# The Influence of a Cloud-Based Enterprise Resource Planning System and Organization IT Strategy on Business Operational Efficiency through the Warehouse Management Process: A Case Study of the Automotive Parts Industry in Thailand

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## Abstract

This research aimed to study the impact on the operational efficiency. Independent variables were the utilizing of ERP Cloud Base system and information technology strategy, while warehouse management was the mediating variable. Dependent variable was the operational efficiency. Sample consisted of 215 people involved in the organization's information system, including executives, information technology executives, information technology managers, and information operation officers, selected from the automotive parts industry via stratified random sampling method. Data were analyzed using the Structural Equation Model (SEM), which the model structure was applied to test the hypothetical model. Results indicated that the model had proportion and all hypotheses regression were accepted with p-value < 0.05. The results of the fit and consistency test were consistent with the empirical data and sub-components of the structural model.

Research results showed that using ERP Cloud Base system and information technology strategy had direct impact on the operational efficiency. In addition, indirect impact was also shown in warehouse management, indicating that ERP Cloud Base system and information technology strategy implementation should combine with appropriate warehouse management in order to further improve the organization's operational efficiency.

**Keywords**: ERP Cloud Base system; Information Technology strategy; Warehouse Management; Operational Efficiency

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# อิทธิพลของระบบการวางแผนทรัพยากรองค์กรบนคลาวด์และการวางกลยุทธ์เทคโนโลยีสารสนเทศในองค์กรที่มีผลต่อประสิทธิภาพการดำเนินงานของธุรกิจผ่านกระบวนการจัดการคลังสินค้า กรณีศึกษาอุตสาหกรรมชิ้นส่วนยานยนต์ในประเทศไทย

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## บทคัดย่อ

ในการศึกษาวิจัยนี้มีวัตถุประสงค์เพื่อศึกษาผลกระทบที่มีต่อประสิทธิภาพของการดำเนินงาน โดยตัวแปรอิสระประกอบไปด้วย การใช้ระบบ ERP Cloud Base และการวางกลยุทธ์เทคโนโลยีสารสนเทศ ในขณะที่การจัดการคลังสินค้าเป็นตัวแปรคั่นกลาง และตัวแปรตามคือประสิทธิภาพการดำเนินงาน ในส่วนของกลุ่มตัวอย่างคือผู้ที่มีส่วนเกี่ยวข้องกับระบบสารสนเทศขององค์กร เช่น ผู้บริหาร ผู้บริหารด้านเทคโนโลยีสารสนเทศ ผู้จัดการฝ่ายเทคโนโลยีสารสนเทศ หรือเจ้าหน้าที่ปฏิบัติการสารสนเทศขององค์กรในอุตสาหกรรมชิ้นส่วนยานยนต์ จำนวน 215 คน คัดเลือกโดยการสุ่มตัวอย่างแบบแบ่งชั้นตามวัตถุประสงค์จากอุตสาหกรรมชิ้นส่วนยานยนต์ มีการวิเคราะห์ข้อมูลโดยใช้แบบจำลองสมการโครงสร้าง (SEM) ซึ่งนำโครงสร้างแบบจำลองไปประยุกต์ใช้กับการทดสอบแบบจำลองสมมุติฐาน ผลลัพธ์ระบุว่าแบบจำลองมีสัดส่วนและการถดถอยของสมมติฐานทั้งหมดได้รับการยอมรับด้วยค่า $p < 0.05$ ส่วนผลการตรวจสอบความสอดคล้องและกลมกลืนมีความสอดคล้องกับข้อมูลเชิงประจักษ์และองค์ประกอบย่อยของโมเดลเชิงโครงสร้าง

ผลการวิจัยพบว่า การใช้ระบบ ERP Cloud Base และการวางกลยุทธ์เทคโนโลยีสารสนเทศ มีผลกระทบโดยตรงต่อประสิทธิภาพการดำเนินงาน นอกจากนี้ ผลกระทบทางอ้อมยังแสดงให้เห็นในการจัดการคลังสินค้า ซึ่งระบุว่าควรนำระบบ ERP Cloud Base และการวางกลยุทธ์เทคโนโลยีสารสนเทศมาใช้ในองค์กรร่วมด้วยการจัดการคลังสินค้าที่เหมาะสมจะช่วยเพิ่มประสิทธิภาพในการดำเนินงานขององค์กรต่อไป

**คำสำคัญ:** ระบบอีอาร์พี คลาวด์เบส; การวางกลยุทธ์เทคโนโลยีสารสนเทศ; การจัดการคลังสินค้า; ประสิทธิภาพการดำเนินงาน

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## Introduction

At present, it can be said that industries in Thailand have high growth rate, particularly in an automotive parts industry which is one among the economically important industries with the production values as high as 2.4 trillion baht per year and approximately five-hundred thousand personnel employment. In the past, many factors caused impacts on an automotive parts industry in Thailand either from social, or economic including quick changes on technological aspect. Especially, electric vehicles technology growth that leads toward decreasing demand on the old automotive parts. This requires the automotive parts manufacturers to adapt themselves and develop new products that suit for electric vehicles such as batteries, electrical system, and driving system. Next, the strong competition in an automotive parts industry since the increasing investment in neighbour countries that have lower costs on various aspects. Therefore, domestic manufacturers need to increase production efficiency, reduce cost, and develop new innovations to maintain competitiveness. In addition, Coronavirus epidemic caused huge impacts on the lowering needs of automotive part products and this led many companies to reduce their production or closed. As stated above, it can be seen that automotive parts industry must invest on innovations in order to handle with such changes (Chantruprakakul, Lata, & Silpcharu, 2023).

Important information technology tool on the aspect of warehouse management process could partly assist on the efficient follow up and product data management. Besides, it would increase the potential for warehouse operation via automated operation and quick data processing such as Barcode and RFID system. Srisawat and Jaturat (2016) state that it also helps on data movement follow up in the warehouse and makes it easier for product specification and controlling in all steps of storing and delivering including stock management that would assist on planning and control for efficient products storing in warehouse. It would improve storing by decreasing loss and increasing efficiency in areas usage. Also, an Order Management System would help managing customers' orders from receiving the order, delivering, tracking on delivering status and using Automated Warehouse Management Systems (Atieh et al., 2016) Currently, efficient warehouse management process is the key factor with direct impact on the organization achievement. (Baruffaldi, Accorsi, & Manzini, 2019) Therefore, bringing ERP Cloud-base system to use is the key strategy for the organizations that need to boost their business operational efficiency and competitive advantage (Weng et al., 2014).

On the aspect of investment in automotive parts industry, it was found that in the past both of domestic and international investors kept entering for investment. Thus, most of those who obtained support from the government sector were in the group of significant automotive parts, the group of automotive parts produced from the rubber. This relied on the readiness of the rubber from Thailand as raw materials for rubber hoses, belt, window seal rubber, and vehicle tires where these required high level of production technology. Next, automotive parts for Powertrain and engine that contained complicate

supply chain process with values that higher than 1 out of 3 of the capital of cars manufacturing costs in form of Internal Combustion Engine: ICE. Also, this was a group that the government sector provided support on the production throughout supply chain such as radiator, exhaust pipe, fuel supply system, fuel tank, ignition system, gear, etc. Lastly, the group of Electric Vehicles: EVs automotive parts that the government supported for the investment in form of work package. Therefore, cars manufacturers gradually requested for the promotion of investment on electric vehicles and automotive parts manufacturing, especially, for battery which is the significant part in electric vehicles. The values were 30% higher than the costs of electric vehicles manufacturing. Thus, the proportion of export values were about 30%-40% of the total revenues in automotive parts manufacturing industry was divided into an Original Equipment Manufacturer or OEM market in which accounted to be 80%-85% of the total export values and Replacement Equipment Manufacturer: REM market in which accounted to be 15%-20% (Mishra, Dutta, Jayasankar, Jain, & Mathiyazhagan, 2023).

Automotive parts industry from domestic and worldwide showed with higher progress rates, while domestic organizations received concretely promotion by the government sector. But with the higher level of competition and increasing efficiency on any aspects such as production, operation, or transportation, these still be the key variables to raise the level and standard toward sustainability from changes. Especially, the appropriate technologies promoting within the organization would lead toward success. In particular, for those innovations on various aspects for instance, data accessing from everywhere at any time no matter the information about customers, products, or other operation processes which help saving time in decision making and increasing speed in operation, or for an in-depth data analysis to predict tendency in warehouse management process, sale or production planning, creating flexible systems and being able to customize based on the business requirements.

From the above background, the author interested to study on the influence of ERP Cloud-base system and Information Technology Strategy over the business operational efficiency through the warehouse management process in the automotive parts industry of Thailand. In order to be the guideline for organization adjustment and to raise the level of production to create competitive advantages that would lead toward organization success in business conducting. It is interesting to study and it would be beneficial for the organizations that are seeking to bring ERP Cloud-base system to utilize in the operation.

## Research Objective

1. To study on the factors supporting the utilization of ERP Cloud-based system and Information Technology Strategy with influences on the business operation efficiency of the automotive parts industry in Thailand.

2. To study the relationship of utilizing ERP Cloud-based system and Information Technology Strategy on the aspect of warehouse management process with influences on the business operation efficiency of the automotive parts industry in Thailand.

3. To study on the successful utilizing of ERP Cloud-based system and Information Technology Strategy with influences on the business operation efficiency of the automotive parts industry in Thailand.

## Research Problems and Research Questions

### 1. Research Problems

What is the pattern of influences from ERP Cloud-based system and Information Technology Strategy on the business operational efficiency through warehouse management process as an intermediate variable?

### 2. Research Questions

Whether the operation of the automotive parts industry in Thailand through Cloud-based ERP system and Information Technology Strategy utilization will have the influences on the business operational efficiency or not, it depends on various factors. Research and study allowed us to know about the impacts from the beneficial utilization of ERP Cloud-based system, Information Technology Strategy and additional factors in warehouse management process. Research questions were as follows:

2.1 How important is utilizing Cloud-based ERP system and Information Technology Strategy for the automotive parts industry in Thailand?

2.2 How can the beneficial utilization of Cloud-based ERP system and Information Technology Strategy increase the business operational efficiency for the automotive parts industry in Thailand?

2.3 How can the warehouse management process affect the business operational efficiency of the automotive parts industry in Thailand?

## Scope of the Research

### 1. Scope of Sample and Populations/Key Informants/Pilot Unit

This study was a Quantitative research that used questionnaire as a tool for statistical results interpretation and analysis. Populations were selected considering from the organizations with business registration capital equal to 30 million baht or more and applying ERP Cloud-base system in the organization operation with publicized information from the Department of Business Development of Thailand. Thus, there were total of 720 companies selected. Populations were those involved in the organization information technology system such as CEO, information technology CEOs, IT Manager, or MIS of the organization within the automotive parts industry.

### 2. Scope of Variables/Content

2.1 ERP cloud-based system refers to Enterprise Resource Planning system in form of Cloud-based. It is the pattern that used trendy software and high efficiency without system installation on computers within the organization, but using via internet; while storing information on cloud system instead. This helps reducing cost of system maintenance and increasing speed on data accessing from everywhere (Shatat & Shatat, 2021).

2.2 Information Technology Strategy refers to planning and providing guidelines to apply information technology in the operation in order to achieve the organization's business goals. Strategy should be considered on various aspects such as supporting toward efficiency in the operation and business process, or information technology management such as hardware, software, and personnel for the utmost benefit (Henderson & Venkatraman, 1999).

2.3 Operational Efficiency refers to the efficient utilization of existing resources in the organization or business for the best outcomes achievement. Performance evaluation was conducted to see if each processing activity was on the correct direction and beneficial for the organization and business (Jeong & Phillips, 2001).

2.4 Warehouse Management Process refers to the process of efficient planning, storing, and controlling over products movements in order to serve the needs of customers on time (Faber, De Koster, & Smidts, 2013).



## Literature Review

### 1. ERP Cloud-Based Technology

According to the literature review of Muslmani, Kazakzeh, Ayoubi, and Aljawarneh (2018), at present efficient organizational resources management is the key to help business to sustainably progress with competitiveness. As a result, Enterprise Resource Planning or ERP system is a technology to support for efficient organization planning and resources management.

Shatat and Shatat (2021) explained ERP system as a software designed to integrate the main organization operational processes together from the aspects of finance, accounting, human resources management, procurement, production and sales. There are information exchanging between sub systems in order for the organization to be able to plan and control. ERP system has the key elements as follows. Central Database is the huge database that connects information from any units within the organization in order to be able to quickly access and exchange information. Next, Core Business Modules consists of core work system modules such as finance, accounting, human resources management, procurement, production and sales to cover all the core operational processes of the organization. Also, Integration system connects information between modules and allows them to accurately exchange and process

data in short time in order to support for the management decision such as reporting system and decision supporting system.

Matende and Ogao (2013) state that at recent various types of ERP system are available to select, while each comes with diverse qualifications and differences as below.

1.1 Cloud-based ERP is an ERP system that used through cloud system without software installation into organization's computer. It stores and processes data in high flexibility server of the service provider and it is adjustable to be used as required with monthly or annually service cost of payment.

1.2 On-Premise ERP is an ERP system that required software installation into the organization's computer. It stores and processes data with high flexibility within the organization itself and the system is adjustable to serve for the organization requirements even better than cloud system. Utilizing cost is a payment for software license and maintenance.

1.3 Hybrid ERP is an ERP system that mixed between Cloud-based ERP and On-Premise ERP. It stores and processes data either on cloud system or within the organization in which allowing to be selected to work on the part that suited for the needs of an organization.

Chopra, Sawant, Kodi, and Terkar (2022) stated that the fast changing of technology and business competition required companies in the manufacturing industry having efficient management system in order to increase the competitive ability and immediately serve to customer's needs. Enterprise Resource Planning (ERP) system is a major tool to help companies in manufacturing industry on resources management or any processes.



## 2. Information Technology Strategy

According to the literature review on Information Technology Strategy, Henderson and Venkatraman (1999) explained that establishing the guideline to use Information Technology or IT for the organization in the long term in order to support business goal and strategy should cover planning on resources allocation. Business strategy in organization running should cover each of division activity either internal or external. Literature review showed that in order for the organization to achieve the goal and objective as planned, there are number of mixed elements toward such achievement.

2.1. Top management Commitment Gomes, De Weerd–Nederhof, Pearson, and Fisscher (2001) stated that high ranking executives must commit with the vision to bring the quality and efficient management system to lead the organization toward goals achievement. It requires communication with personnel in the organization to have knowledge and understanding with mutual commitment and acceptance on the operational policy toward the organization goal. Moreover, it requires having an efficient resources management.

2.2 User involvement He and King (2008) stated that bringing information system to use in the organization consisted of the unit that processes to manage and connect each activity into the same database. In addition, Foster Jr and Franz (1999) stated that the application in each step needs co-planning between users and the operators to set up the operation scope that conform to other work systems. Users' participation is the key factor in the operation.

2.3 Information quality Batini and Scannapieco (2016) stated that information quality referred to the organization having appropriate information to be used and right to the needs of users. It must produce from the fact and up-to-date information from reliable sources with clear meaning. Information should be efficiently accessed with quality and simple presentation form.

## 3. Warehouse Management

Faber et al. (2013) stated that warehouse management was an important and necessary process for the business either large or small. Efficient warehouse management helped the business to appropriately control and manage on warehouse as well as delivery products to customers in short time. Thus, good warehouse management process requires planning, products control, storing and delivery that would help creating competitive potential of business.

3.1 Warehouse Management Strategy

3.1.1 Inventory Planning

Faber and Van de Velde (2002) stated that organization planned to increase inventory management efficiency such as need prediction technology and procurement planning to have sufficient products to serve the demand, but not too overwhelm. It allowed the organization to have appropriate inventory control. The demand prediction technology should be precise together with sharp procurement plan in order to allocate sufficient products as needed by customer without cost of products stocking than demanding. It would help increasing inventory management and cost control efficiency.

3.1.2 Product Storage and Placement

Fontana and Nepomuceno (2017) stated that systematic storing and products placement such as using Barcode technology and storing system based on FIFO (First In, First Out) that allowed for quick tracking and accessing into products, focusing on systematic storing and product placement were the key for efficient inventory management.

3.1.3 Application of Information Technology

Anđelković and Radosavljević (2018) stated that information technology application in the operation was a guideline to enhance efficiency and accuracy in the warehouse management process with significance. WMS or Warehouse Management System would assist on speed and systematic inventory management from products receiving, preserving, and delivering, as well as the stock control.

### 4. Operational Efficiency

Certo and Certo (2019) stated that there were three factors effecting the organization efficiency.

4.1. Organization Structure "How efficient the organization will be", it depends on the appropriate structural characteristics. This related to the crucial sub factors below.

4.1.1 Policy factor covers on the establishing of vision, missions that conform to vision, as well as organization's goals and objectives either in short term or long term, setting the standard of practices and operation, etc.

4.1.2 Management and administration factor covered the structural arranging for new tasks, complication, formality, centralization or decentralization, arranging work lines, commanding, task grouping, resources allocation, monitoring and supervision, and performance evaluation.

4.2 Personnel factor is the most crucial factor since personnel are group of team joined together as an organization with the mutual objectives, work role, or any related operations in order to achieve the goals. Therefore, for personnel in any positions or functions under the organization structure from high, middle, or bottom ranking personnel and all levels of the operation, the organization efficiency depends on the characteristics and qualification as required on any aspects. For instance, amount of personnel in each work group, basic skills and knowledge, knowledge and skill related to work functions, leadership, communication skill, technology skill, administrative skill, attitude, desired value, and people development and work development ability, adjustment toward policy conformance, and organizational operation plan.

4.3 Technology factor is the factor affecting the products design, management design, tools utilizing, and modern equipment in manufacturing process, control, and quality audit, data system preparation to connect the markets and services for products distribution to society.

### 5. Theory of Resource-Based View (RBV)

Resource-Based View: RBV has become a vital theory in strategic management by it stresses on the significance of resources and the companies' unique abilities to gain competitive advantages. Basic concept of RBV is that all the resources have not created to be equal, however, some resources could give particular advantages for the company that cannot be copied by the rivals. This has stressed that valuable resources that are hardly found and cannot be copied or replaced are crucial for the sustainable competitive advantage (Madhani, 2010).

Theory that relies on resources helps the management to be able to comprehensively evaluate on strengths and weaknesses of the resources. This analysis would help the manager exercising strengths to create the utmost benefits while applying any measures to ease the weaknesses of resources by using strengths to strategically solve the bottle neck problems. The organization will be able to process along with the long-term goal, create the competitive advantages in the industry, and guarantee for the sustainable success with changed in marketing factors. RBV theory is the strategy that stresses on the significance of

resources and the ability of the organization as the key to retrieve advantages and competitive efficiency. Group of personnel with top skills could help the organization exploring the opportunity and preventing risks in advance. Besides, it helps the organization on bringing strategy to improve work effectiveness and efficiency as well. In addition, RBV has the major role to create understanding on the dynamic of marketing strategy. It is noted that the relationship between resources and the operation efficiency is a vital area of RBV. It explains how the company can use benefits from its specific resources to win over the rivals. Resource-Based View: RBV is the secure framework to understand how the organizations can use benefits from their resources and specific abilities to gain competitive advantages (Lockett, Thompson, & Morgenstern (2009).

The researchers prepared a summary table of the definitions of each construct and indicators to ensure the internal validity of each construct, as shown in Table 1.

**Table 1** Definitions of Each Construct and Indicators

| Construct | Definition | Indicator | Questionnaire |
|---|---|---|---|
| ERP Cloud-Based (ERPCB) | Cloud-based enterprise resource planning (ERP cloud-based) refers to a cloud-based enterprise resource planning (ERP) system, which is a modern and highly efficient software application model that does not require installation on an organization's computers. Shatat and Shatat (2021) | The importance of using ERP Cloud-based technology<br>1. Speed of Inspection<br>2. Management<br>3. Strategy<br>4. Decision Making<br>5. Maintenance<br>6. Satisfaction | <br>1. Items 1-2<br>2. Items 3-4<br>3. Items 5-6<br>4. Items 7-8<br>5. Items 9-10<br>6. Items 11-12 |
| Organization Information Technology Strategy (ORGIT) | Planning and determining the guidelines for using information technology to support operations and achieve the organization's business goals. This strategy must take into account many aspects, such as supporting operations and business processes to be efficient or managing information technology resources. Henderson and Venkatraman (1999) | The importance of information strategy in the organization<br>1. Policy and Objectives<br>2. Guidance and Participation<br>3. Planning and Scoping<br>4. Data Continuity<br>5. Data Security | <br>1. Items 13-14<br>2. Items 15-16<br>3. Items 17-18<br>4. Items 19-20<br>5. Items 21-22 |

**Table 1** Definitions of Each Construct and Indicators (Continue)

| Construct | Definition | Indicator | Questionnaire |
|---|---|---|---|
| Warehouse Management Process (WM) | The process of planning, storing, and controlling the movement of goods efficiently in order to promptly respond to customer needs. Good warehouse management will reduce costs, increase product availability, and improve space utilization to the fullest extent possible. Faber et al. (2013) | The importance of warehouse management<br>1. Inventory Planning<br>2. Storage and Arrangement<br>3. Information Technology<br>4. Automation and Big Data<br>5. Logistics Management | 1. Items 23-24<br>2. Items 25-26<br>3. Items 27-28<br>4. Items 29-30<br>5. Items 31-32 |
| Operational Efficiency (OP) | The efficient use of resources available in an organization or business to achieve the best results. Performance is measured and evaluated to know whether each activity is being carried out in the right way and is beneficial to the organization. Jeong and Phillips (2001) | The importance of Operational Efficiency<br>1. Quality of Work<br>2. Work Load<br>3. Time<br>4. Cost and Investment | 1. Items 33-34<br>2. Items 35-36<br>3. Items 37-38<br>4. Items 39-40 |



## 6. Related Researches

Researches on theoretical framework were adopted as the guideline for the analysis and hypotheses testing. This included linking the relationship between independent variables and dependent variables in applying ERP Cloud-Base system and information technology strategy that influenced on supply chain efficiency as the key supporting reason for research conducting. Eampoonga and Leelasantitham (2023) utilized modern ERP in the automotive industry with the aim to resolve challenges and increase successful rate of ERP projects. Mixed methods related to case study observing were conducted in form of literature review, experts interview, and users questionnaire so that in-depth information were acquired with the values related to factors influencing on the efficiency of Hybrid ERP system on cloud hybrid in the automotive sector of Thailand. Data analysis on 455 of system users from 114 places in automotive industry was conducted by SEM model creating and the method of partial PLS value finding supported 15 hypotheses from the total of 18 hypotheses.

Developed conceptual model can be applied in practicing framework for organizational management and for the relevant project managers to bring Hybrid ERP system on cloud to successfully apply with ERP system in the industry as can be seen in figure 1.

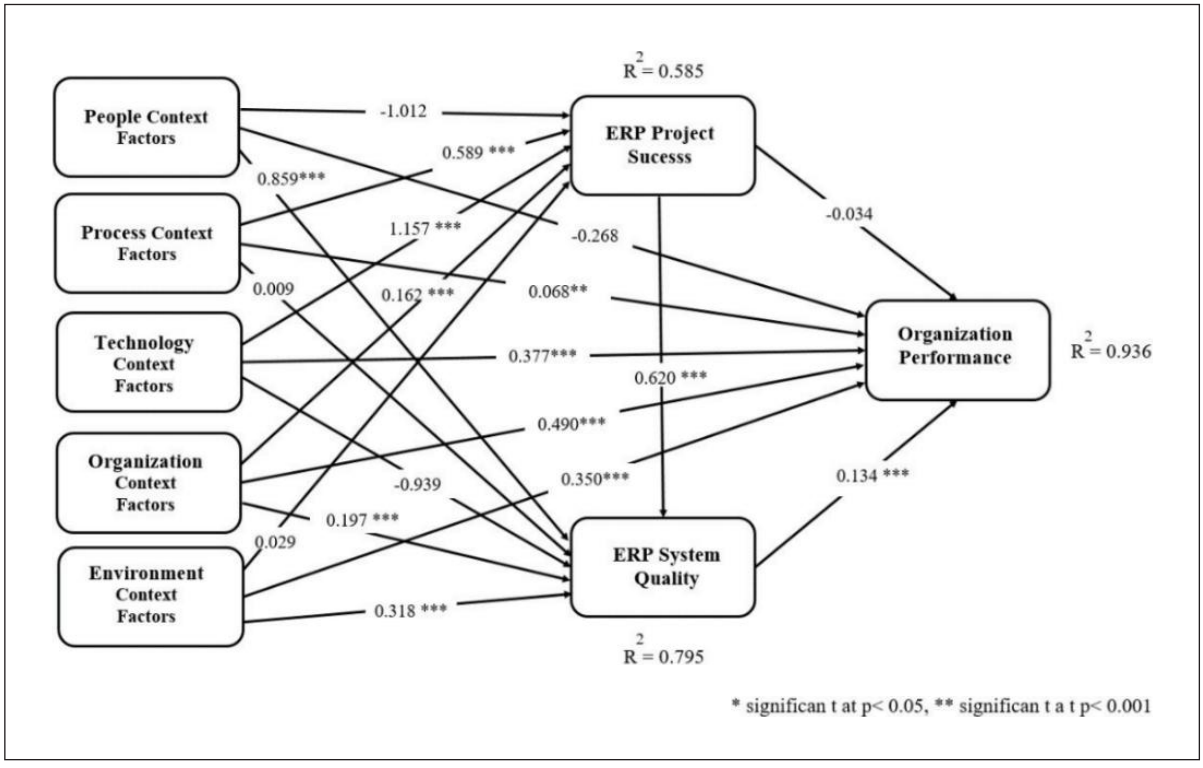


**Figure 1** Results of Theoretical Model with PLS-SEM Analysis (Eampoonga & Leelasantitham, 2023)

Research result gave the improved guideline to utilize ERP system and in-depth information for technologies merging such as modern Block Chain and ERP system in to business sectors. These would help improving overall business operational efficiency and competitive ability. Results also extended the scope of study into the real application with recommendations for the future research direction as well. It pointed out the areas for further exploration in the scope of utilization and ERP system management which would help enhancing toward ongoing progress on this branch. Overall, this study stressed on the importance of the guideline that covered to utilizing ERP system emphasizing on the key factors toward success and the operational plan preparation for the organization that required for the efficiently use of benefits from ERP system on cloud hybrid in the automotive industry in Thailand.

Next, literature review on Ince, Imamoglu, Keskin, Akgun, and Efe (2013) who studied on ERP system which was a vital tool for business processes planning, data flow, implementation and control on the sources of the company's operational site (on the aspect of finance, material, equipment, and labour) in any places. By the guideline for supply chain management (SCM) is the channel that companies used to

guarantee the joint benefits in their own process. Bringing ERP system and SCM guideline to successfully practice and integrate would lead to the advantages in planning, decision forming, implementation, and increasing company's efficiency. This study investigated on the dimension of SCM practice guideline and ERP system, then tested the relationship between the competitive advantages and the company's efficiency. This research processed with management of 138 companies in Turkey using path analysis to test on research hypotheses. Bringing SCM and ERP system to practice showed that the practice guideline of SCM and ERP system gave positive results on companies' efficiency and competitive advantages. The structural equation model was shown in figure 2.

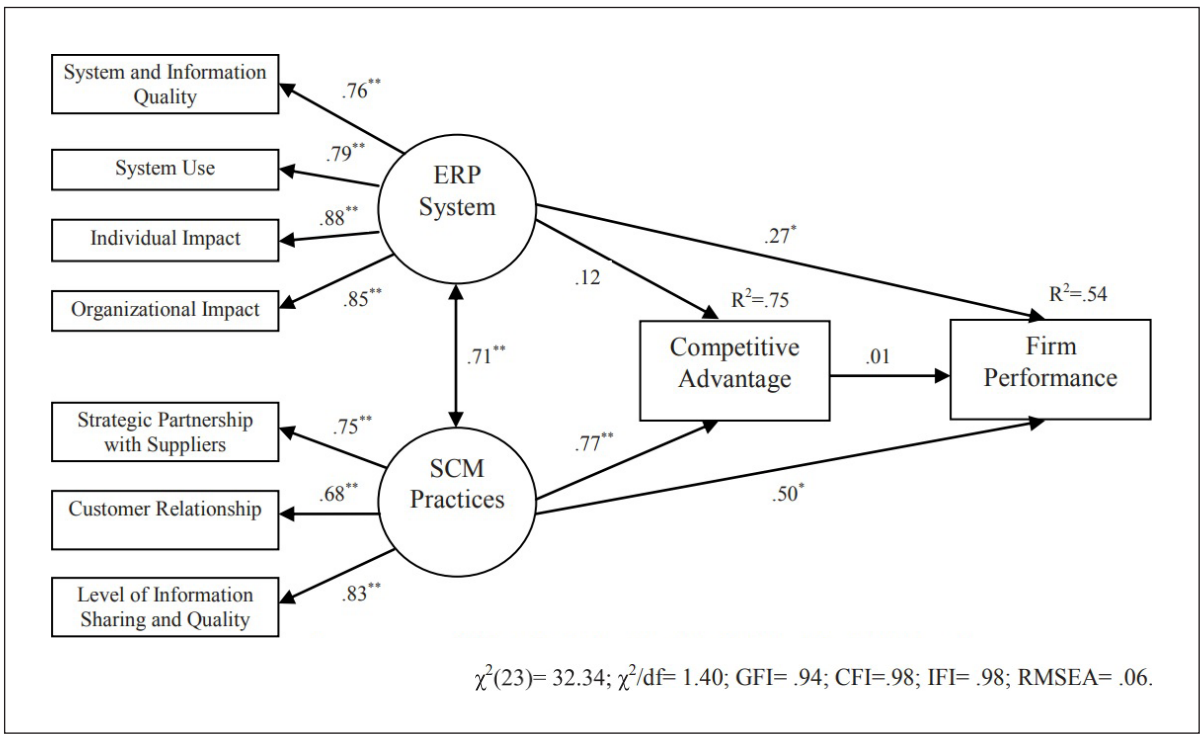


**Figure 2** Results of the Path Analysis Ince et al. (2013)

According to the research results, it was found that decision to select services from third party was one of a crucial issues in sustainable development. Number of quality criteria were included in the decision making process, while establishing the organization's core ability. Especially, top management must aware on the core ability in order to achieve and improve their own organization. Therefore, this study evaluated the core ability in making the strategic decision to select services from third party considering the quantitative criteria in technologies evaluation.

## Conceptual Framework and Research Hypotheses

### 1. Research Hypotheses

1.1 Hypothesis 1 (H1) : Utilizing ERP Cloud-base system has positive effect toward warehouse management process.

1.2 Hypothesis 2 (H2) : Information Technology Strategy has positive effect toward warehouse management process.

1.3 Hypothesis 3 (H3) : ERP Cloud-base system has positive effect toward business operational efficiency.

1.4 Hypothesis 4 (H4) : Information Technology Strategy has positive effect toward business operational efficiency.

1.5 Hypothesis 5 (H5) : Warehouse management process has positive effect toward business operational efficiency.

### 2. Research Conceptual Framework

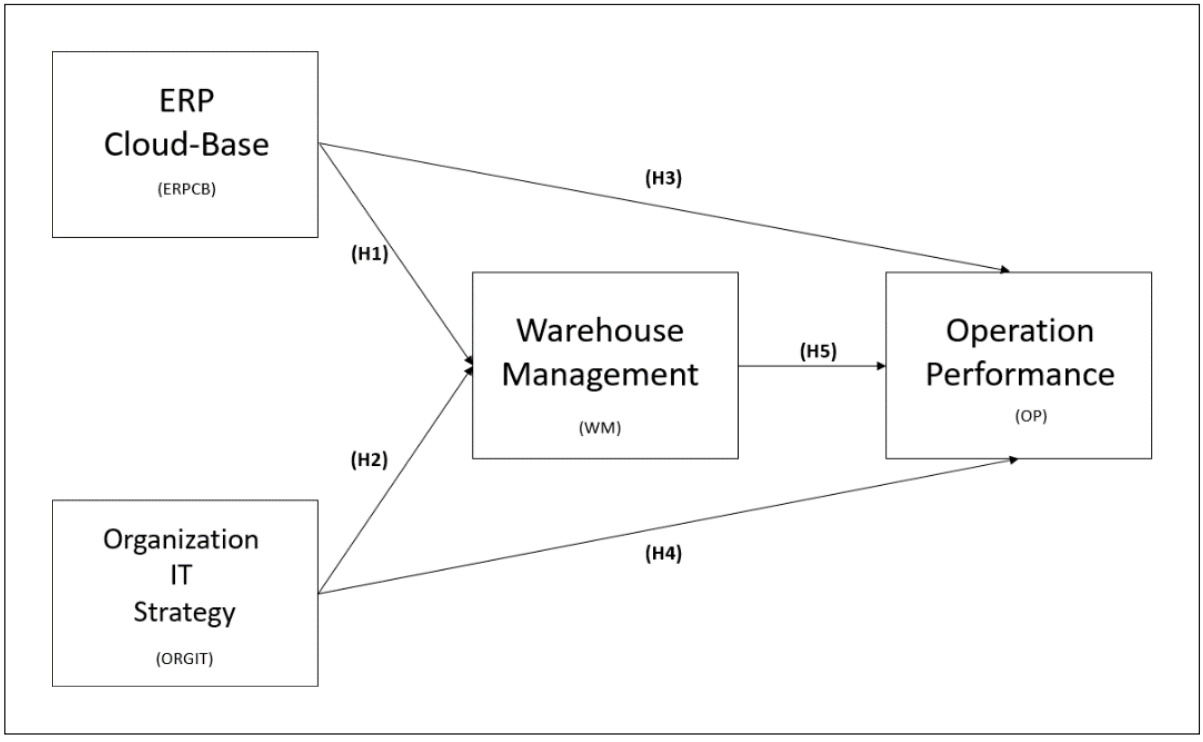


Figure 3 Research Conceptual Framework

## Research Methods

This research passed the approval on the Ethics of research in human subject from Uttaradit Rajabhat University according to document COA No.022/2024 and URU-REC No.022/2567. There were 220 questionnaire respondents; later on, the author considered on Data Cleaning to create proper data for the analysis. It was found that the questionnaire from 215 places contained complete data and could be further processed.

### 1. Populations and Samples

This research selected population group from the organizations with registered capital on automotive parts in Thailand from 30 million baht onward and applied ERP Cloud-base system in their operation and the organizations shown with publicized data by the Department of Business Development of Thailand. Samples were those relevant in the organization information system such as CEO, Information Technology CEOs, IT Manager or MIS officers of the organizations in the automotive parts industry; divided into 10 population groups from total of 720 places. Sample size was considered based on the appropriate size for SEM analysis. Sarstedt, Ringle, Smith, Reams, and Hair Jr (2014) stated that sample size for the analysis must have ten times amount of observed variable group. Wilson et al. (2010) This research contained 20 observed variables therefore, the sample size of this research should not lesser than 200 samples.



### 2. Research Tool

In this study, the author designed questionnaire as a tool for data collection consisting of three parts detailed as below.

**Section 1** Presenting general information of the questionnaire respondents. The characteristics of questionnaire was in form of 6 items Check-List covered the information of gender, age, status, education level, work experience and current position. Data analysis in term of frequency and percentage presented in form of tables and results interpretation via description.

**Section 2** Presenting information related to the influence of Cloud-Based Enterprise Resource Planning System and Information Technology Strategy in the organization toward business operational efficiency through warehouse management process of the automotive parts industry in Thailand. Mean and Standard Deviation were calculated then interpreted values. The questionnaire contained with 40 question items in form of scores evaluation. All the questions covered research framework such as focusing on the utilization of ERP Cloud-base, focusing on Information Technology Strategy, warehouse management process, and focusing on business operational efficiency. The criteria of score were divided into 7 levels comparable to Likert 7 Scale. Joshi, Kale, Chandel, and Pal (2015)

**Section 3** Conclusion of recommendations from the questionnaire respondents were separated into each aspect and concluded into items. Repeating recommendations were described in only one item.

### Tool Validity

Content Validity was done to test the validity of question items by calculating to find Index of item Objective Congruence: IOC. The questionnaire was sent to three experts and found the congruence between questions and objectives with at average score of 0.81. Next, conducting Trying Out for confidence by Cronbach's Alpha Coefficient, $\alpha$ testing for 30 sets (Cronbach, 1951), it was found that the value of Cronbach's Alpha Coefficient was in the acceptable range which was 0.90. It referred to that the questions had highly confidence and can be further used for data gathering.

### Data Analysis

1. Descriptive statistics were used to describe the preliminary analyzed results to consider data from different context using percentage, mean, and standard deviation.

2. Inferential statistics analyzed data from SEM in order to check on the reliability of variables by testing on discriminant validity and Convergent Validity, then evaluating the appropriateness of model data.



## 3. Results

The author in this research studied on the influence of a Cloud-Based Enterprise Resource Planning System and organization Information Technology Strategy on business operational efficiency through the warehouse management process, a case study of the automotive parts industry in Thailand with the analyzed results as follows.

### Section 1 General Information of Questionnaire Respondents

General information of questionnaire respondents, most of them were male 70 persons, and female 45 persons. Range of age for most questionnaire respondents was between 31-40 years old with marital status. Most respondents were graduated with Bachelor degree with 5-10 years of working experience. Lastly, on the aspect of current job position, most of questionnaire respondents were in the group of head of department.

### Section 2 Structural Equation Model

1. Reliability Testing One of the requirements in Structural Equation Model analysis was that the observed variables should be reliable. Therefore, the acceptable value of Cronbach's Alpha Coefficient was higher than 0.7. After reliability testing, results of variable group had the average Cronbach's Alpha Coefficient value at .889, mean = 6.27, and standard deviation = .546.

1.1 Multicollinearlity Testing

The author tested the correlation between independent variables to ensure that independent variables can be added in the equation since Structural Equation Model was based on the regression analysis. Therefore, this study shall pass the correlation testing between themselves. Hypothesis for regression analysis limited that each variable should not be much correlated, then using acceptable tolerance measuring and VIF to test; tolerance ratio must higher than 0.1 or VIF must lesser than 10 (VIF = 1/tolerance ratio) in order to accept that there was no problem in form of correlation. Hair, Ringle, and Sarstedt (2013) The results of Multicollinearity were shown in Table 2.

**Table 2** (Multicollinearlity Testing) (n = 215)

| Variable | Collinearity Statistics | |
|---|---|---|
| | Tolerance | VIF |
| **ERP Cloud-Base** | | |
| Speed of Inspection (ERPCB_SP) | .754 | 1.326 |
| Management Aspects (ERPCB_MA) | .409 | 2.444 |
| Strategic Planning (ERPCB_ST) | .441 | 2.269 |
| Decision Making (ERPCB_DIS) | .539 | 1.855 |
| Maintenance (ERPCB_MANT) | .448 | 2.230 |
| Satisfaction (ERPCB_SATIS) | .574 | 1.741 |
| **Information Technology Strategy** | | |
| Policy and Objectives (ORGIT_POL) | .759 | 1.318 |
| Advice and Participation (ORGIT_ADV) | .564 | 1.774 |
| Planning and Scoping (ORGIT_PLA) | .421 | 2.377 |
| Data Continuity (ORGIT_CON) | .513 | 1.951 |
| Data Security (ORGIT_SEC) | .408 | 2.452 |
| **Warehouse Management** | | |
| Inventory Planning (WM_INV) | .312 | 3.202 |
| Storage and Arrangement (WM_STO) | .200 | 5.012 |
| Storage and Arrangement (WM_INF) | .305 | 3.275 |
| Automation Systems (WM_AUT) | .299 | 3.343 |
| Logistics Management (WM_LOG) | .614 | 1.630 |

**Table 2** (Multicollinearlity Testing) (n = 215) (Continue)

| Variable | Collinearity Statistics | |
|---|---|---|
| | Tolerance | VIF |
| **Operation Efficiency** | | |
| Quality of Work (OP_QUA) | .678 | 1.476 |
| Workload (OP_WOR) | .758 | 1.320 |
| In Terms of Time (OP_INT) | .722 | 1.384 |
| Expenses and Investment (OP_EXP) | .632 | 1.583 |

According to Table 1, the author analyzed the relationship of variables to prevent inter-relation in more than two independent variables. It was found that the Tolerance ratio of all variables is more than 0.1 which is acceptable, while VIF in the test is lesser than 10 in all variable. Therefore, all variables were accepted without a problem of correlation model in which resulted in capable to use as equation to predict for independent variables without any deviation.

2. Construct Validity Creating model for Structural Equation Model analysis including Convergent Validity testing which was the test on the value that reflected latent variable, and Discriminant Validity testing to test on the observed variable on the same latent variable that was not related to the observed variable of other latent variables.

2.1 Convergent Validity

Next, testing the accuracy of element weight values, variance values extracted mean, coefficient predictive value, and confidence value of latent variables of the model that the author assessed the accuracy divided into two types: discriminate validity testing and Convergent Validity testing. From the testing results of Convergent Validity of element weight value must higher than 0.6. Testing results show that the element weight value is between 0.6 and 0.9, which is in proper range as can be seen in figure 4.

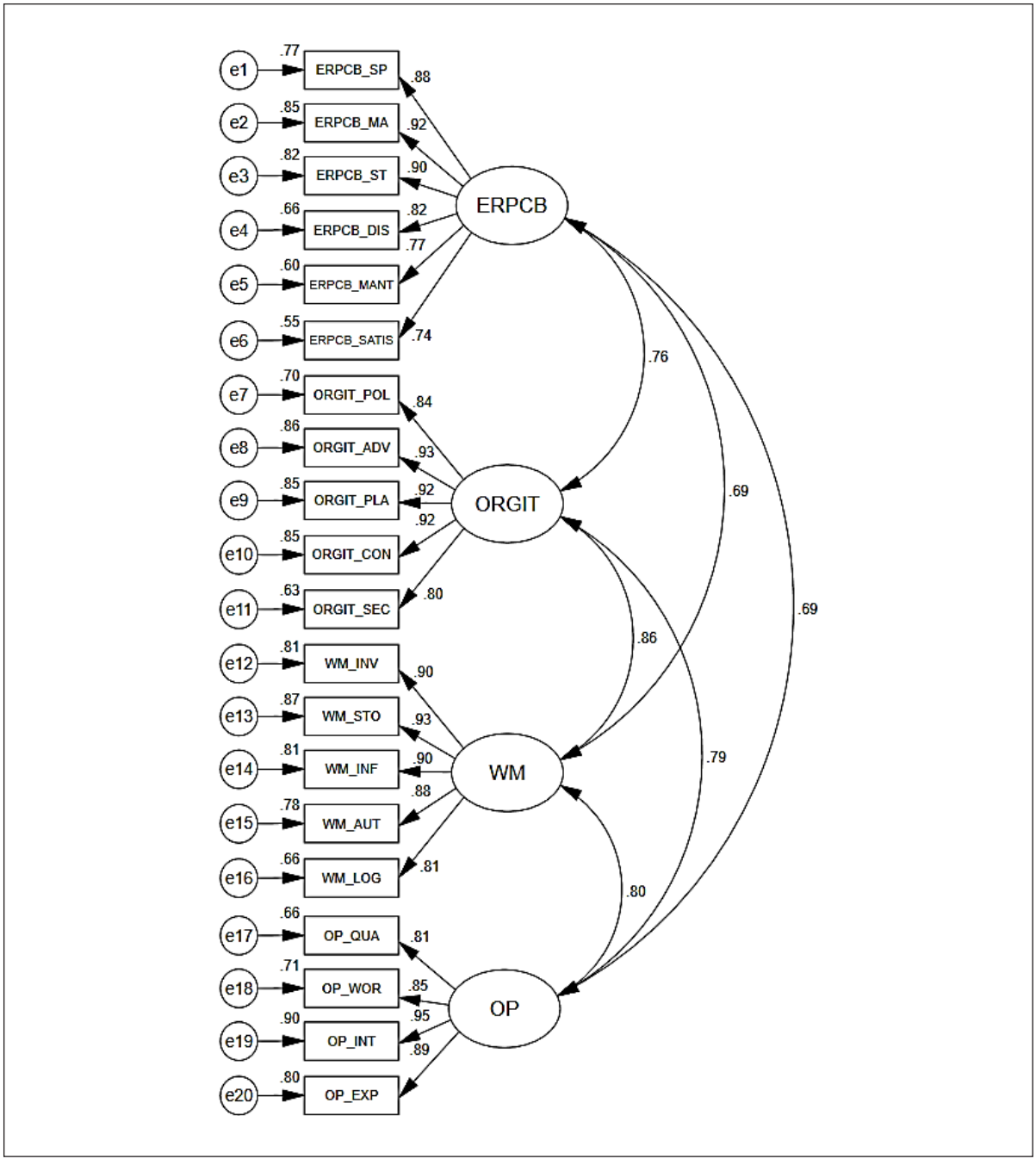


**Figure 4** Confirm Factor Analysis (CFA)

Besides, the coefficient predictive value ($R^2$) shows that results between 0.547 and 0.902 which are within criteria. The Composite Reliability: CR is in the range between 0.930 and 0.947 which is within the criteria. For the confidence value of latent variable and variance values extracted mean, it is in the range between 0.840 and 0.876 in which higher than 0.5, thus considered as proper within criteria as shown in Table 3.

**Table 3** Convergent Validity

| Factor | Factor Loading | $R^2$ | CR | AVE |
|---|---|---|---|---|
| **ERP Cloud-Base (ERPCB)** | | | 0.935 | 0.840 |
| Speed of Inspection (ERPCB_SP) | 0.88 | 0.774 | | |
| Management Aspects (ERPCB_MA) | 0.92 | 0.846 | | |
| Strategic Planning (ERPCB_ST) | 0.90 | 0.810 | | |
| Decision Making (ERPCB_DIS) | 0.82 | 0.672 | | |
| Maintenance (ERPCB_MANT) | 0.77 | 0.592 | | |
| Satisfaction (ERPCB_SATIS) | 0.74 | 0.547 | | |
| **Organization Information Technology Strategy (ORGIT)** | | | 0.947 | 0.883 |
| Policy and Objectives (ORGIT_POL) | 0.84 | 0.705 | | |
| Advice and Participation (ORGIT_ADV) | 0.93 | 0.864 | | |
| Planning and Scoping (ORGIT_PLA) | 0.92 | 0.846 | | |
| Data Continuity (ORGIT_CON) | 0.92 | 0.846 | | |
| Data Security (ORGIT_SEC) | 0.80 | 0.640 | | |
| **Warehouse Management (WM)** | | | 0.947 | 0.884 |
| Inventory Planning (WM_INV) | .312 | 3.202 | | |
| Storage and Arrangement (WM_STO) | .200 | 5.012 | | |
| Storage and Arrangement (WM_INF) | .305 | 3.275 | | |
| Automation Systems (WM_AUT) | .299 | 3.343 | | |
| Logistics Management (WM_LOG) | .614 | 1.630 | | |
| **Operation Efficiency (OP)** | | | 0.930 | 0.876 |
| Quality of Work (OP_QUA) | 0.81 | 0.656 | | |
| Workload (OP_WOR) | 0.85 | 0.722 | | |
| In Terms of Time (OP_INT) | 0.95 | 0.902 | | |
| Expenses and Investment (OP_EXP) | 0.89 | 0.792 | | |

2.2 Discriminant Validity

The explainable variance value of response variable is between 0.82 and 0.89, the acceptable criteria is equal or more than 0.2 but not exceed 1.00. The accuracy of Discriminant Validity testing can be

checked from the comparison between the average value of variance extracted and the variance value of response variable Hair Jr et al. (2021). Next, the author tested on Discriminant Validity of the tool by testing on the average value of variance extracted as shown in Table 4.

**Table 4** Discriminant Validity

| | ERPCB | ORGIT | WM | OP |
|---|---|---|---|---|
| ERPCB | 0.840 | | | |
| ORGIT | 0.578 | 0.883 | | |
| WM | 0.477 | 0.740 | 0.884 | |
| OP | 0.476 | 0.624 | 0.640 | 0.876 |

2.3 Construct Model

Construct Model testing can be explained as Chi-Square = 284.245, Degree of freedom = 100, Relative Chi-Square = 2.842, Chi-Square of fit Statistic P = 0.000, Goodness of fit index (GFI) = 0.883, Adjusted Goodness of fit index (AGFI) = 0.821, Root mean square residual (RMR) = 0.445, Root mean square Error of Approximation (RMSEA) = 0.093, Normed fit index (NFI) = 0.933, Comparative fit index (CFI) = 0.955, and Goodness fit index of model assessment (Hoelter) = 203 (0.01) as shown in figure 5.

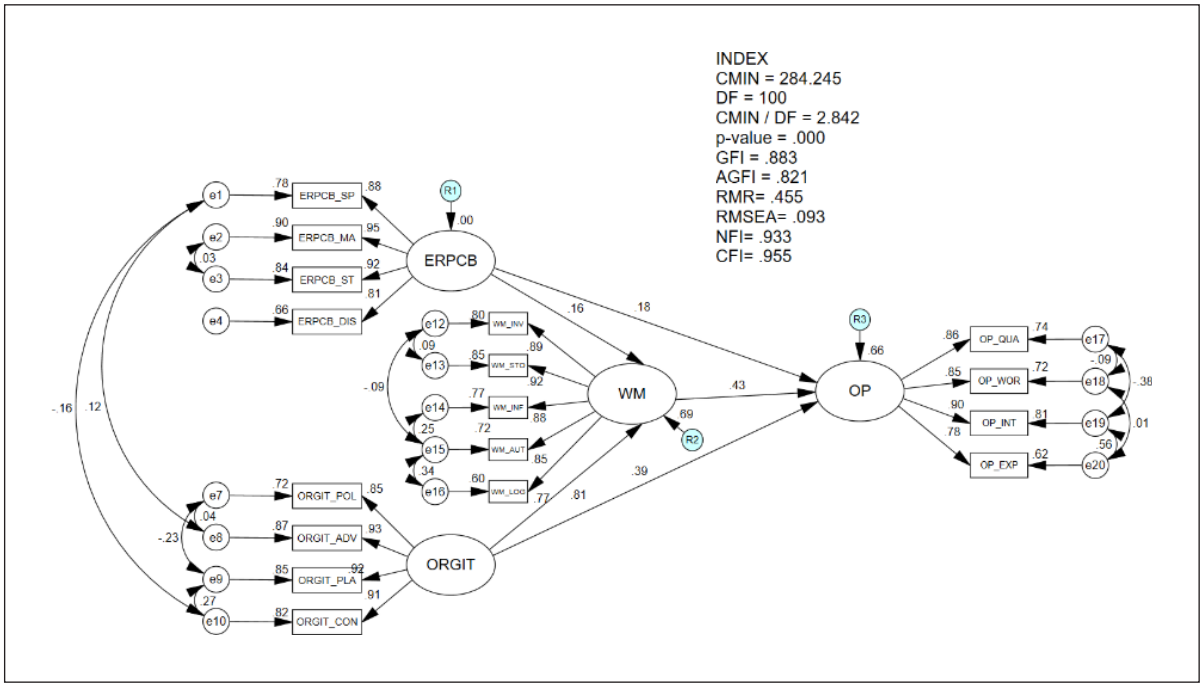


**Figure 5** Structural Equation Model

From the structural model analysis, results showed with statistical significance as can be seen from Table 5.

**Table 5** Hypothesis Testing

| Hypothesis of Reserch | Estimate | S.E. | C.R. | p-value |
|---|---|---|---|---|
| H1 : ERPCB → WM | .130 | .039 | 3.349 | *** |
| H2 : ORGIT → WM | .704 | .064 | 10.988 | *** |
| H3 : ERPCB → OP | .160 | .044 | 3.618 | *** |
| H4 : ORGIT → OP | .361 | .088 | 4.084 | *** |
| H5 : WM → OP | .468 | .106 | 4.428 | *** |

*** p-value < 0.001 (p-value less than 0.001 was at the significance level of 0.001)

2.4 Direct Effect and Indirect Effect

According to the analysis it can be explained as the coefficient value that set the factor of $R^2$ reveals that ERP Cloud-base system and Information Technology Strategy utilization affected on warehouse management process with 93% of precision. Next, utilizing ERP Cloud-base technology and Information Technology Strategy affected the business operational efficiency with 62% of precision as shown in Table 6.

**Table 6** Direct, Indirect and Combined Effects of Standardized Variables

| Dependent Variable | $R^2$ | Direct Effect | | | Indirect Effect | | | Total Direct Effect | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ERPCB | ORGIT | WM | ERPCB | ORGIT | WM | ERPCB | ORGIT | WM |
| ERPCB | | | | | | | | | | |
| ORGIT | | | | | | | | | | |
| WM | .93 | .155*** | .814*** | | | | | .155*** | .814*** | |
| OP | .62 | .177*** | .386*** | .432*** | .067*** | .352*** | | .244*** | .738*** | .432*** |

*** Statistically significant at the level 0.001

2.5 Conclusion and Model Analysis

From the model analysis, results showed the positive effect of utilizing ERP Cloud base system and Information Technology Strategy toward business operational efficiency. Utilizing ERP Cloud base system and Information Technology Strategy had direct positive effect on business operational efficiency and warehouse management process as shown in figure 6.

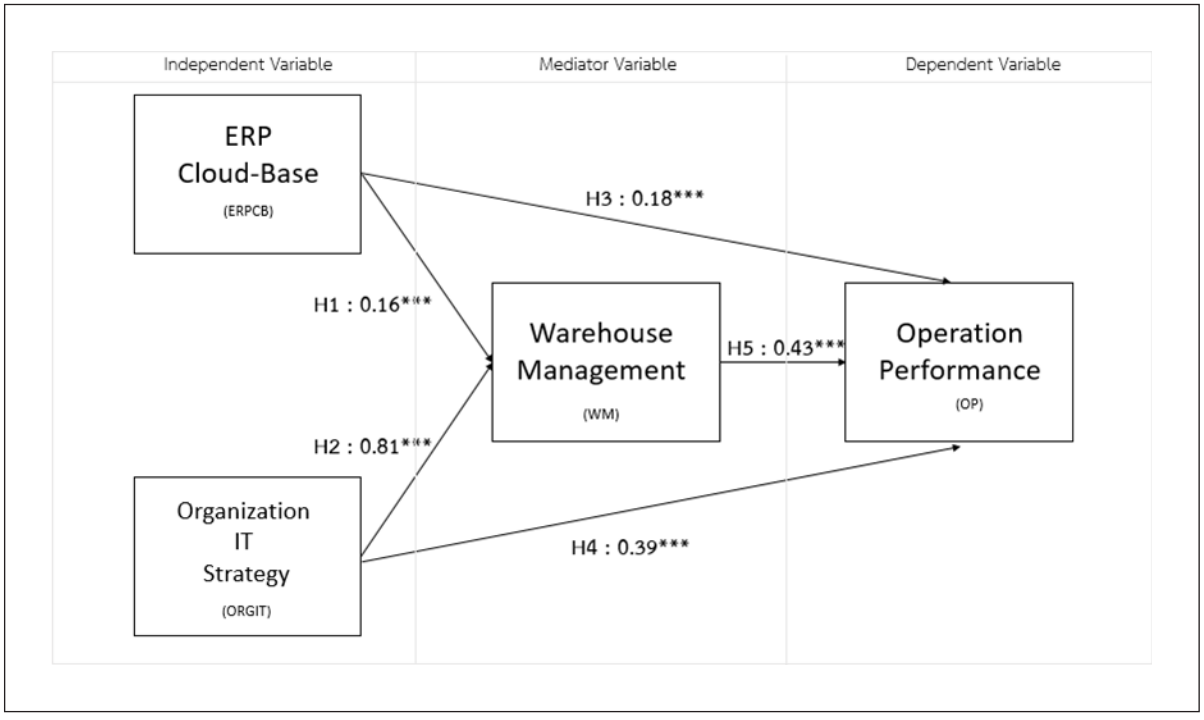


**Figure 6** Model Analysis

2.6 Hypothesis Testing

Hypothesis 1 (H1): Utilizing ERP Cloud-base system had positive effect toward warehouse management process. From the correlation analysis, positive effect was found with path coefficient value $\beta$ = 0.16 thus, H1 hypothesis was acceptable. Next, Hypothesis 2 (H2): Information Technology Strategy had positive effect toward warehouse management process. Correlation analysis showed that it had positive effect with path coefficient value $\beta$ = 0.81, therefore, H2 hypothesis was acceptable. Further, Hypothesis 3 (H3): Utilizing ERP Cloud-base showed positive effect on the business operational efficiency. Correlation analysis showed that it had positive effect with path coefficient value $\beta$ = 0.18, therefore, H3 hypothesis was acceptable. Next, Hypothesis 4 (H4): Information Technology Strategy had positive effect toward the business operational efficiency. From the correlation analysis, positive effect was found with path coefficient value $\beta$ = 0.39, therefore, H4 hypothesis was acceptable. Lastly, Hypothesis 5 (H5): the warehouse management process had positive effect toward business operational efficiency. Correlation

analysis showed that it had positive effect with path coefficient value $\beta$ = 0.43, that H5 hypothesis was acceptable.

## Conclusion and Discussion

This research aimed to study on the influence of Cloud-Based Enterprise Resource Planning System and Information Technology Strategy in the organization toward business operational efficiency through warehouse management process of the automotive parts industry in Thailand. It was hypothesized that Cloud-Based Enterprise Resource Planning System and Information Technology Strategy would have the positive effect on the business operational efficiency via the warehouse management process. Variables were ERP Cloud-based system and Information Technology Strategy utilization, where business operational efficiency was the dependent variable and the warehouse management process was the intermediate variable. Populations in this study were the organizations with registered capital in automotive parts business more than 30 million baht onward and applied ERP Cloud-based system in their operation. According to the information from the Department of Business Development of Thailand 2024 there were total of 720 companies. Sample group was those relevant in information system of the organization such as CEO, Information Technology CEOs, IT Manager, or MIS officers of the organizations in the automotive parts industry. Sample size was randomized using Stratified sampling method. After launching the questionnaire and retrieved them back via Data Cleaning process, the amount of sample was 215.

Research results when considering from research question no.1 which was how important is utilizing Cloud-based ERP system and Information Technology Strategy for automotive parts industry in Thailand. This conformed to Hypothesis 3 (H3) that utilizing ERP Cloud-base system had positive effect on the business operational efficiency; and conformed to Hypothesis 4 (H4) that Information Technology Strategy had positive effect toward the business operational efficiency. Thus, from the literature review of Lee (2006), it found the conformity on the issue of Information Technology Strategy that must conform to the organization goals. It is vital to increase the utmost operational efficiency by emphasizing on information technology strategy planning for outsources that conformed with the business objectives and to give the better efficient outcomes. This pointed out that well planned information technology strategy could increase the overall business efficiency. This concept was supported by Yeh and Lin of strong MIS development that also to truly connected with the higher organization efficiency achievement. This emphasized on the concept of IT strategy design by considering the objective of the organization. Next, on the issue of organization changes with employees' participation, this remained as significant role to achieve IT strategy practices. Nasamu (2022) studied on the strategy to increase operational efficiency to create changes in the organization. This research pointed out that it required employees' participation in any changes in order to increase the operational efficiency. This would reduce any resistance and form acceptance in IT system adopting context that would lead to the success of new system.

When considering on research question no. 2 which was How can the beneficial utilization of Cloud-based ERP system and Information Technology Strategy increase the business operational efficiency for the automotive parts industry in Thailand, this conformed to Hypothesis 1 (H1) where utilizing ERP Cloud-base system had positive effect on the warehouse management process and also conformed to Hypothesis 2 (H2) that Information Technology Strategy had positive effect on the warehouse management process. From the study results, it found the conformance with the research by Badewi, Shehab, Zeng, and Mohamad (2018) who conducted the study on competency framework on the benefit of ERP: the issue of coordination theory perspective in which found that the ability to make automated ERP Cloud-base system would help better management on areas and resources inventory. This would later on lead to cost saving since the shorter processing time and no repeating data feeding in which very useful for SMEs business that usually faced with resources limitation. They would be able to take benefits from ERP Cloud-base system to extend the potential in operation without large amount paid for advance investment.

When considering on research question no. 3 which was how can the warehouse management process affect the business operational efficiency of the automotive parts industry in Thailand that conformed to Hypothesis 5 (H5) where the warehouse management process had positive effect toward business operational efficiency. Results revealed the conformity with the study by Lam, Choy, and Chung (2010) who studied on the measuring framework for business operational efficiency of inventory. It was found that warehouse management process (WMS) system was widely used to increase the competitive potential toward better inventory control since the past century. However, most of WMS did not support for planning and resource inventory auditing, but emphasizing only on inventory management. Inventory management and planning from customers' order only relied on the knowledge of inventory experts. Decision making process could be hardly made with the complicate and repeated purchasing orders. This article brought the concept of warehouse resources management (WRM) for general WMS by separating the chara teristic of purchasing orders with WMS qualification to finish the processing by proper resources usage applied RBR. Research objective was to efficiently achieve the fulfilment of customers' order with proper resources in order to reach better customers' satisfaction and increase the warehouse business operational efficiency.

Currently, the automotive parts industry in Thailand has been highly advanced, especially, on the integration of the organizations' Cloud-Based ERP system in the automotive parts industry sector of Thailand. The dominant feature is the strong manufacturer network including with around 720 suppliers in the first level, and 1,100 suppliers in the second and third level. Thus, Thailand has become an automotive manufacturing hub of Southeast Asia, where this large network has been supported by the National Strategic Initiatives to increase the competitive potential of the industry through innovative technology of Cloud-based ERP system. This has become the power of change in the automotive parts industry of Thailand that helps the manufactures improving work processes, data management, and the overall efficiency via applying Cloud-based ERP system. This allows any companies to use benefits from high technology

advancement without burden from large investment on IT infrastructure. Moreover, it is strongly beneficial for SMEs since Cloud-based ERP model would help integrating on huge data analysis in which significantly affected on companies' efficiency by providing insight information that drive toward strategic decisions (Tansakul, Suanmali, & Shirahada, 2021).

Bringing Cloud-based ERP system to use in the automotive parts industry of Thailand is considered as the key progress on the operation efficiency and strategic management. It will facilitate for better data management, improving best practices toward sustainability, and promoting innovations. These systems are prompted to enhance the competitive position of Thai manufacturers in the world's automotive market. Applying ERP system in the automotive parts industry reflects the unique characteristic when comparing to other industries especially, as a result from the needs of distinguish operation, regulations and requirements, and competitive dynamic within the automotive parts sector. One of the key differences is the complication in supply chain management, the automotive parts industry is operated under highly complicated supply chain in associate with suppliers, manufacturers, and distributors in different levels. This complication requires a strong ERP system that can gather all functions such as production planning, inventory management, and logistics to ensure for smooth operation throughout the supply chain. On the other hand, industries with lesser supply chain complication may have no need to mix within the same level. They would have easier ERP solutions that stress on main business functions instead of large reliance. Moreover, the automotive parts industry is under the strict measure of quality control, integrated Manufacturing Execution System (MES) with ERP system which is very crucial in this sector in order to ensure the compliance on industry rules and regulations while maintaining high level of manufacturing quality. Strict requirements for compliance and quality certification can lead toward bringing ERP to adjust for the more complete qualifications in the automotive parts sector comparing to other industries that pressure from the regulations may not severe.



## Research Limitations

1. The operation by utilizing ERP Cloud Base system in the automotive parts industry had the key limitation from work function of ERP Cloud Base system when comparing with the traditional operation process in the organization. It can be seen that traditional ERP system can fully respond to the operation, while ERP Cloud Base system kept developing where some modules were unable to work along with the same level of function and control system of traditional ERP system.

2. Bringing Cloud Base system to use usually required much changing in the organization which it could come with the obstacles to apply toward achievement. It may result on resistance from employees who felt familiar with former ERP system. Therefore, it is necessary for the organization to increase technical skills and understanding on cloud technology among employees and management.

3. Disclosure of organization business information still have limitations under strict rules. Data gathering from questionnaire distribution may not yet cover, thus in-depth interview is required to confirm the questions for further beneficial use.

## Recommendations for Future Research

For the future researches relate to the influence of ERP cloud-based and Information Technology Strategy for business operation efficiency increasing through the warehouse management process, the author suggests to study on the relationship between the utilization of ERP cloud-based and Information Technology Strategy toward supply chain efficiency specifically on each aspect in order to match with the current technological changes. However, this was a cross-sectional study with specifically focused on the automotive parts industry; therefore, the issue for future studies must be for the consistent advanced knowledge such as AI, joint working between human and robots in warehouse that driven by ERP Cloud Base. For example, the role of Block chain in ERP Cloud Base to process the warehouse, data analysis and Business Intelligence (BI) in ERP Cloud Base system and the integration of IoT and ERP Cloud Base in the modern warehouse management process; thus, for sustainability and efficient operation of automotive parts industry sector in Thailand.

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