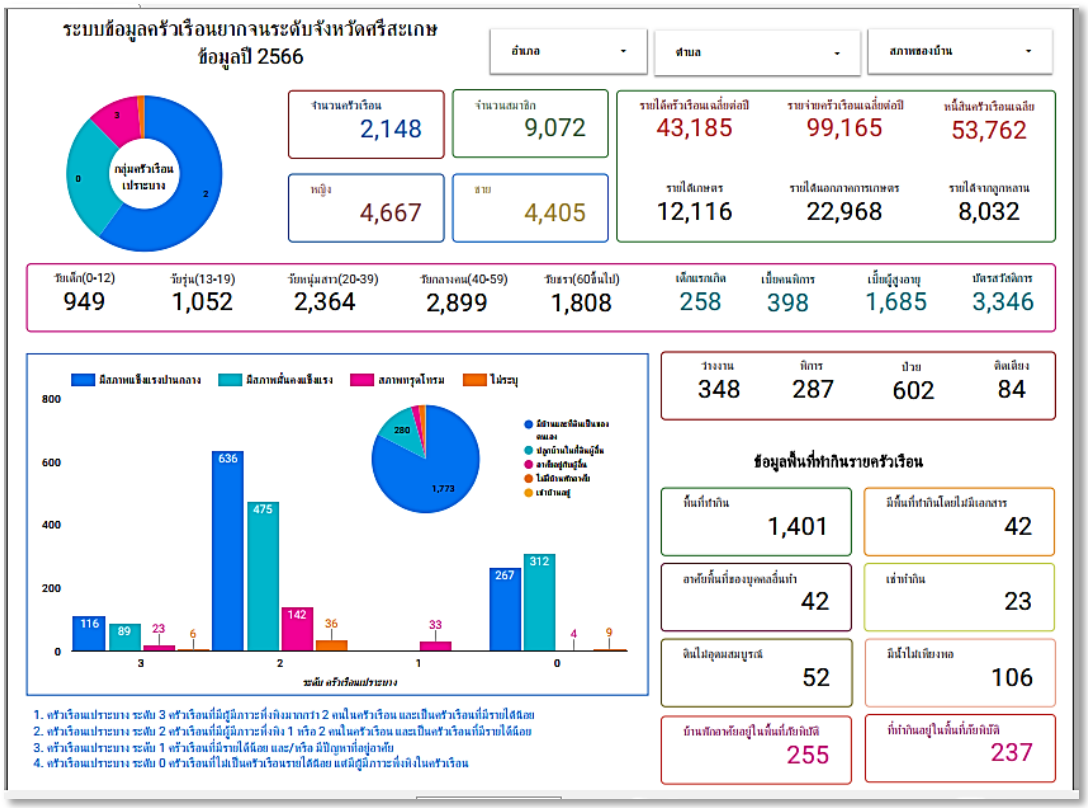
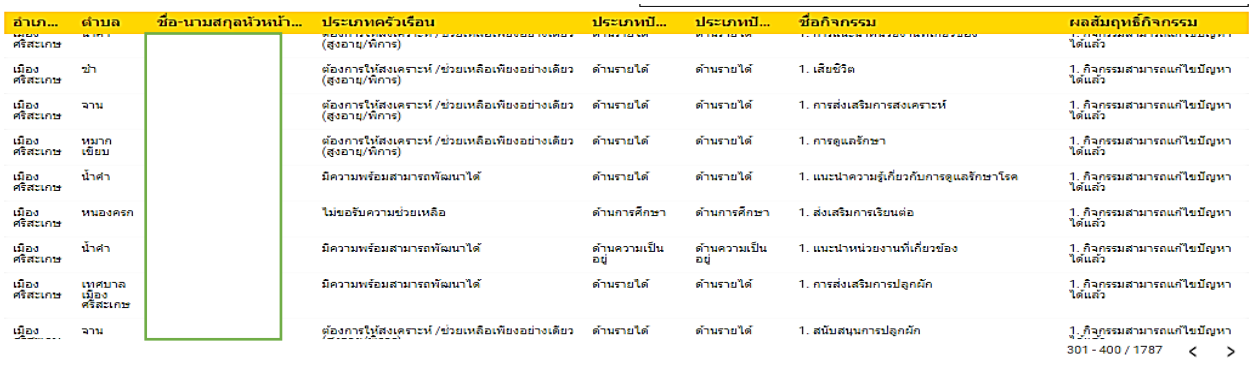


Figure 7: Data analysis results of data analysis of the poor families in Sisaket

4) Forwarding for Assistance

The results of data analysis were classified four groups of poverty: Group 1 living with sufferings, 2) living with difficulties, 3) living alright, and 4) living well. Forwarding for assistance refers to bringing the data in Group 1 to the welfare supporting unit urgently. For Group 2 and 3, the data would be sent for the research project for innovation development to solve poverty and to the related agencies for development of skills, occupation using technology and suitable innovation to elevate income. For Group 4 being the group capable of living without receiving assistance but having ability in investment and receive Group 2 and 3 to join activities/business. The research project would support them with body of knowledge and innovation, decrease the operation cost or expand the amount of production.



อำเภ...	ตำบล	ชื่อ-นามสกุลหัวหน้า...	ประเภทครัวเรือน	ประเภทปั...	ประเภทปั...	ชื่อกิจกรรม	ผลสัมฤทธิ์กิจกรรม
เมือง ศรีสะเกษ			(สูงอายุ/พิการ)				ได้แล้ว
เมือง ศรีสะเกษ	ขำ		ต้องการให้ส่งเคราะห์ /ช่วยเหลือเพียงอย่างเดียว (สูงอายุ/พิการ)	ด้านรายได้	ด้านรายได้	1. เลี้ยชีวิต	1. กิจกรรมสามารถแก้ไขปัญหาได้แล้ว
เมือง ศรีสะเกษ	จาน		ต้องการให้ส่งเคราะห์ /ช่วยเหลือเพียงอย่างเดียว (สูงอายุ/พิการ)	ด้านรายได้	ด้านรายได้	1. การส่งเสริมการส่งเคราะห์	1. กิจกรรมสามารถแก้ไขปัญหาได้แล้ว
เมือง ศรีสะเกษ	หมาก เขียบ		ต้องการให้ส่งเคราะห์ /ช่วยเหลือเพียงอย่างเดียว (สูงอายุ/พิการ)	ด้านรายได้	ด้านรายได้	1. การดูแลรักษา	1. กิจกรรมสามารถแก้ไขปัญหาได้แล้ว
เมือง ศรีสะเกษ	น้ำคำ		มีความพร้อมสามารถพัฒนาได้	ด้านรายได้	ด้านรายได้	1. แนะนำความรู้เกี่ยวกับการดูแลรักษาโรค	1. กิจกรรมสามารถแก้ไขปัญหาได้แล้ว
เมือง ศรีสะเกษ	หนองครก		ไม่ขอรับความช่วยเหลือ	ด้านการศึกษา	ด้านการศึกษา	1. ส่งเสริมการเรียนต่อ	1. กิจกรรมสามารถแก้ไขปัญหาได้แล้ว
เมือง ศรีสะเกษ	น้ำคำ		มีความพร้อมสามารถพัฒนาได้	ด้านความเป็นอยู่	ด้านความเป็นอยู่	1. แนะนำหน่วยงานที่เกี่ยวข้อง	1. กิจกรรมสามารถแก้ไขปัญหาได้แล้ว
เมือง ศรีสะเกษ	เทศบาลเมือง ศรีสะเกษ		มีความพร้อมสามารถพัฒนาได้	ด้านรายได้	ด้านรายได้	1. การส่งเสริมการปลูกผัก	1. กิจกรรมสามารถแก้ไขปัญหาได้แล้ว
เมือง	จาน		ต้องการให้ส่งเคราะห์ /ช่วยเหลือเพียงอย่างเดียว	ด้านรายได้	ด้านรายได้	1. สนับสนุนการปลูกผัก	1. กิจกรรมสามารถแก้ไขปัญหา

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Figure 8: Reporting the Results of Assistance to Targeted Poor People

Development and Alleviation of the Data System for Spatial Family Poverty to Be the Central Data System for the Provincial Data System of Family Poverty (Provincial Thai People Map). Sisaket Equity System (SES) has been developed from the shared approval of the Committee of the Provincial Administration Center on Sustainable Poverty Elimination and Development of Every Generation following the Sufficiency Economic Philosophy as the central data system of Sisaket province which aims at data management/the changing situation, utilizing the information by the agencies directly benefits, namely: Community Development, Social Development and Human Security, and Committee on Provincial Development and Alleviation of Family Poverty Problem, and District Development and Alleviation of Family Poverty Problem for using the data for work planning and complete and accurate poverty problem solving. In this connection, key performance has been set up in accordance with those set up by the province for its self-evaluation (MPI) of Jor Por Thor in TPMAP and THaiQM which the system can collect the data at the sub-district, district and provincial levels.

To develop and alleviate the system of forwarding for assistance for the target poor group to have access to the government/ community or private welfare in a concrete manner, Sisaket province has cooperation mechanism of data integration for solving spatial poverty problem in Sisaket in four steps, namely:

Step 1 Integration and connecting the data of TPMAP, THaiQM MSO Logbook, PPPconnect (connecting the data to outside of PPAOS), re-examine the data to correspond to each other, the participants are from important related provincial agencies, local administration organizations, Sisaket Rajabhat University/ private sector/civil society.

Step 2 Data analysis and report by the research team, Sisaket Rajabhat University . The report of the data has been classified by problem situations into six dimensions, namely: 1) health dimension, 2) living dimension, 3) education dimension, 4) income dimension, 5) dimension on access to government services, and 6) other dimensions. The report on brittle families where people are in the situation that should have assistance and taken care by the families such as little children, the elderly, the disable and the bedridden patients or being the family with little incomes (the family with income less than 100,000 baht). The brittle families are classified into four level (Office of the National Economic and Social Development)

- Level 3 Family with more than two dependencies and with little incomes.
- Level 2 Family with one or two dependencies and with little incomes.
- Level 1 Family with little incomes and or with residence problem.
- Level 0 Family not being a family with little incomes but with dependencies.

Step 3 Forwarding the Data providing assistance immediately and providing assistance by an agency under the work plan/project/activity of the relevant agency.

Step 4 Bringing the data after providing assistance, bringing the data to the Feedback Loops SES in order to follow up the assistance in the next working circle.

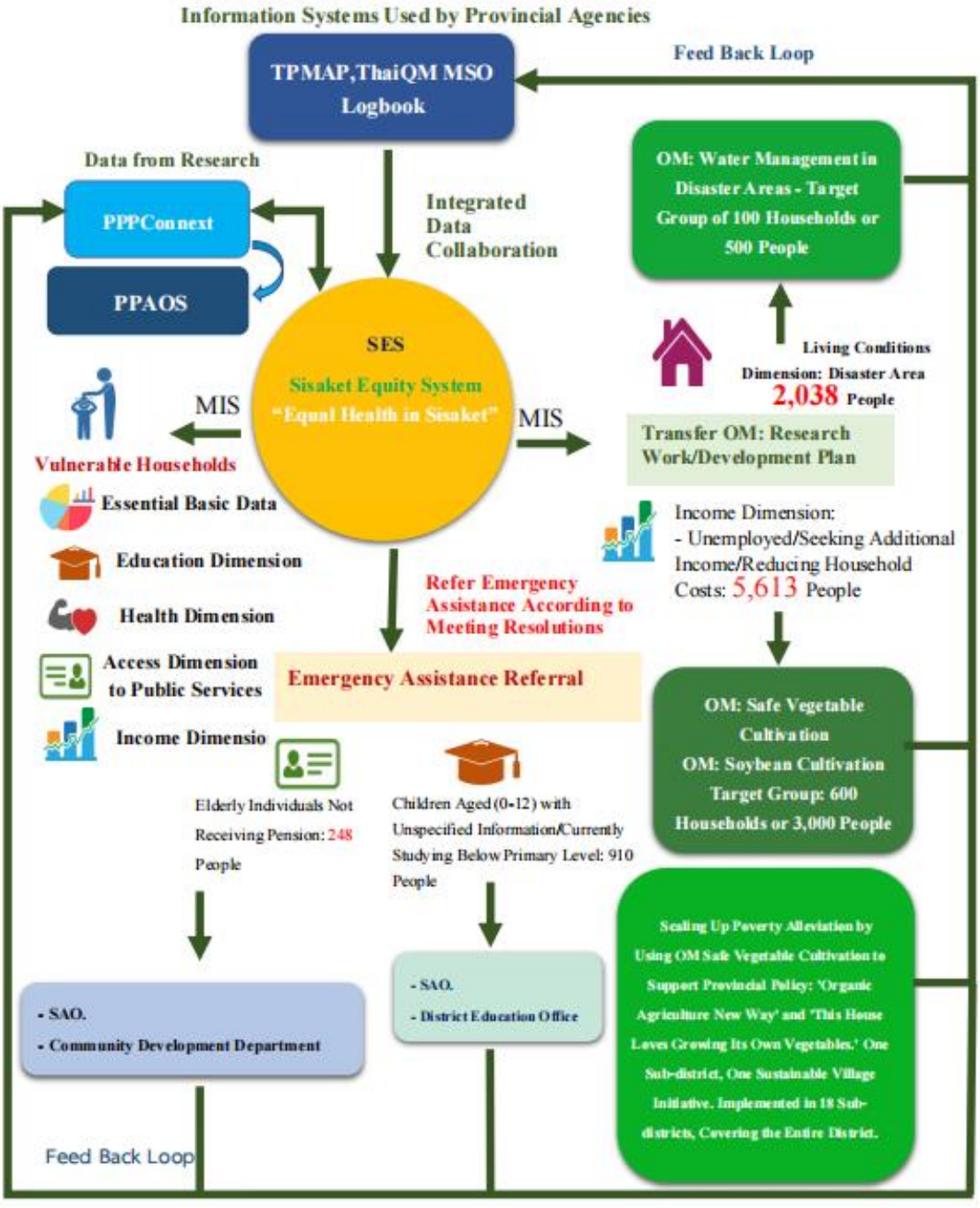

Figure 9: Workflow of the Poor Household Data System in Sisaket Province

Data Integration for Solving Spatial Poverty in Sisaket Province

In holding the meeting to integrate the data for solving spatial poverty problem in Sisaket province, the researchers cooperated with the relevant agencies in analyzing and developing the central data system on poor families of the province by presenting the result of data analysis and connecting with the mechanism of solving poverty problem using Sisaket Equity System which is a data integrating system jointly used with various agencies.

The meeting – workshop for using the developed data system has listened to the suggestions and needs of the users from community leaders, officials of local administration organizations and the committee of the Provincial Administration Center on Sustainable Poverty Elimination and Development of Every Generation Following the Sufficiency Economic Philosophy (district and provincial levels) which analyzed and improved the system to suit the spatial users most.

The result of data analysis has been brought to the meeting of the provincial committee chaired by the governor has leaded to connecting the data and the provincial development plan in the year 2026. The information resulting from the meeting would be used for laying a development plan of each relevant government agency such as Office of Sisaket Province, Sisaket Horticulture Research Center, Sisaket Tourism and Sports Office, Sisaket Community Development Office, Natural Resource and Environment Office, Social Development and Human Security Office, Sisaket Agriculture Office, and the Office of Agriculture and Agricultural Cooperatives

The data integration is aimed at building connectivity and cooperation among government agencies in sufficiently dealing and solving spatial poverty problems, data management and laying development plan consistent with poverty problem solving thoroughly and sustainably.

Figure 10: Workshop for the Use of the Data System Presented at the Sisaket Provincial Committee Meeting

Discussion

The mechanism of network cooperation in re-examining the data, driving development of the data system to solve poverty problems and forwarding for assistance in this study showed that the mechanism of the cooperation among agencies is very important in management of the family poverty data and forwarding for assistance. Efficient collaboration could be established through working ecology with strong participation and relations among agencies. A continuation of collaboration enhances friendship and decreases the steps of formal contact and coordination resulting in working more efficiently.

According to Katzenbach, J.R., & Smith, D.K. (1993), Lencioni, P. (2002), Hackman, J.R. (2011), Dyer, W.G., Dyer, J.H., & Dyer, W.G. (2013), the concept of governing by thinking together and working together emphasizes the significance of connecting and collaboration, working together, within an organization or among organizations in order to share knowledge, information, skills and motivation to achieve the shared goal together. Building good cooperation is, therefore, able to lead to working efficiently, establishing innovation, solving complex problems, and developing sustainable organizations.

Establishing spatial cooperation both formally and informally has played important roles in driving the policy on poverty problem solving. Establishing formal cooperation could be done through governing order and invitation letters from the organizations at the same level, while the informal one arising through networking from the meeting and informal conversation.

Furthermore, a study by Phimlikid Kaewhanarm et al (2021) found that working with the Community Development Office that has the network in every district and sub-district is more efficient than working without an agreement to work together. The coordination and re-examining of the data were correct and fast resulting in decreasing work and budget. Additionally, because of the reliability of the network of the people working at the Community Development Office, data collection of the poor all over the districts and the province proceeded efficiently.

Therefore, working on a complex and wide spatial basis is necessary to use a systematic and reliable working mechanism. Establishing cooperation and education network, and an analysis of working mechanism in the area in details is important in making the working process successful and achieve the goal of having sustainable solutions solving the poverty problems.

The Power of Data in Driving Spatial Poverty Problem Solving

The concept of transition of the structure and process of government agencies based on DFID (2000) indicates that the structure and process of government organizations play vital roles in specifying life style and people's choices, particularly the poor group. Therefore, availability of accurate and up-to-date data would help the organizations be able to lay plans and policy in line with real situation efficiently.

In Sisaket context, integration the data from the same source helped spatial poverty problem solving proceeded completely and thoroughly. Having high quality data enabled us to specify the problem and deal with it on the point which is line with the concept of organization management and the analysis process and designing the system as Sahutsa Ponnil (2023) states that having correct data and up-to-date is important for administrators' decision making in eliminating various problems.

Reliable and quality data collection and data storing must have a clear cut process and participation from all sectors in the organization. Significance given to the data collection from various and reliable sources would help increase efficiency in planning and solving poverty problems. Besides, using accurate data also helps decrease risks in making a wrong decision and increase ability in response to rapidly changing situations.

For this reason, the development of quality data system and participation of all sectors in the process of data collection are highly important so as to be able to solve poverty problems efficiently and sustainably in the long run.

Suggestions

As to enhance the efficiency of the system of data collection to be correct, accurate and up-to-date, the suggestions are as follows.

1.Sisaket province should have a plan to improve the central system with an annual budget and have a management committee for the provincial Central Data System, and every agency takes part in running the center so as to create acceptance of the data and make use of them widely.

2. Sub-district administration organizations which are spatial key agencies should give significance to this matter by setting manpower as officials to manage the information at the sub-district level because the information data at this level are most important and will be forwarded to other agencies following the administrative structure.

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