THE INFLUENCE OF TECHNOLOGY-ORGANIZATION-ENVIRONMENT (TOE) FRAMEWORK ON FIRM PERFORMANCE WITH ERP CYCLE IMPLEMENTATION

JANJIRA DEELERT

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF
PHILOSOPHY PROGRAM IN BUSINESS ADMINISTRATION
FACULTY OF BUSINESS ADMINISTRATION
RAJAMANGALA UNIVERSITY OF TECHNOLOGY THANYABURI
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Dissertation Title	The Influence of Technology-Organization-Environment (TOE) Framework on Firm Performance with ERP Cycle Implementation
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Program	Business Administration
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March 19, 2021

หัวข้อดุษฎีนิพนธ์	อิทธิพลของเทคโนโลยี-องค์กร-สภาพแวดล้อม ต่อผลการดำเนินงานของบริษัทผ่านการปรับใช้วงจรอีอาร์พี
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ปีการศึกษา	2563

บทคัดย่อ

งานวิจัยนี้ขยายผลกระทบของกรอบแนวคิดทีโออีโดยการตรวจสอบความสัมพันธ์ระหว่างกรอบแนวคิดทีโออีกับผลการดำเนินงานของบริษัท โดยเน้นที่ผลการไกล่เกลี่ยของการยอมรับอีอาร์พี การใช้งานอีอาร์พี และการดูดกลืนอีอาร์พี การศึกษาครั้งนี้มีวัตถุประสงค์เพื่อกำหนดความสัมพันธ์ภายในกรอบแนวคิดทีโออีด้วยตนเอง: 1) บริบทด้านเทคโนโลยี 2) บริบทด้านองค์กร และ 3) บริบทด้านสภาพแวดล้อมด้วยผลการดำเนินงานของบริษัทผ่านบทบาทการเป็นสื่อกลางของการยอมรับอีอาร์พี การใช้งานอีอาร์พี และการดูดกลืนอีอาร์พี การสำรวจจัดทำขึ้นเกี่ยวกับอุตสาหกรรมการผลิตในประเทศไทย โดยมีผู้เข้าร่วมจากรายชื่อที่จัดทำโดยกรมพัฒนาธุรกิจการค้า กระทรวงพาณิชย์ แบบจำลองสมการโครงสร้างเป็นเครื่องมือทางสถิติที่ใช้ในการจัดตารางการวัดความสัมพันธ์ระหว่างตัวแปรที่กล่าวถึงข้างต้น

ผลการวิจัยชี้ให้เห็นว่าบริบทด้านเทคโนโลยี บริบทด้านองค์กร และบริบทด้านสภาพแวดล้อมมีผลกระทบต่อผลการดำเนินงานของบริษัทผ่านการใช้งานอีอาร์พี และการดูดกลืนอีอาร์พี การวิเคราะห์ข้อมูลเพิ่มเติมแสดงให้เห็นถึงความสัมพันธ์เชิงบวกระหว่างกรอบแนวคิดทีโออีและผลการดำเนินงานของบริษัทผ่านการใช้งานอีอาร์พีและการดูดกลืนอีอาร์พี การใช้งานระบบอีอาร์พีอย่างมีประสิทธิภาพถือเป็นตัวขับเคลื่อนที่สำคัญที่สุดสำหรับธุรกิจ

ระบบอีอาร์พีมีบทบาทสำคัญในการปรับปรุงผลการดำเนินงานของบริษัท อย่างไรก็ตาม ผู้จัดการระดับสูงต้องเข้าใจวิธีการนำระบบอีอาร์พีไปใช้ในองค์กร เนื่องจากความสำเร็จของบริษัทขึ้นอยู่กับระดับของการนำระบบอีอาร์พีไปใช้ เห็นได้ชัดว่าการใช้ระบบอีอาร์พีอย่างมีประสิทธิภาพนำไปสู่การปรับปรุงความสามารถในการทำกำไรและส่วนแบ่งการตลาด และองค์กรควรตระหนักถึงบทบาทของอีอาร์พีต่อความสำเร็จ

คำสำคัญ: บริบทด้านเทคโนโลยี บริบทด้านองค์กร บริบทด้านสภาพแวดล้อม การยอมรับอีอาร์พี การใช้งานอีอาร์พี การดูดกลืนอีอาร์พี ผลการดำเนินงานของบริษัท

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ABSTRACT

This research extended the implications of the TOE Framework by examining the relationship between the TOE Framework and firm performance, focusing on the mediating effect of ERP adoption, ERP implementation, and ERP assimilation. The purpose of this study was to determine relationships within the TOE Framework: 1) the technological context, 2) the organizational context, and 3) the environmental context, regarding firm performance with the mediating role of ERP adoption, ERP implementation, and ERP assimilation. The survey was conducted in manufacturing industries in Thailand. The participants were selected from a list provided by the Department of Business Development, Ministry of Commerce. Structure Equation Modeling (SEM) was used as the statistical instrument to tabulate the results measuring the relationships between the above mentioned variables.

The results revealed that the technological context, the organizational context, and the environmental context had an impact on firm performance with ERP implementation and ERP assimilation. The further analysis of the data indicated a positive relationship between the TOE Framework and firm performance with ERP implementation and ERP assimilation. Therefore, the efficient use of the ERP system could be the most important key business driver.

The ERP system played a critical role in improving firm performance. However, top managers had to understand how to implement the ERP system in their organizations as the success of the company depended on the level of ERP implementation. It was affirmed that the effective implementation of the ERP system could increase profitability

and market share. Moreover, the organizations should be aware of the role of the ERP system in their success.

Keywords: technological context, organizational context, environmental context, ERP adoption, ERP implementation, ERP assimilation, firm performance

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My next thanks must be delivered to my family and all my sisters in the field of business computing for their encouragement, suggestions and guidance. Many times, when I felt down, they were always there for me. Futrhermore, I also need to express many thanks to Mr. Surasak Suthongwan, Associate Professor Dr. Phut Ploywan, Dr. Noppamas Kruasuwan, Assistant Professor Dr. Phattaranan Surachatri, and Assistant Professor Dr. Patpasut Satunuwat for their expert examination of my research tools. Lastly, my special thanks go to the respondents to my research questionnaires, my senior colleagues and my friends who introduced relevant individuals who were able and willing to comlete the research questionnaires.

Janjira Deelert

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CHAPTER 1
INTRODUCTION

1.1 Background and Statement of the Problem

Business conducting at recent shall rely on technology in order to compete and stay survival (Melville, Kraemer, & Gurbaxani, 2004). All the organizations turn to pay attention and invest into technology to add more efficiency in operation. However, not all the organizations that put the effort into technology will always be successful. In order to be successful, the organization shall select to invest into technologies that can response to the real organization operation. Thus, it is the duty of the management to plan on the guideline to operate in conformance between the business operation, technology and decision.

Information system is important for the internal organization management since it enhances for the efficiency in operation. Especially, in the current situation while the world keeps dynamically changing all the time with the highly business competition. The organization with the efficiency in management and can quickly access into the information will be able to survive. Therefore, the organization management has the main role in advanced information system development and to use it efficiently to form the business strength to add more efficiency in the production of product and service and the potential in competition. Information system can help creating the benefits in the organization operation as follows:

1. Information system would help users to access to their required information quickly on time since the information are systematically stored and managed. The management can access to the information quickly in proper form and to bring the information to use as required.

2. Information system can assist in establishing of goals, strategy, and operational planning. Since information system is systematically gathered and managed makes it has the continual history of information and can indicate the operation tendency whether it should head to which direction.

3. Information system can help checking the operation. When the operational plan was brought to practice for a period, the controller shall check for the results of

implementation. It will bring some part of information to process for the assessment, the output information will show the performance whether it conforms to the required goals or not.

4. Information system helps in the study and analysis on the cause of problem. The management can use Information system together with the education and seeking for cause or the mistake that can occur during the implementation. If the operation is not as planned, it may call for additional information from the system to know that what are the causes of mistake in the operation or arranging for the information from in new problem analysis.

5. Information system helps user analyzing on the problems or obstacles to find the approaches to control, improve and resolve the problems. Information from the processing would help the management to analyze how the implementation in each choice would help fix or control the problem. What shall business do to adjust or develop the operation according to the work plan or goals.

6. Information system would help reduce the cost of the organization. Efficient information system would help reduce the business time, labor and cost of operation. It would add more efficiency and potential in business competition.

ERP is the system used in the organization management by planning for the utmost benefits from the resources used in the organization. ERP system would link the information and all processes in the organization in order to cooperate in one system. ERP system is the integrative software with high flexibility, efficiency and being accepted globally today. ERP system is designed with the aim to operate all department tasks according to the business characteristics in conformance to the reference model for supply chain operation. Ten reasons that the company shall rely on ERP are as follows (Tech, 2017).

1. ERP helps gathering financial information of the company for the managing director to understand the overall picture of financial status and the company operation in which will result on the management decision. ERP will help gathering one set of information to answer the questions and all doubts since all use the same system.

2. ERP system would help gathering the information of product ordering by customers from the purchasing of customer via the sale representative until the steps of

products delivery and money collection. By it would allow the company the easier in operation as well as the internal communication. ERP system can help coordinating between the processes from the production, product storage, until products delivery to the different destination at the same time.

3. ERP system would help forming the standard to increase speed in the production process. Thus, the production companies that use different systems to connect the information and communicate to each other. By ERP system has come to form the standard in each step of the production process. There are computer systems for one system management. The operation will be beneficial from time saving, increasing productivity and reducing cost per unit.

4. ERP system would help reducing the inventory burden. ERP system would help enhancing the smoothness in the production and to increase the efficiency in production. To show the purchasing order in conformance to the production and help planning on products transportation to customers in which it helps reducing the inventory problem so well.

5. ERP system helps in human resources planning in the organization in order to know about the efficiency of staff work in each department. The organization can reduce time in salary calculation and record the information in the personnel database management system. Especially, the company has various business units, where ERP can eliminate the communication problem with all staff.

6. ERP system help forecasting the situations in any work units in advance no matter the forecasting of sale rate, inventory level and any department prediction. These things help the management knows about the situation in advance for the decision in business planning in any aspects quickly and correctly.

7. ERP system helps forming the standard of operation and the operational processes in the units to be in the same form and standard. Forming the clarity and work responsibility in the operation, reducing mis-understanding, mistake, and increasing the efficiency in the communication between officers.

8. ERP system would help evaluating the salesperson efficiency on the aspects of raw material, service quality and after sale quality. In order to remain on the production standard and the selection of trade partners with the best efficiency.

9. ERP system would help managing on the property, equipment, machine, tools and any measuring tools. ERP system helps planning on the maintenance and improvement to remain on the usage condition and collecting the history of maintenance in details.

10. ERP system is the genius reporting system that all levels of user required. ERP system helps you on report creating by self. The genius report is important for the top executive management as much to form the statistics report, the comparison report of any rates by periodic, products, and report for more other decision for the best planning and decision so called “Better Information Better Decisions”.

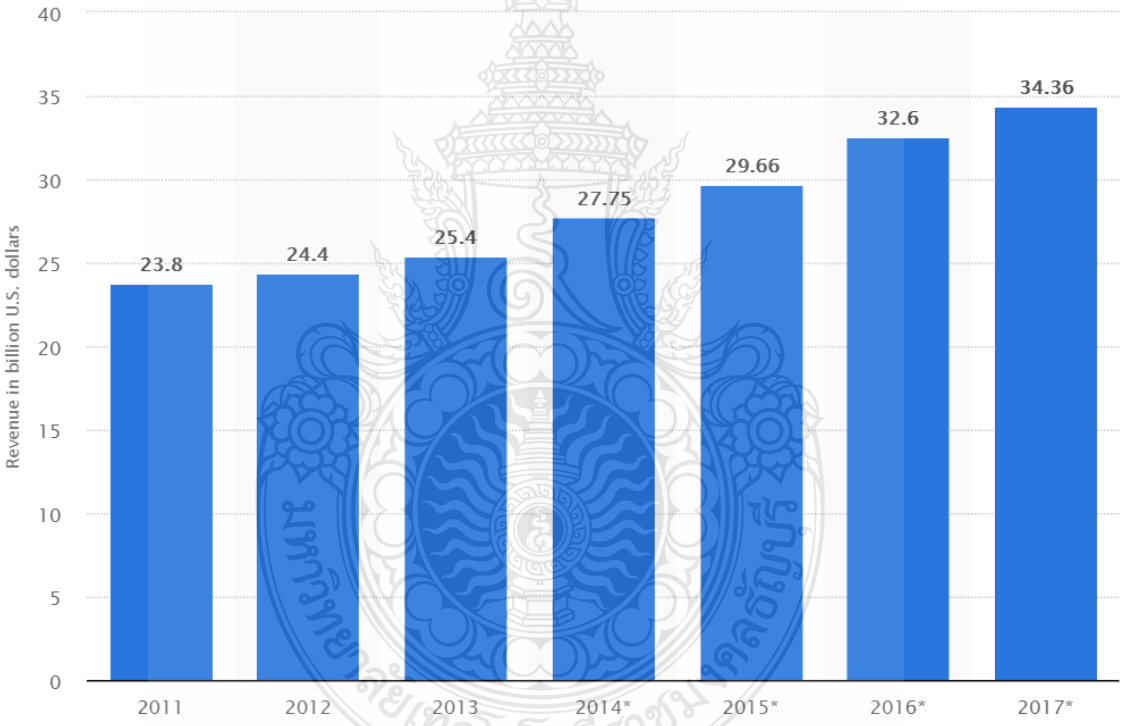

Figure 1.1 Forecasting: global ERP software income 2011-2017 (Statista, 2018).

The statistics in figure 1.1 presents the global incomes of ERP software since 2011-2013 and forecasted for 2017. In 2017, the global income for ERP software was expected to reach up to 34.36 billion US dollar. According to the estimation for ERP market globally. In general, they are large businesses with the complexity in the process

and the system requires for software helps in efficiency management. While ERP software for the small business usually suite for the specific industry.

ERP software is different between systems, the emphasizing industry, presenting attributes; however, most of the system would have many modules as follows:

1. Human Resource
2. Customer Relationship Management
3. Finance/Accounting
4. IT Helpdesk
5. E-Commerce
6. Supply Chain Management
7. Order Processing
8. Inventory and Procurement

Besides any modules mentioned above, amount of ERP platforms have been specifically designed for the specific industries such as production industry, service, or technology. ERP system that focuses on industry uses the beneficial attributes with the co-benefit and may have the start point that is beneficial for new generation of ERP software.

Table 1.1 Top ERP Companies (By Niche) (TechnologyAdvice, 2018).

Enterprise	Medium-Sized	Small Business
SAP	Netsuite	Deltex
Oracle	Sage	Work (etc)
Microsoft Dynamics	Infor	Syspro
IFS Applications	Macola	Intacct

Enterprise Resource Planning: ERP system has been accepted by the huge and medium organizations worldwide (Liang, Saraf, Hu, & Xue, 2007). ERP system is the software kit mixed between any business processes such as production, supply chain, sales, financial, human resources, budget arrangement and customer service activities (Amalnick, Ansarinejad, Nargesi, & Taheri, 2011). In the past few years, ERP system has become the global tendency where the organizations are making the huge investment

(Nandi & Kumar, 2016). However, if there is no efficient system used, the benefits as expected for the better production and competitive advantage will not happen (Addo-Tenkorang & Helo, 2011).

ERP system is complex, using a lot of costs and it is the integrative software that allows the organization to have the competitive advantage. The well-known major success and well managed is to use ERP to form the competitive advantages that cover on the basic platform for the processing, supply chain management, customer relation management, knowledge management, decision supporting management and strategic management (Awa, Ukoha, & Emecheta, 2016). This would lead to the enormous investment in software and packaging adjustment (Doom, Milis, Poelmans, & Bloemen, 2010).

The cycle of ERP system contains with three steps which are acceptance, usage, and ERP absorbing (Liang et al., 2007). Using ERP system in the organization usually comes with changes in structure and approach (Kallunki, Laitinen, & Silvola, 2011). Using ERP is the critical issue in the organization since in the past, ERP usage was failed from the defect in its use (Kemp & Low, 2008). Though with the popularity of ERP; the failure ratio of ERP remains high. From the investigation with 117 organizations operating via the meeting committee, 40% of ERP products fail to run the business (Cooke, Gelman, & Peterson, 2001). Likewise, the study of Gioia LLC which is the information technology consulting company found that 51% of the companies in any industries reported that they are failed to use ERP (Gioia, 2002). Therefore, it is crucial for the management and managers to understand the factors that may affect on the successful ERP to reduce the failure rate from ERP using and to add more efficiency in organization operation.

Although the ERP system has received widespread attention, but there is still a problem of failure from investing in the ERP system which has identified the failure statistics from the investment in the ERP system 10 things as follows: (Carlton, 2017)

1. 95% of companies failing to provide a budget of less than 10% of the total budget (preparing only the budget for buying ERP but lacking the budget to use for education, training, and change management).

2. 90% failed to deliver measurable ROI. This measure is essentially a direct failure of effective expectations management.

3. 80% of customers are not satisfied with the current ERP system, which is mainly caused by poor overall strategic planning, malformed requirements, wrong budgets, poor training programs, and even general problems with the ERP platform.

4. 60% of ERP projects fail due to poor management.

5. 57% of ERP systems take longer than expected. Time is money, when time lapses means loss of profits. If the situation is not resolved quickly managers often reduce losses by allowing half the system to launch.

6. 54% spend more budget than set.

7. 41% of entrepreneurs do not achieve benefits.

8. 40% of the system is experiencing work interruption.

9. 39% of employees are not satisfied.

10. 32% of executives are not satisfied.

Based on the reasons for the failure of ERP above, the organization has to plan and prepare carefully before implementing the ERP system within the organization which must take into account three important factors:

1. Technology, which must be studied whether there are currently any technologies that are relevant and can be used to help increase the operational efficiency of the organization. Which must be based on the technological readiness of the organization as well.

2. Organization, by looking in the context of the organization taking into account the nature and resources of the organization, the linkage between employees Including the entire operation process of the organization and most importantly, the vision of the senior management of the organization.

3. Environment, the organization must look at the environment that influences the marketing system that the organization is in at both micro and macro levels.

If the organization reviews all 3 factors above, it will help the organization to plan and prepare for the implementation of the ERP system within the organization. Which will help reduce the risk of failure to invest in the ERP system in return, which

will increase the chances of success in investing in the ERP system as well as help the organization's performance improve.

In the past, there are the study related to ERP acceptance (Awa & Ojiabo, 2016; Kharuddin, Foong, & Senik, 2015; Seethamraju, 2015), using of ERP (Garg & Chauhan, 2015; Migdadi, Abu Zaid, Al-Hujran, & Aloudat, 2016; Schniederjans & Yadav, 2013) as well as the absorbing of ERP (Kouki, Poulin, & Pellerin, 2010; Xu, Ou, & Fan, 2017). However, there are limitations to study on the acceptance, usage, absorption of ERP to reflect the efficiency of the firms. Mostly the former researches have been done via stressing on just one step of ERP cycle.

Motivation in this study is to reduce the gap in testing the impacts from technology, organization, and environment via Mediating Model of ERP and the impact on the company efficiency. By the study would done only with the industrial production group in Thailand to confirm the study result, the obtained outcomes will give in-depth information on the theory for the overall understanding in the relationship between TOE Framework and the efficiency of the company through the Mediating in ERP cycle. Using ERP efficiently will help the company can improve its operations in which will lead to the better efficiency over the competitors.

1.2 Purpose of the Study

The purpose of this study is to extend an understanding of TOE framework with manufacturing industry in Thailand, by empirically examine relationship between TOE framework, which includes technology, organization, and environment, with the ERP cycle and the impact on the company's operations. The emphasis on the analysis on effects of the ERP cycle as an intermediary and the impact on the performance of companies in manufacturing industry in Thailand.

Thus the main objectives of this study are as follows:

1.2.1 To examine the effects of technological context, organizational context, and environmental context on firm performance through ERP adoption.

1.2.2 To examine the effects of technological context, organizational context, and environmental context on firm performance through ERP implementation.

1.2.3 To examine the effects of technological context, organizational context, and environmental context on firm performance through ERP assimilation.

These research objective, which emerged the literatures review of previous studies, can further be delineated per below research questions. The methods and data collection and empirically analysis of data received from manufacturing industry in Thailand.

1.3 Research Questions and Hypotheses

The preceding discussion raises the following major research questions for this study:

RQ1. Does technological context, organizational context, and environmental context affect the firm performance and through ERP adoption?

RQ2. Does technological context, organizational context, and environmental context t affect the firm performance and through ERP implementation?

RQ3. Does technological context, organizational context, and environmental context affect the firm performance and through ERP assimilation?

Consequently, we propose the following hypotheses

1. Hypotheses on the relationship between technological context and firm performance.

The study by Bharadwaj, (2000) suggested that firms with high information technology capability tend to outperform a control sample of firms on a variety of profit and cost-based performance measure. As same as Melville et al. (2004) suggested that organizational performance impacts of information technology. Therefore, it is proposed that:

H1: There is a positive relationship between technological context and ERP adoption.

H2: There is a positive relationship between technological context and ERP implementation.

H3: There is a positive relationship between technological context and ERP assimilation.

H4: There is a positive relationship between ERP adoption and firm performance.

2. Hypotheses on the relationship between organizational context and firm performance.

Migdadi et al. (2016) found that organizational factors influence e-business implementation. Moreover, e- business implementation affects organizational performance. And Barrick et al. (2015) found that collective organizational engagement influence firm performance. Thus proposed that:

H5: There is a positive relationship between organizational context and ERP adoption.

H6: There is a positive relationship between organizational context and ERP implementation.

H7: There is a positive relationship between organizational context and ERP assimilation.

H8: There is a positive relationship between ERP implementation and firm performance.

3. Hypotheses on the relationship between environmental context and firm performance.

Raymond et al. (2005) found that environmental context influences scope of production. The firm's networking intensity, to be more competitive. And Xu et al. (2017) found that competitiveness of the environment has a direct impact on the ERP assimilation. Therefore, it is proposed that:

H9: There is a positive relationship between environmental context and ERP adoption.

H10: There is a positive relationship between environmental context and ERP implementation.

H11: There is a positive relationship between environmental context and ERP assimilation.

H12: There is a positive relationship between ERP assimilation and firm performance.

1.4 Research Framework

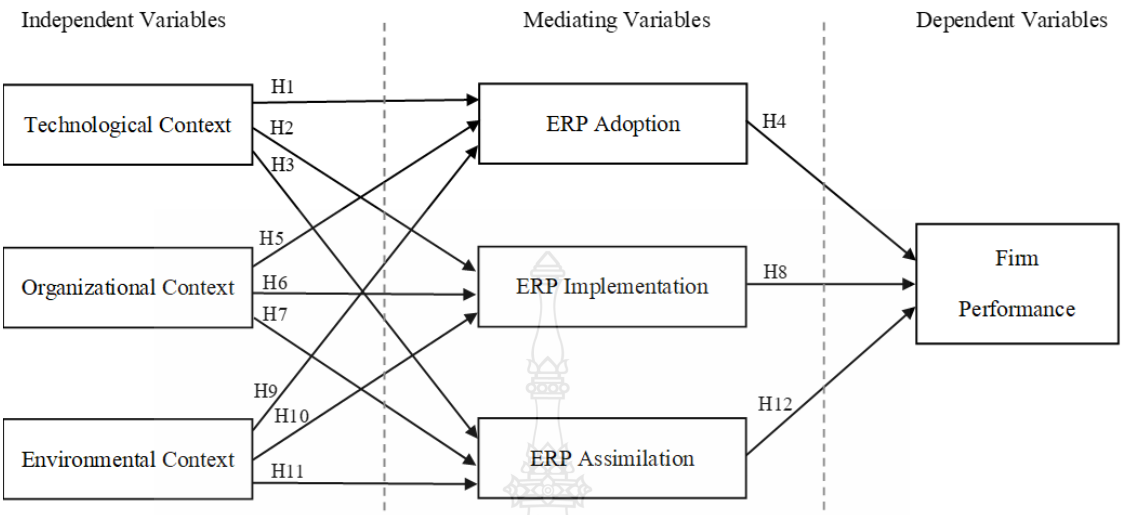

Figure 1.2 Research Framework

1.5 Definitions of Terms

The term definitions in the following, described the terminology used in this study.

1.5.1 Technological

The technological context includes all of the technologies that are relevant to the firm - both technologies that are already in use at the firm as well as those that are available in the marketplace but not currently in use (Baker, 2012).

1.5.2 Organizational

The organizational context refers to the characteristics and resources of the firm, including linking structures between employees, intra-firm communication processes, firm size, and the amount of slack resources (Baker, 2012).

1.5.3 Environmental

The environmental context includes the structure of the industry, the presence or absence of technology service providers, and the regulatory environment (Baker, 2012).

1.5.4 ERP adoption

ERP adoption refers to the decision to adopt an ERP system for use in an organization.

1.5.5 ERP implementation

ERP implementation refers to the decision to use the ERP system of the user in the organization.

1.5.6 ERP assimilation

ERP assimilation is defined as the extent to which the use of ERP system diffuses across the organizational work processes and becomes routinized in the process activities (Purvis, Sambamurthy, & Zmud, 2001).

1.5.7 Firm performance

Firm performance refers to the better performance of the organization after use the ERP system.

1.5.8 Enterprise Resource Planning

Enterprise Resource Planning (ERP) refers to a system that collects business components such as planning, production, sales, accounting, finance, and human resource. To data sharing from the same database.

1.6 Scope of the Study

The key objectives of this study is to examine the relationship between TOE framework, ERP cycle, and firm performance as to develop a better understanding of the ERP implementation and its impact with the manufacturing industry in Thailand. This study chooses to focus on one industry as it allows more control of extraneous variables and provides robust results for theory testing.

The target key respondents are manufacturing industry in Thailand who are in the roles that are able and will be willing to share the surveyed information.

This study uses a cross-sectional and mail survey methodology to collect data for further analysis.

1.7 Limitation of the Study

As mentioned earlier that the key objectives of this study is to examine the relationship between TOE framework, ERP cycle, and firm performance with the manufacturing industry in Thailand, however, it may be necessary to discuss some limitations of this study. First, firm performance may be affected by various other

variables not included in this study. Second, the questionnaire for this study is a self-report. Therefore, there is a possibility that the respondents may misinterpret the meaning of the questions. Variables which may cause in answering questionnaire in a way that is perceived than what is actually meant. Third, there may limitation of internal information disclosure. And finally, the sample of firm was draw from single industry, the manufacturing industry, which may yield different results with other industries.

1.8 Organization of the Study

This study is organization into five chapters.

Chapter One Introduction, this chapter presents background and statement of the problem for this study, including research objective, research question, hypotheses and conceptual framework, scope of the study, limitation, and contribution of this study.

Chapter Two Review of the Literature, based on the reviewing of the theories and previous studies in related areas to lay a foundation for the study both theoretically and empirically. This chapter is designed to review key theoretical concepts in the TOE framework, ERP adoption, ERP implementation, ERP assimilation, and firm performance.

Chapter Three Research Methodology, presents methodology relevant in the study, based on research questions, research hypotheses, and literature reviews in chapters one and two. Topics of relevance are the research design, research methodology, random sampling, measurement criteria, data analysis plan and quantitative measurement. Particular attention is given to the test for validity and reliability of the research constructs. Qualitative research is undertaken to confirm quantitative research results.

Chapter Four Research Results, presents in this chapter is the data obtained from using statistics to interpret results in the research report. With presenting information in tables or figures.

Chapter Five Conclusions and Recommendations, this chapter present summary of the fourth chapter and discuss the results of research. With the effect of chapter four, how does it fit in with the second chapter? As well as recommendations for future research.

1.9 Contribution of the Study

The results of this study are anticipated to have contributing values for both a theoretical and practical perspective.

On the theory side, the study is significant since it further the studies and extend an understanding of TOE framework. With examining relationship between ERP cycle and firm performance.

On the practical side, this study raises the awareness for firms on an importance of ERP implementation as a crucial part for business success and enhance the firms' performance. This will help the firms to stay competitive in the current business competitive situation. The results of this study should assist managers for better understanding of the implication of ERP implementation in the business practices for create a competitive advantage.

CHAPTER 2
REVIEW OF THE LITERATURE

In this chapter, the researcher conducted the literature reviews from the relevant sources consisting of four main parts as follows: First, the researcher mentioned on the theoretical view of TOE Framework. Second by ERP system in which can be divided into five parts of History of ERP System, ERP System Software, Purpose of ERP Systems, Benefits of ERP Systems, and ERP System Cycle; Third, mentioning on the efficiency of the firm as it adopted ERP; and lastly to suggest the theoretical framework to be used in the study.

2.1 TOE Framework

Conceptual framework, technology-organization-environment can be explained by Tornatzky and Fleischer in the book of The Processes of Technology Innovation (1990). This book explained on the procedures, innovation development, acceptance and the adoption of those innovations in the firm in any contexts. TOE Framework is part of the process with the influence on the acceptance and the use of innovation.

TOE Framework is the organization level theory that explained on the three different components of the firm with the influence toward acceptance decision. All the three components are the technological context, organizational context and environmental context. All three factors are confirmed as the influential parts over the innovation (Baker, 2012). Technological factor is to describe on the characteristics of IT/ IS with the influences on innovation distribution (Tornatzky et al., 1990) since, IS creates the relationship advantage to the data quality. Organizational factor refers to the explanation related to the organization such as size, scope, and organization resources (Zhu & Kraemer, 2005). It is shown from the former study that the organizational factor is only important for the distribution of IS. Environmental factor is to explain on the external organization with the influence on the distribution of IS including industry, competitors, and government (Tornatzky et al., 1990).

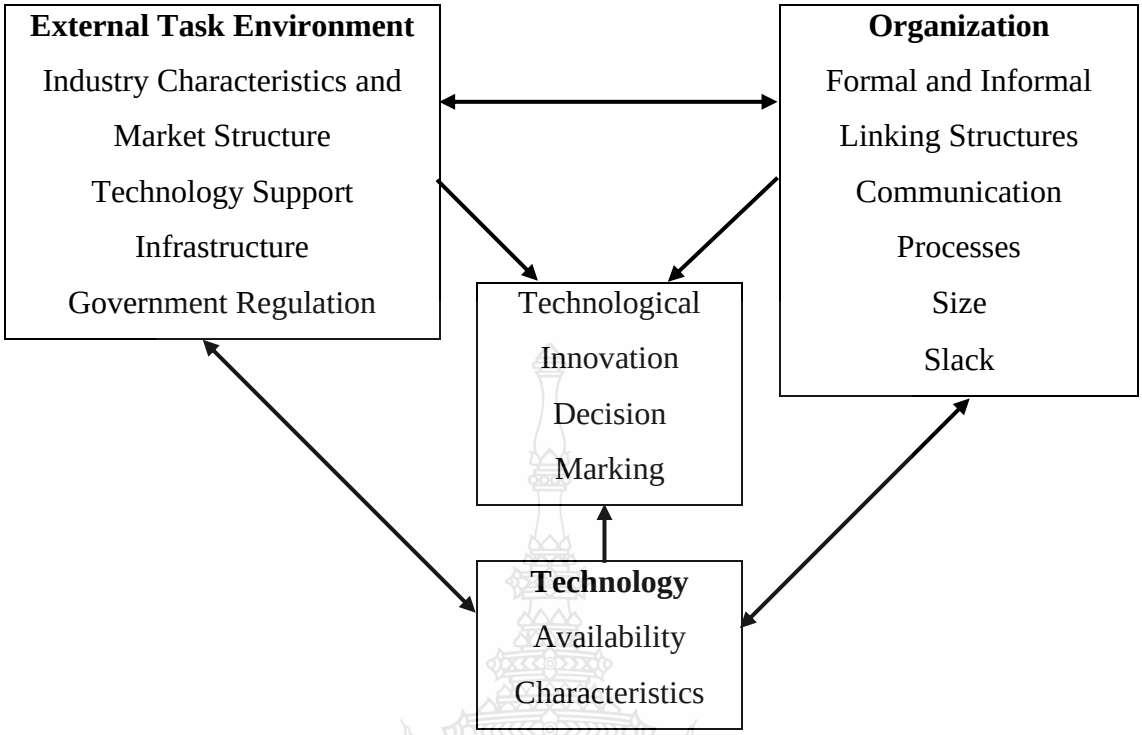

Figure 2. 1 The technology- organization- environment framework (Tornatzky et al., 1990).

Many studies that used TOE framework to prove on the acceptance of successful IT innovation helped increase the potential of the organizations (Srivastava & Teo, 2007). Teo et.al. addressed though TOE framework was widely used in the previous researches, but the specific internal factors in each aspect consisted of technological factor, organizational factor and environmental factor in which were different (Teo, Lin, & Lai, 2009).

2.1.1 The Technological Context

Technological context means all the information technology related to the company. Either technologies existed in the company or technologies in the market that have not been adopted for the current use. Existing technologies in the company are crucial for the acceptance procedure since these technologies can be changed all the time (Collins, Hage, & Hull, 1988). Existing innovations without usage in the company can also affect on innovation in the scope setting for the adoption of innovation in the company as well as to show the company's guideline for development and adjustment in the use of technology (Baker, 2012).

Within the innovation groups external to the company, there are three types of them which are the create incremental, synthetic, and discontinuous changes (M. Tushman & Nadler, 1986). Innovation leads to these changes and reflects the risk in adoption. Internal technological resources such as basic infrastructure, technical skills, developer and user time are crucial for the acceptance for success information system (Kwon & Zmud, 1987).

Innovation dominated industry that leads to the increasing though with changes but they would help on measuring of acceptance. On the contrary, the innovation dominated industry that leads toward non-continual changes requires the company to quickly process and makes sharp decision on acceptance and add the competitive potential. When estimating on technologies that create the non-continual changes, the company shall also consider whether those technologies are "competence-enhancing" or "competence-destroying" (M. L. Tushman & Anderson, 1986). Innovation promotes for the potential to help the company changes toward expertise, however, the innovation with destroying innovation can outdate the existing technologies.

It can be concluded that organization shall deliberately consider on the types of change in which to be formed up by the use of new technologies. Some of innovations may have huge impact on the company and the competitive industry.

In the study on technological context with the influence on the use of ERP consisting of: technology readiness, IT capability level, compatibility, and complexity.

1) Technology readiness

Technology readiness refers to the level prepared by the firm related to the environment and staff to accept on new technologies (Finney & Corbett, 2007; Soja, 2006). It is necessary to estimate on technology readiness of the organization as well as the skill and IT infrastructure (Somers & Nelson, 2004; Tarafdar & Roy, 2003). IT skill refers to the ability of the IT staff to set for the values and maintenance on information technology for business support (Stratman & Roth, 2002). Technological skill and readiness for the strength in training are required for the company to improve its main capacity (Ravichandran, Lertwongsatien, & Lertwongsatien, 2005). The company with high level of technical expertise and infrastructure can expect to use technical aspect in its business and help the company to gain better efficiency that the company with lower

technical expertise and infrastructure (Lee, Lee, & Lin, 2007). Technology readiness is the main factor for ERP acceptance (Pan & Jang, 2008).

2) IT Capability Level

CMM (Capability Maturity Model) presented that the level of goal setting in IT system can be done only after passing the period that have been slightly processed (Randeree, Mahal, & Narwani, 2012). Paulk (1999) explains the levels of CMM as follows: Level 1 (Initial) is that the process with specific characteristics can be complicate for sometimes, the process is few settings while the success remains on individual's intention and skill of each. Level 2 (Repeatable) the process for basic infrastructure management in which established to follow the cost, program and work functions with the necessary methodology to be used in the process that required to repeat on the previous success of the project. Level 3 (Defined) is the process for engineering activity management, documenting according to the standard and combined into the standard process in the organization. All the project uses standard software process of the organization for software development and maintenance. Level 4 (Managed) is to collected the details of the process and product quality both in the software and product process. Level 5 (Optimizing) is the continual process improvement from the quantitative response from the process and to lead on idea and technology innovations. The companies in level 5 use new ERP system with the tendency to be more successful than the company in level 4, 3 and else (Schniederjans & Yadav, 2013). The previous research defined that growth with high potential would support the creation, assessment and continual improvement of IT service that issued to achieve the business objective (Bowen, Cheung, & Rohde, 2007).

3) Compatibility

Compatibility is the level where innovation has been perceived as conforming to the existing one, needs, experiences and the organizational operation with the compatibility to the organization and technical compatibility (Schultz & Slevin, 1975). Compatibility of the organizations assessed from the attitude and belief of the organization while technical compatibility can be assessed from the existing information system, hardware and software (Schultz & Slevin, 1975). In the context of ERP, ERP assimilation usually comes with changes in business process and existing cultures, thus,

organization compatibility is then so crucial for ERP assimilation. Besides, the technical compatibility is also crucial since, some software may be kept and combined together with ERP system (Bradford & Florin, 2003). Therefore, if to combine the new ERP system with the operation and the existing systems, there will be more chances for ERP assimilation (DeLone & McLean, 1992; Tornatzky & Klein, 1982).

4) Complexity

The complex innovations are difficult to understand and use (Rogers, 1995). Complexity is the natural qualification of ERP system. ERP service providers had developed the best ERP module in the specific industry in which adding more complexity by presenting the strength in the data distribution of ERP (Poston & Grabski, 2001). Additional complexity from ERP assimilation leads toward big changes in the department or the entire organization (Poston & Grabski, 2001). When ERP system is too complex, it would result on the lesser use of ERP at the organization level. Innovation complexity may lead to the resistance since the lack of necessary skills (Rogers, 1995). Complexity will not only influence on the initial use of ERP system, but it also stops the use of ERP in the higher level (Vluggen, 2005). Therefore, the complexity would reduce the ERP assimilation.

2.1.2 The Organizational Context

The organization context refers to the characteristic and resources of the company including the link between the structure between employees, communication process between the companies, size of the company and the amount of loosen resources (Baker, 2012). Organizational context can influence on the decision to use and practice in several methods as follows: Firstly, the mechanism that links sub-unit in the organization or the internal scope helps promoting innovation (M. Tushman & Nadler, 1986). Unofficial link such as the sale representative of the product, scope evaluator, and those who look after on the use, cross-line team and unofficial staff or unofficial staff in other units or partners in the value chain are the additional samples of the mentioned mechanism.

The communication process in the organizational context can promote or stop the innovation thus, the high-level management can promote on innovation via forming the organization context that prompt for the changes and support on the innovations that

would continually aid the company essential mission and attitude. The best leadership and management behavior are to explain on the role of innovation in the mutual strategy of the organization, this points out the importance of innovation toward subordinate, the reward of innovation both official and unofficial, stressing on the background of innovation within the company, and to form up the skillful management team that can form the interesting vision about the future of the company.

There is the evidence that the organization structure is the key variance to predict for technology adoption (Ramdani, Chevers, & A. Williams, 2013). Within TOE framework, organization structure refers to the company on the aspect of supporting on the high level of management and technological knowledge related to new technology (Chong & Chan, 2012). Support from the high level of management will measure from the level that the management consider they understand on the work of new technology and support for the adoption. It has pointed out by the academician that the high level of management can communicate with any units in the organization about the importance of new technologies and influence on the firm's intention to bring technology to use (Y.-M. Wang, Wang, & Yang, 2010).

In the study of organizational context influence on the use of ERP, there are: firm size, top management support, type of production, and perceived barriers.

1) Firm Size

Size is the key factor in organization management on technology (Tornatzky et al., 1990; Yao, Xu, Liu, & Lu, 2003). There are usually the reports that the big organization tends to use more innovations since the flexibility and ability to absorb more risks (Zhu, Kraemer, & Xu, 2003; Zhu & Kraemer, 2005). It is reported that the processing of ERP system is the long process and costly. Shehab et al. (2004) and Huang et al. (2004) confirmed on the use of ERP required large capital cost and personnel. However, other researchers have argued on this by defining that size of organization and IT acceptance are not related (Armstrong & Sambamurthy, 1999; Iacovou, Benbasat, & Dexter, 1995).

2) Top Management Support

Supporting on the high level of management refers to supporting on the significant priority by the high level of management or leadership (Martin, 1982). Researches in the past have not linked the attempt to become the leadership with the management ability and to overcome any obstacles to bring information system to use (Oliveira & Martins, 2011). In the same way, the past studies reflected the successfulness in ERP had the positive relationship with the organization culture in which supported by the leader (Al-Shamlan & Al-Mudimigh, 2011; Khattak, Yuanguan, Irfan, Khattak, & Khattak, 2012). However, the high level of management and the company need to support on the company overall for the successful use of ERP (Moohebat, Jazi, & Asemi, 2011).

3) Type of Production

Raymond and Uwizeyemungu, (2007) had found that the types of production were related to the acceptance of ERP. Marketing91, (2018) defined that there were four different types of company' s production such as the type of product, the need for production as well as the seeking for raw material. Four types of production are as follows: (1) Unit or job production is the goods production with diverse characteristics according to the demand of consumers. The amount of production per time is in lot and any machines and equipment will be gathered according to the work functions into the production station dividing into categories kept in any parts of the plant chart at the point that can make all the production processes run fluently as planned. Running the machine until the product can be produced in the required amount then, shift to produce other types of product by the same machine. (2) Batch type of production is the production that similar to the non-continual until sometimes it is considered as the same type of production, but differ only that the Batch type production will have the specific characteristic of the product. They will be separated in groups while each group will be produced with the same standard in whole lot. Whereas as the non-continual production will have more specific diversity characteristics of the products. The characteristics of machine arrangement in the Batch type of production is similar to the non-continual production which is to set the machine from its work function and being the station for works to flow through to each station according to the order of works. And since the Batch type of production is the production in lot, the production process then has the plan

in order like groups according to the production lot. This type of production is adopted in production by order or production to prompt for sale. (3) Mass production or flow production is the production of similar items in large amount such as shampoo production, automobile manufacturing and washing machine production. Flow production uses specific machines in each production line in separated and not to join in using the machine. Machines are specific to each product line for the speed in production with high amount. This production is suited for the prompt production for sale or to use in the module of production to wait for the orders from customers. (4) Continuous production or process production is the production of only kind of product continually in large amount using the specific machine. It is usually the production and transformation of natural resources into raw material for the next step of production such as oil extraction, chemical production or paper production.

4) Perceived Barriers

The difficulty in ERP acceptance may result from the resistance of the users and this may begin to occur during the step of brining to use. Therefore, the perception of obstacle is important. The supporting from high level of management in the organization will help overcoming the difficulty and complexity found in acceptance to use IT (Bajwa, Garcia, & Mooney, 2004; Nah & Delgado, 2006; Umble, Haft, & Umble, 2003). The company that perceives of the obstacle in bringing to use IT in low level tends to accept technology more than the company that perceives on the obstacle in the use of IT in high level.

2.1.3 The Environmental Context

Environmental context is including with the industrial structure, exist or not exist of technology provider and regulation environment (Baker, 2012). Industrial structure has been examined in various forms such as intense competition will stimulate for the innovation acceptance (Mansfield, 1977). Besides, the dominate company in the value chain would have influence on the partners in other value chain on creation of new things (Kamath & Liker, 1994). In the saturated industry that runs the business for a long time, it may not obviously practice on innovation. Some firm used the downfall period of the industry to invent on new innovation. Some company avoids the innovation investment by trying to reduce the cost.

The basic infrastructure to support on technology also influence on innovations. The company that has to pay for the high amount of skillful workforce normally be forced to invent on the innovation to save wage cost. The prompt of skillful workforce and consultant or any technological suppliers also promote for innovation.

Lastly, the rule and regulation of the government may provide pros ad con on innovation. When the government has set on new limitations in the industry such as to have the operation control equipment for the energy company; thus, innovation is important to them. In the same way, limitations on safety and strict testing can slower the forming of innovation in any industries. For example, in the construction that required to test on new materials before using or in the agricultural sector that new plants shall be patented and approved in which the cost might be so high. Another sample is in the bank where the personal requirements may not allow the bank to suggest on new method for the consumers to access into their own account. Thus, the rule and regulation from the government can either support or obstruct on innovation (Baker, 2012).

In this study, the environmental context may affect on the use of ERP as follows: external support, competitive pressure, trading partners' readiness, and market uncertainty.

1) External Support

External supporting on relevant technology is considered as the key factor in which essential for the users with potential. External supporting may have the different data sources in each country and from regional to regional within the same country. Technology distribution government and the agency of changes can provide support from external. It is confirmed from the study that external support is not only a key factor to drive toward success of ICT (DeLone, 1988). However, it is the key factor for the real acceptance (Premkumar & Roberts, 1999). Li (2008) found that external support is the key factor to use electronic purchasing in the production, external support is the key factor of acceptance (Awa & Ojiabo, 2016).

2) Competitive Pressure

The role of pressure in competition is accepted as the efficient motivator (H.-F. Lin & Lin, 2008). Zhu and Kraemer (2005) defined that it was the pressure level that the company sensed from the rivals in the industry. Industry competition in general will

perceive on the positive result toward information technology acceptance especially when information technology has directly affected on the competition and this is the necessary strategy to bring new technology into the market (Ramdani, Kawalek, & Lorenzo, 2009). Competitive pressure is the key factor for acceptance (Awa et al., 2016). Information technology acceptance is benefited for the company in changing its competitive environment on the aspect of rule for competition, industrial structure and higher efficiency above their rivals.

3) Trading Partners' Readiness

The relationship with partners is the key factor for both the operators and the academics. Though the relationship with partners may related to the relationship between the successful buyer and seller, but the collaboration that is honored as the root of Internet-based interorganizational system: IIOS. The promptness of partners can be seen form the promptness of partner with potential in which become the main point in system planning between the organization and to improve the ability in system planning between the organization (H.-F. Lin & Lin, 2008). In case of the dependent on each other and between companies and trading companies that seem to increase. The company tends to get better understanding on the needs of trader and risk opportunity from the external.

4) Market Uncertainty

Uncertainty is the unpredictable situation that takes place without knowing when and how it will occur. The uncertainty would surely lead to many impacts on human, organization and others. Uncertainty is crucial for the organizational planning especially, the market uncertainty. In case that the market uncertainty is high, it may result of the sign to forward the negative information and the company may postpone the announcement of its official performance. Besides, in case that the company is not intend to provide the guideline when the prediction is wrong (Libby & Rennekamp, 2012), the increasing market uncertainty may prevent the company from issuing the suggestion since it could result on the ability to predict for the accurate income. Market and environmental factor such as competitive level in the market, security of demand for products and loyalty level among the customers cannot be controlled by the organization management but may affect on its business running method. From the IT perspective, management shall require for more response and flexibility in IT supporting. Therefore, there is the assumption that

the companies that face with market uncertainty at high level tend to accept more on the open system (Chau & Tam, 1997).

It can be concluded that all the three components in TOE framework which are technology, organization and environment can form the limitations and opportunities for the technology innovation creation. These components have the influence on the level of technology in the organization.

Table 2.1 Summary of prior studies using the TOE framework

Reference and innovation	Technological context factors	Organizational context factors	Environmental context factors
(Zhu et al., 2003) *E-business*	- Technology competence	- Firm size -Firm scope	- Competitive pressure - Consumer readiness
(Raymond et al., 2005) *E-business*	- Manufacturing technology	- Strategic orientation - Managerial context - Manufacturing context	- Networking intensity
(Raymond & Uwizeyemungu, 2007) *ERP*	- Assimilation of CIM systems	- Size and structure - Type of production - Operational capacity - Innovation capacity - Financial capacity	- Commercial dependence - Networking intensity
(Pan & Jang, 2008) *ERP*	- IT infrastructure - Technology readiness	- Size - Perceived barriers	- Production and prerations improvement - Enhancement of products and services - Competitive pressure - Regulatory policy

Table 2.1 Summary of prior studies using the TOE framework (Cont.)

Reference and innovation	Technological context factors	Organizational context factors	Environmental context factors
(Kouki et al., 2010) *ERP*	- ERP attributes - IT/ERP expertise	- Top management support - Strategic Alignment - User involvement - Absorptive capability - Reward system	- Institutional pressures - Vendor support - Consultant effectiveness
(Schniederjans & Yadav, 2013) *ERP*	- IT capability level	- Understanding user requirements - Change management - Implementation plan - Project management - Top management support	- External pressure - Trust
(Sila, 2013) *E-commerce*	- Costs - Network reliability - Data security - Scalability - Complexity	- Top management support - Trust	- Pressure from trading partners - Pressure from competitors

Table 2.1 Summary of prior studies using the TOE framework (Cont.)

Reference and innovation	Technological context factors	Organizational context factors	Environmental context factors
(Thi, Lim, & Al-Zoubi, 2014) *E-government*	- IT infrastructure - Relative Advantage - Compatibility - Security	- Culture_Version - Culture_Others - Top management support - Financial resources - Human resources	- Government support - Competition pressure
(Fu, Chang, Ku, Chang, & Huang, 2014) *Inter-organization systems*	- System function - Technology trust - Cognition benefit	- Partner willingness and ability - Organization characteristic - Organization readiness	- Overall environment - Industry environment - External pressure
(Xu et al., 2017) *ERP*	- Relative advantage - Compatibility - Complexity	- Top management support - Organization fit - Financial commitment	- Competitive pressure
(Gutierrez, Boukrami, & Lumsden, 2015) *Cloud computing*	- Relative advantage - Complexity - Compatibility	- Top management support - Firm size - Technology readiness	- Competitive pressure - Trading partner pressure

Table 2.1 Summary of prior studies using the TOE framework (Cont.)

Reference and innovation	Technological context factors	Organizational context factors	Environmental context factors
(Awa et al., 2016) *ERP*	- ICT infrastructures - Technical know-how - Perceived compatibility - Perceived values - Security	- Size of the firm - Demographic composition - Scope of business operations - Subjective norms	- External support - Competitive pressure - Trading partners' readiness
(Chatzoglou & Chatzoudes, 2016) *E-business*	- IT infrastructure - Internet skills	- Firm size - Firm scope - CEO's knowledge - Adoption cost	- Willingness and capabilities of supply chain partners - Competitive pressure - Government support - Consumer readiness
(Hsu & Lin, 2016) *Cloud service in enterprise*	- Relative advantage - Ease of use - Compatibility - Trialability - Observability - Security	- Firm size - Global scope - Financial costs - Satisfaction with existing IS	- Competition intensity - Regulatory environment

Table 2.1 Summary of prior studies using the TOE framework (Cont.)

Reference and innovation	Technological context factors	Organizational context factors	Environmental context factors
(Molinillo & Japutra, 2017) *Digital information and technology*	- Perceived benefits or relative advantage - Compatibility - Complexity - Trialability - Perceived barriers - Perceived risks - Perceived ease of use - Perceived importance of compliance	- Firm size - Organizational readiness - Technical competence - Financial readiness - Top management support - Internal needs - Proactive technical orientation - Firm scope - Satisfaction with existing systems	- External pressures - Third party sponsorship - Customer readiness - Participation level in a professional and trade association
(Verma & Bhattacharyya, 2017) *Big data analytics*	- Complexity - Compatibility - IT assets	- Top management support - Organizational data environment - Perceived costs	- External pressure - Industry type

2.2 ERP System

ERP is the software that used for organizational resources management, it is the complete software that can cope with the needs of organization in all departments from accounting, human resources, financial, sales, marketing and production. ERP enhances for data integration in the organization and coordination between business processes that can save cost in overall. Besides, it enhances for information integrity, real time and prompt to be exchanged with customers and suppliers. Companies that used ERP system received benefits from quick and accurate data collections, quick decision making, low cost of inventory, better relationship with customers, and improved product quality. Therefore, ERP can be used as the integrative information system in supporting for the business processes and any functions through the efficient and effective organizational resources management (Hwang, 2011).

2.2.1 History of ERP System

In the period of 1960s, most of the organization paid attention on design, development and computer system by using the central stock control system. The languages used during that time were COBOL, ALOGOL and FORTRAN. There was the initial system forming for material requirement planning (MRP) in 1970 in which related to the planning for the products or parts requirements according to the core products. Next, in 1980 there was the new software development for the replacement so called MRP II in which it stressed on efficiency adding to the production process and to coordinate together the production and required materials. Besides, MRP II had gathered any processes components such as shelf and distribution management, project management, financial, human resources and engineering. ERP system had firstly presented in the end of 1980 and early of 1990 via the coordinating and integrating between all the organization units (Rashid, Hossain, & Patrick, 2002).

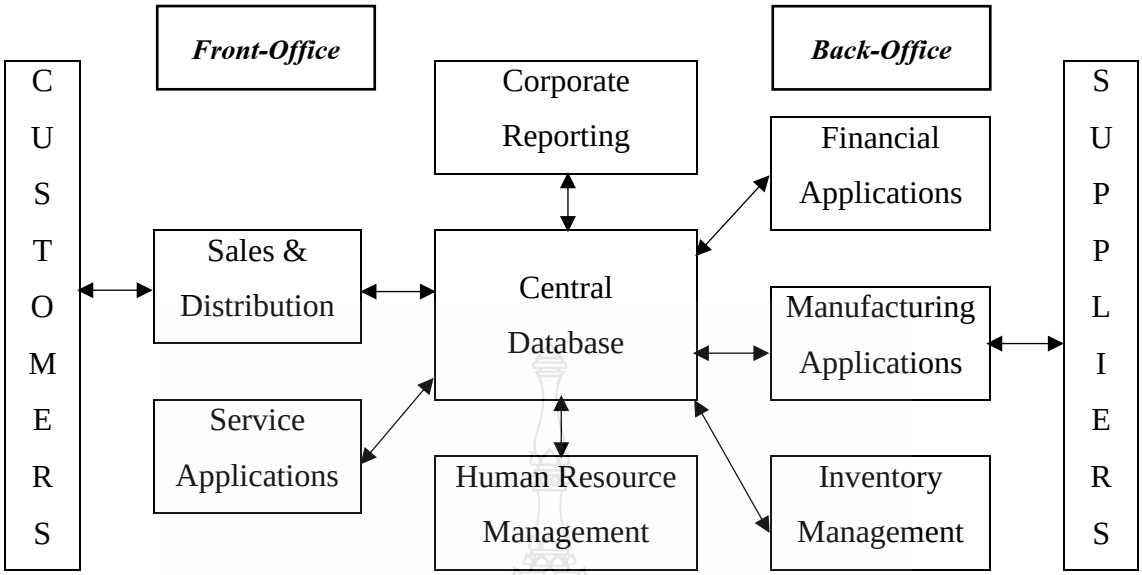

Figure 2.2 ERP system concept (Rashid et al., 2002).

In 1990, ERP seller added more modules and functions in form of “add-ons” in the core module. This included advanced planning and warning as well as any e-business solutions such as customer relation management (CRM) and supply chain management (SCM).

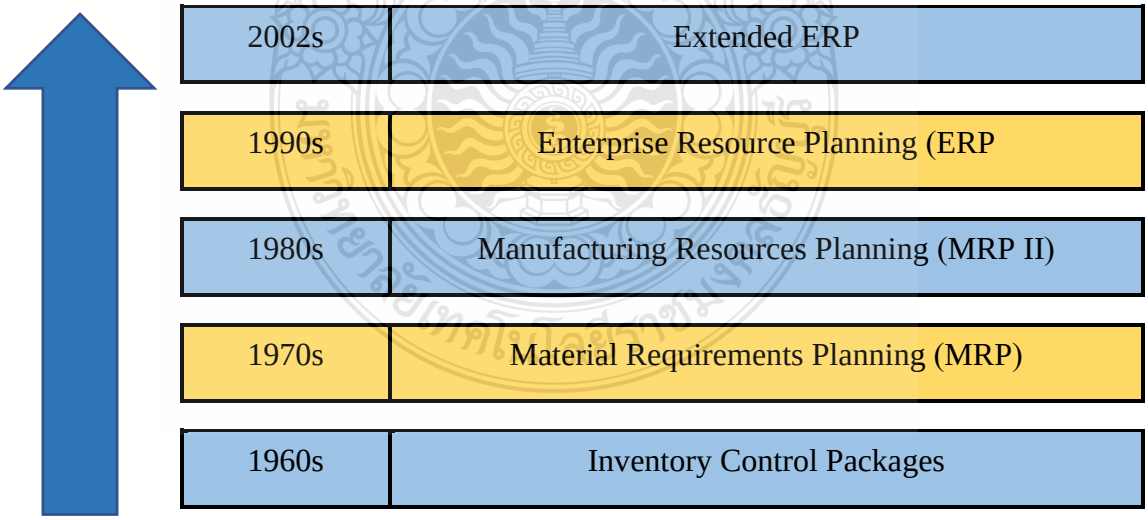

Figure 2.3 ERP evolution (Rashid et al., 2002).

2.2.2 ERP System Software

ERP was designed to help the companies getting prompt toward growth and expansion. At recent, ERP is advanced toward ability to take care almost every process in the organization. One of the key benefits of ERP system is that the business process will become the automatic system throughout the company in which this would help the high-level management and the employees in the whole company get the benefits. ERP has the major components as follows:

1) Human Resource

Human resource features are for instance, the payroll software, payroll by employee, automatic transfer to bank account, taxes and deduction of claim values in which IT can be worthily and beneficially adopted. Staff management is crucial thus, the human resources components must be able to completely handle on the staff management.

2) Customer Relationship Management

Customer relation management is used to follow up the customer purchasing behaviors. This work system can facilitate for products management and generate more sales. Besides, it can be used to follow up chat history with customers in order to know the individual customers that have conversation with the sale-person. Using this data can reduce the overlapping in sale process, reducing customers bristly and forming in the confidence in successful sale. Customer management and sale opportunity are important for the organization because if the organization has no customer, business will be unable to survive. Customer relation management (CRM) is part of ERP that helps on customers follow up and bringing the information to use in the organization to add more marketing and sales efficiency.

3) Business Intelligence

BI is part of ERP that will present the insight information in the report. The characteristic of good report is the crucial thing in BI that can help forming the understanding on the information needed for analysis. Though some reports are in form of figures and table, however, many may prefer the pictorial report since it gives quick vision on the trend. At recent, BI has become quickly become the standard in ERP system. BI components in ERP is to gather and analyze the information as the insight information that can be presented in the business process. And since the business pays attention to the

supporting information for the decision, thus, BI is an important thing that cannot be missed.

4) Supply Chain Management

Creating efficient supply chain is not easy especially, when there is no best tool to look after the organizational operation. Examining the organization's ERP with the components for supply chain management (SCM) is crucial to keep the competitive ability. SCM for the organization shall add efficiency both in the production process and distribution as well as to form the better efficient supply chain. The information begins from real time collection. Real time information would help the organization seek and solve the problems immediately. Besides, it would assist in the prediction analysis to aid in the planning of needs. Real time information can help the organization forming the right and up to date production plan for the organization to answer to the needs but not exceed over them.

5) Inventory Management System

Inventory management is the most relevant part to ERP. Inventory management will run together with SCM components and this helps reducing the confusion in other processes such as sales and warehouse. The main objectives of these components are to manage, comply to the purchasing order and keep stock in the warehouse. The components in inventory management come with the follow up attribute as well as the follow up in any levels according to the product codes or SKU (Stock Keeping Unit).

6) Financial Management

Since the processes in any business types are related to cash flow no matter the employee's payroll or payment for product delivery in which working together with ERP system. Financial management system will collect and analyze all the organization's financial information including the creditor's account, debtor account and budget. Information analysis of the organization can reveal the cost tendency that would help the organization better understand on their profits calculation and seek for the way to reduce cost. Besides, it can accept the financial forecasting from data analysis and helping organization to add more profits in the future. It is considered by many of the management that success or failure in using ERP is depended on software or mistakes of the purchased software. In reality, 95% of success or failure is depended on the companies that may use

software that does not come from the software distributors. Turban and Volonino, (2012) defined that from the investigation in 2008, ERP experts found that there were five factors of success in ERP and the 6th factor was all five factors together. This can be shown in levels of success as follow:

1. Strength in program management: 6%
2. Supporting from the management: 19%
3. Organization changes management and training: 13%
4. Real expectation: 8%
5. Aiming at the business process: 5%
6. Interaction of five factors: 49%

Those are 49% of the ERP experts, it is found that success depends on the five factors or to be said also almost half of the experts define that failure of one out of these five factors may lead to the failure of ERP.

Table 2.2 ERP Failures (Turban & Volonino, 2012).

Company and Industry	Description of ERP Failure
Hershey Foods, manufacturer of chocolates, confectionaries, and beverages	Hershey took three years to adopt ERP system with the value of 115 million US dollar and SAP/ ERP to replace all the old systems such as inventory, purchasing order processing, salary, financial and accounting. The worse mistake of Hershey was trying to use all the systems in all departments at the same time and at the time of the year with the most load of works.
Waste Management, garbage-disposal giant	In the middle of 2009, Waste Management had joined the legal battle for 100 million US dollars with SAP to install ERP software in 18 months period. SAP sued back and accused that Waste Management breached the contract.

Table 2.2 ERP Failures (Turban & Volonino, 2012) (Cont.)

Company and Industry	Description of ERP Failure
Nike, athletic shoe and apparel manufacturer	Nike used i2 and software for supplying plan before using SAP ERP for supply chain management and all sale processes. i2 system formed repeating orders, the customers' orders were deleted and deleted the request for production to the plants in Asia. Adding problems, ERP was not designed to manage on a lot of products at Nike. The former systems were left to use in which they lacked of the ability to communicate with the supply chain software such as lacked of the efficiency and led to the delay and large problems. Upgrading for supply chain and ERP system at Nike for 400 million US dollars made it loss 100 million US dollar sales, or 20 percent reducing in the stock price. Nike blamed for this failure to estimate the lowest value of necessary resources for i2 system and begin to use SAP before the mean time.
FoxMeyer, bankrupted; Formerly the fourth largest Pharmaceuticals distributor	ERP of FoxMeyer cannot process the necessary transaction to supply customers with their purchasing order. FoxMeyer processed on 425,000 invoices per day. The ability to process the purchasing order was reduced, it made the company quickly bankrupt and close at the end.

ERP is the application program containing various modules to help fluently improving the business processes. Organization transactional structure evolution will replace the stand-alone applications in the company with joint system to integrate the whole organization. Amount of studies continually give credit for ERP for its ability to improve the potential of business decision making and organization efficiency. ERP has been honored as the important part for the basic infrastructure of organization data for the

modern business. In the past few years, this has widely resulted on the feeling of the companies that will invest in ERP project.

2.2.3 Purpose of ERP Systems

Enterprise resource planning of the organization is complicated with the layers of software package that required for the proper configurations with the organization form (Staehr, Shanks, & Seddon, 2012). System consists of set of standard software and database to support the whole organization from recording, processing, checking until reporting on all transactions (Zhang, Gao, & Ge, 2013). Besides, with the objectives and functions of ERP software, it leads toward complication and large size (Zeng & Skibniewski, 2013). ERP system consists of the group of business modules that link with many work forms to facilitate for data movement throughout the organization (Kumar & Malik, 2012; M. Beheshti, K. Blaylock, A. Henderson, & G. Lollar, 2014). Software designing helps circulating the data between any business functions in the organization (Bhattacharyya & Dan, 2014). This system supports for accounting, financial, purchasing, human resources, logistics, production and customer service between other business functions (Kumar & Malik, 2012; M. Beheshti et al., 2014; Zhang et al., 2013). ERP system is the heart of information system that covers the organization overall to help the authorized person to make decision and can access to all the relevant data at the right time, with reliable and conformity (Bhattacharyya & Dan, 2014).

Enterprise resource planning can manage both internal and external resources for the data circulation between any activities (Zeng & Skibniewski, 2013). Internet has facilitated for the convenience of ERP application using outside the organization premise to connect with the customers' business, business partners and suppliers (M. Beheshti et al., 2014). By this reason, ERP system can help sharing the information in the organization units as well as distributed to the business network. Central database is the heart of the system to receive and send to the application via the same type of computer platform (Bhattacharyya & Dan, 2014). Besides, since all the information is in the same database, system then makes the standard business process on the aspect of information and data requirements in which enhancing for one time feeding and can be seen throughout the organization (Bhattacharyya & Dan, 2014; Escobar-Rodriguez & Bartual-Sopena, 2013).

System designer can set the configuration for ERP system to promote the efficiency and effectiveness organization goal and objective (Murphy, Chang, & Unsworth, 2012). Therefore, ERP system is suited to adjust to internal and external organization according to the pattern of world economy (Xia, Min, & Shuang, 2013). System administrator shall checkup the system configuration for the accuracy in all steps and to meet with the changing needs of the business (Grabski, Leech, & Schmidt, 2011). System designer can set system configuration to conform with the rules and regulations (M. Beheshti et al., 2014). Therefore, ERP system has set for the business process, examine the staff work and enhance on the internal control (Grabski et al., 2011). Besides, the primary objective of ERP system is to facilitate for the convenience coordination and co- operation between the company' s employees (Pasaoglu, 2011). The enterprise resource planning system can manage on languages translation and currencies (M. Beheshti et al., 2014). Apart from various languages and currencies managing, ERP system can response to diverse needs of units and places (Xia et al., 2013), Plus, it is to promote on the information flow in many areas both domestically and internationally (M. Beheshti et al., 2014).

2.2.4 Benefits of ERP Systems

The main reason to use ERP system is the top management request for the improvement on the efficiency and cost reduction as well as to form the organization potential to have the competitive ability (M. Beheshti et al., 2014; Vinatoru & Calota, 2014). Xia et al. (2013) supported on this view in his report that ERP system can improve the market competition and economic efficiency. Grabski et al. (2011) found that the top objective is for the economic benefits such as improving the decision, adding efficiency or cost saving. The most important benefits of ERP are better cost structure, quicker response rate from customers, better clarity of information and production processes improvement (Gattiker & Goodhue, 2005; Nicolaou, 2004; Nikookar, Safavi, Hakim, & Homayoun, 2010; Romero, Menon, Banker, & Anderson, 2010). Zeng and Skibniewski (2013) stressed that ERP system forms the ability for the organization in cost and production rounds saving as well as adding more efficiency and effectiveness. Organizational resources planning system helps adding flexibility, efficiency in data gathering and processing and putting together the accounting applications with the

business process (Kanellou & Spathis, 2013). Tsai et al. (2012) found that the immediate sending out and data gathering were efficient in adding the business continuity, improving the budget planning and reducing the income management.

The major benefits of ERP system are to add more opportunities in business automatic financial information checking together with the improvement for the direct accessing to the details of transaction (Grabski et al., 2011). Tsai et al. (2012) emphasized that ERP system can improve the checking quality in which reflected the system quality that supported for accounting task. Besides, Murphy et al. (2012) concluded that the system improved the ability of checking, adding more operational display and increasing the error control. Kanellou and Spathis, (2013) supported that the accounting benefits as well as the improvement on the flexibility in information forming, report quality improvement, and reducing time to generate annual accounting. Besides, ERP system partly helps in risk management as well as the stricter internal control, better checking route and well regulation compliance (Grabski et al., 2011). ERP system helps the investors and the investing analysts' accessing to the relevant information for the better transparent of the market in which would help in securities trade and business governance (Tsai et al., 2012).

Ability to access into the information in compliance at the right time from diverse areas of the organization would be beneficial to boost the management to adopt ERP system (Grabski et al., 2011). Bhattacharyya and Dan (2014) stressed at this point that ERP system helped accessing to the reliable information with simpler integration. Besides, forming up to date information and correctness throughout the organization with the mutual views on the relevant information to enhance the decision (Bhattacharyya & Dan, 2014). The following outcome is to eliminate the repeating information and reasonable business process in which can save much cost (Bhattacharyya & Dan, 2014). Besides, ERP system supports for the transparency and organization control since the standard and gathering of processes throughout the organization (Maas, van Fenema, & Soeters, 2014). Organization leader uses system to best operate the business for the better work efficiency and effectiveness (Mouakket, 2012).

The attribute for internal and external connection helps on better connection between organization, customers and all the stakeholders in which lead to the quick

success on the business objectives, cost reduction and increasing productivity (M. Beheshti et al., 2014). The external communication interface of ERP system helps on customers and supplier's safety in the proper network in access to the information (Kumar & Malik, 2012). This helps the organization leader improved relationship with customers, supply chain management and reducing cost of inventory (M. Beheshti et al., 2014). Therefore, using ERP system can create more customer satisfaction, improve the supply chain efficiency and good seller efficiency (Kumar & Malik, 2012). The module for customer relationship recording and storing all the conversation with customers in database to add more display of customers to the managers and staff throughout the company (M. Beheshti et al., 2014). This attribute can response more to the needs of customers and reducing sale time (Kumar & Malik, 2012). Since the relationship with customer is important for the organization efficiency, ERP system would help reducing cost of operation, generating profits from the operation, getting market shares and reaching to the organization goals (Xia et al., 2013).

2.2.5 ERP System Cycle

The cycle of ERP system consists of three steps as follows: ERP adoption, ERP implementation, and ERP assimilation (Liang et al., 2007).

1) ERP Adoption

ERP Adoption is to decide to accept ERP system to bring to use in the company. The economic reason for the decision to use ERP is up to the perspective of resources use (Barney, 1991), the company that can develop and keep the competitive advantage by taking the benefits and developing the resources such as capacity, assets, knowledge, and ability with valuable and hardly to copy (Mata, Fuerst, & Barney, 1995). ERP has the new ability that any organization can take the benefits and keep the competitive advantage (Parker & Castleman, 2009).

The study on ERP acceptance is important since the problem that the company has not selected the right choice for the acceptance process (Markus & Tanis, 2000). Besides, it is the accepting process required by the company to ensure that ERP system is suited to the business and needs of information. The organization shall understand in system use by considering from the views of user to prepare the staff to face with the new

challenge and learn on the method to take benefits from technology to gather the concrete benefits.

2) ERP Implementation

ERP Implementation refers to the decision to use ERP system of users in the company. The researchers who studied on the key successful factors in using ERP pointed out that the leader and the aim of management were the most successful factors in ERP operation (Bingi, Sharma, & Godla, 1999). The steps in software selection and using process were the key factor for the successful adoption of ERP (Umble et al., 2003). All the process in the company has to coordinate with ERP (Al-Mashari, Al-Mudimigh, & Zairi, 2003). Al-Mashari et al. (2003) presented new thing from the awareness and to increase the benefits from ERP through the key factors. It was argued to receive the benefits from ERP only when there was the link of the operation guideline with the business efficient measures together. They emphasized on the important of support from the high-level management, vision and planning for ERP system installation.

Nah et al. (2003) defined five key factors of success from the view of CIO for instance; (1) supporting for the high-level management; (2) Project champion; (3) team working of ERP as well as the team compositions; (4) project management including changing in management program; and (5) culture. Tarafdar and Roy, (2003) presented on the use of ERP process in which consisting of different processes such as: planning, operation, and post audit after the operation. They stressed on the significance of four main components in the planning process; forming the business from ERP, understanding the specific characteristics of business that adopted ERP system, to estimate the organization prompt on IT aspect and project planning. In the using process, technical management and change management in the organization will be lastly stressed. They also emphasized on the importance of changes in the process and to set for the organization benefits and assimilation from learning in the post operation. The key factors of success in using ERP are the strong and attentive leader, opening communication, loyalty and the balance and authorized teamwork (Sarker & Lee, 2003).

3) ERP Assimilation

ERP Assimilation refers to the scope of technology usage in which expands to all the processes in the organization operation and becomes the regular activities in the

work process (Purvis et al., 2001). ERP assimilation is different from the use and acceptance of ERP. From the point of project management, ERP assimilation is related to ERP mixed with the work and activities of the organization.

ERP assimilation can be set from the width and depth of IT usage in the activities of business process. In the same way, IT assimilation can be divided into two parts: obtaining and using IT benefits (Bajwa et al., 2008). According to the study of IT assimilation, we have set the scope that the organization uses ERP system to process the regular business activities. It was found by the study result that gathering the hub, data concentration, external pressure and perceiving the advantages in which so much important to the use of ERP system (Vluggen, 2005). Research from for ERP assimilation has been developed from the organizational pressure (Liang et al., 2007). It was shown from the study result that the confidence and participation of high executive management will be the medium to force the direct effect on the assimilation of ERP. The long-term study found that the pressure from the organization and external partner are the key factors to set for the method to absorb ERP (P. Wang, 2008). The case study found the uncertainty of the environment, perceived of benefits, and needs for the internal management were the three main factors affect the assimilation of ERP (Liu, Feng, Hu, & Huang, 2010).

2.3 Firm Performance

One of the greatest challenges for the company in the competitive business environment at recent is to be able to compete by remaining with their efficiency and improvement. The efficiency of the company beyond the others does not only affect on customer but the internal organization as well. The company shall alert to operate on their functions to response to the customer expectation since the pressure from the changing needs and increasing customers as well as the more violence competition in the market. The study on the operation performance of the interesting hub company based on several subject branches such as Economics, Sociology, and Organizational Behavior.

Lin and Huang, (2011) pointed out that the operation performance did not only relate to the former success but also, extended to the ability to achieve the future goal. To improve the company efficiency is the heart of the strategic management of the

organization with the influence on the organization goal (Venkatraman, 1991). The company efficiency consists of all the behaviors related to the objective of the whole organization and depends on level of performance of organization personnel (Borman & Motowidlo, 1993). The company performance result has largely been affected from the business governance in which may help attracting the investment and increasing the capital cost to the most and it would lead toward the better performance of the company (Ehikioya, 2009).

Gavrea et al. (2011), gave the concept and definition for the company performance at that time, the efficiency assessment in 50 century stressed on work, personnel, and organizational structure thus, efficiency is seen as the social system to achieve the organizational objectives, in the 60s and 70s century, efficiency was set to be the ability to take benefits from the environment since the hardly found resources, the efficiency during 80s and 90s century had the more complicate method with the efficiency and effectiveness since the organization success in achieving the goal (effectiveness) by using less resources (efficiency).

Kitrangsikul and Kuntonbutr, (2017) defined the idea related to the efficiency of the company which was the effectiveness assessment in various of business organization variables and divided into the financial and non- financial index measurement. Financial efficiency is according to the following criteria: return of the investment, growth of sale rate, and income; the non- financial operation efficiency that cover on the market share, product quality, new innovated products, marketing effectiveness, value added process and other non- financial criteria. Venkatraman (1991) assumed that efficiency did not only aim to measure according to the financial index but, it was also depended on the organization performance such as the business efficiency and organization effectiveness. Carter and Narasimhan (1996) mentioned on the efficient measure of the company as the growth, profits generating and market share. This view was direct to Green and Inman (2005) who divided the factor of company efficiency into: market share, growth of sale rate and sale profits.

Vivek and Ravindran (2009) had been accepted on the experiment result from the study of SMEs in India and defined the six dimensions of information to measure on the organization efficiency such as return of investment (ROI), market share, sales profits

and competitive status as a whole. Ruekert et al. (1985) had defined on the capacity measuring index of the company in three dimensions in which consisted of efficiency, effectiveness and adjustment. Keats and Hitt (1988) pointed out that the organizational efficiency index can be divided into various variables in the effective measurer, while it is claimed by Katou and Budhwar (2010) the organizational performance result that the organization consisted of six variables such as efficiency, effectiveness, development, satisfaction, innovation and quality.

ERP system is integrated to promote for the joint between groups, teamwork, expertise, business knowledge and processes, and to help the authorized person and responsible (Davenport, 1998). The study by Benchmarking Partners (1998) the company that answered for the questionnaire survey aware on benefits either tangible and intangible from the use of ERP system. Abstract benefit is related to the gathering of internal system, better information and processes and better customer service. The concrete benefit is related to the reduction of inventory, personnel, cost of purchasing and order management as well as more profits generating. Therefore, the characteristic of ERP system was to capture the effects of the organization in compliance to the system. It was reported that ERP system can influence on the company's efficiency, For instance, Hunton et al. (2003) has tested on the effect to bring ERP to use and the performance result by conducting the comparison analysis between the companies that use and do not use ERP system.

In the developing country, ERP system usually be adopted as part of the attempt of the organization to improve and choose to practice, not to replace the old system. ERP system is certified by various organizations to support for the integrating form, ready-made solution to response to the data needs among customers. Besides the fact that the organization expects to gain much benefits from their using of ERP system, the internal problem of the operation process can stop the enterprise from the awareness on the expected benefits or, to recover the cost of attempt to use it. Poston and Grabski (2011) reported that bringing ERP to use would help adding efficiency in reducing staff and staff ratio pe annual income. Besides, using ERP would help the organization gains benefit from the competition. Voulgaris et al. (2015) pointed out on the efficiency of those who used ERP in which better that those that do not accept it. Nicolaou and Bajor (2011)

defined that the results of analysis on the difference of the efficiency in each time reflects that the companies that used ERP system had the very different operational performance. Le and Han (2016) defined that the use of ERP system had been succeeded in the improvement of the company performance in indirect way through the ability of the organization and the competitive advantage in which the most influenced came from personal effect.

2.4 Theoretical Framework

TOE framework is the theory at the organization level and the beneficial analysis framework that can be used to study on the acceptance and mixing between any types of IT innovation. TOE framework consists of three different components in each company. The three components are technological context, organizational context and environmental context.

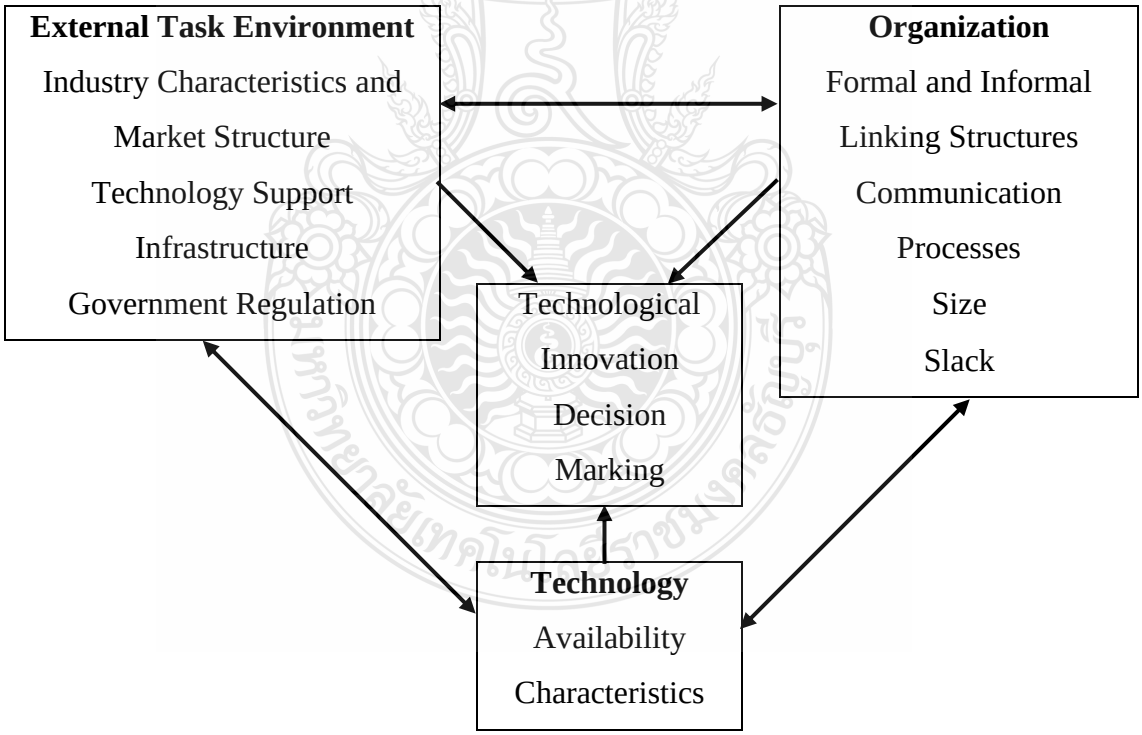

Figure 2. 4 The technology- organization- environment framework (Tornatzky et al., 1990).

The Technological Context

Technological context refers to internal and external technology related to the company. Technology may include the equipment and any processes. Technology is the key components for the innovation acceptance of the organization. It helps the organization to process with efficiency. Technology leading organization will gain confidence from customers. At recent, technology is the crucial basic components for any organizations.

The Organizational Context

Organizational context refers to the characteristic and the company resources as well as the company size, level of central gathering, official level, management structure, human resources, amount of deterioration resources and the connection between staff. Organization context is another driven factor for the organization to accept innovation. Top executive management of the organization is the main variable to promote the organization innovation to help continuing the key vision and mission of the company.

The Environmental Context

Environmental context refers to size and structure of industry, company rivals, meta- economic and legal environment. Environmental context is another factor influenced on the organization innovation acceptance. The industry competition, IT infrastructure, as well as the government rules and regulations that all result on the organization innovation acceptance.

Awa and Ojiabo, (2016) studied on the form of factor of ERP acceptance under the T- O- E framework and found that ICT infrastructure, perception of blending, perception of value, security, and size of company were the factors resulted on the ERP acceptance. Thus, the scope of company business, promptness of partners, population component, personal norm, external support, and pressure from the key competitiveness are important to ERP acceptance. Therefore, bringing ERP to use will receive push from technology factor rather than the factor of organization and environment.

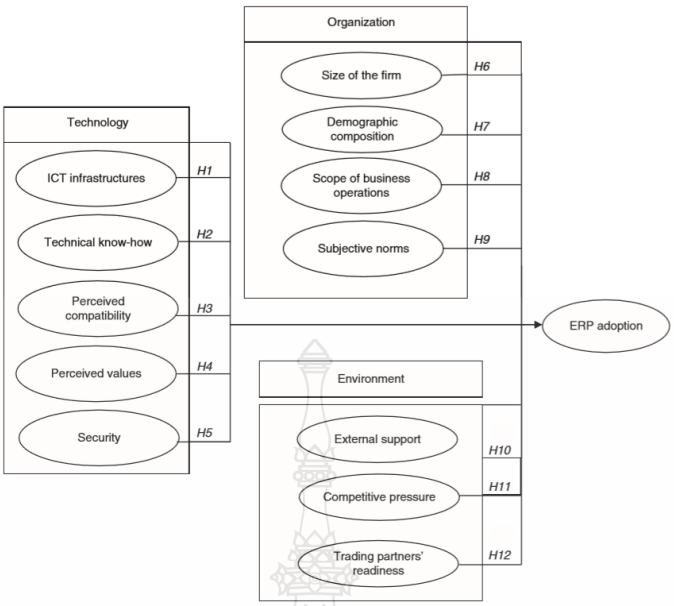

Figure 2.5 Research model for a model of adoption determinants of ERP within T-O-E framework (Awa & Ojiabo, 2016).

Garg and Chauhan, (2015) studies on the factor affected the success of ERP adoption in retail sector of India. The analysis of factors and impacts on ERP adoption found success from the use in Structural Equation Model (SEM). Factors used for examination are organization, technology, people, and project management. It is found from the study result that the factor of organization, technology, people and project management have resulted on the successful use of ERP in retail sector of India.

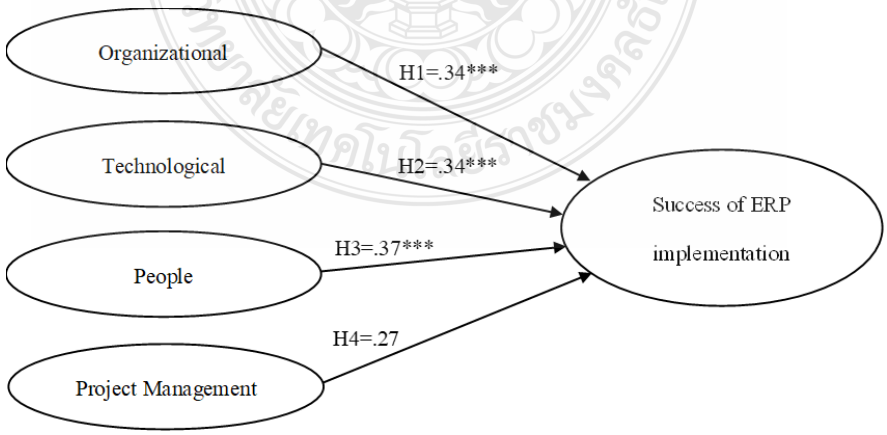

Figure 2.6 Research model for the factors affecting the ERP implementation in Indian retail sector a structural equation modelling approach (Garg & Chauhan, 2015).

Xu et al. (2017) studied on the ERP assimilation and the impact on the worthiness of ERP under the TOE framework by comparing the concentration of assimilation and worthiness of ERP in different forms of owner. It is found from the study result that the relative advantage, complexity, well-blend, supporting for the high level of management, organization sufficient, financial attention, and pressure from the competition which are the key index for the ERP assimilation. Besides, the study result confirmed the distribution of traditional innovation, supporting for the high level of management, and pressure from the competition were important in the whole ERP life cycle. Moreover, to emphasize and confirm on the importance of ERP assimilation in company efficiency improvement. The in-depth information defined the ERP assimilation and worthiness of ERP as influenced from the components in the context and the different impacts in each types of owner.

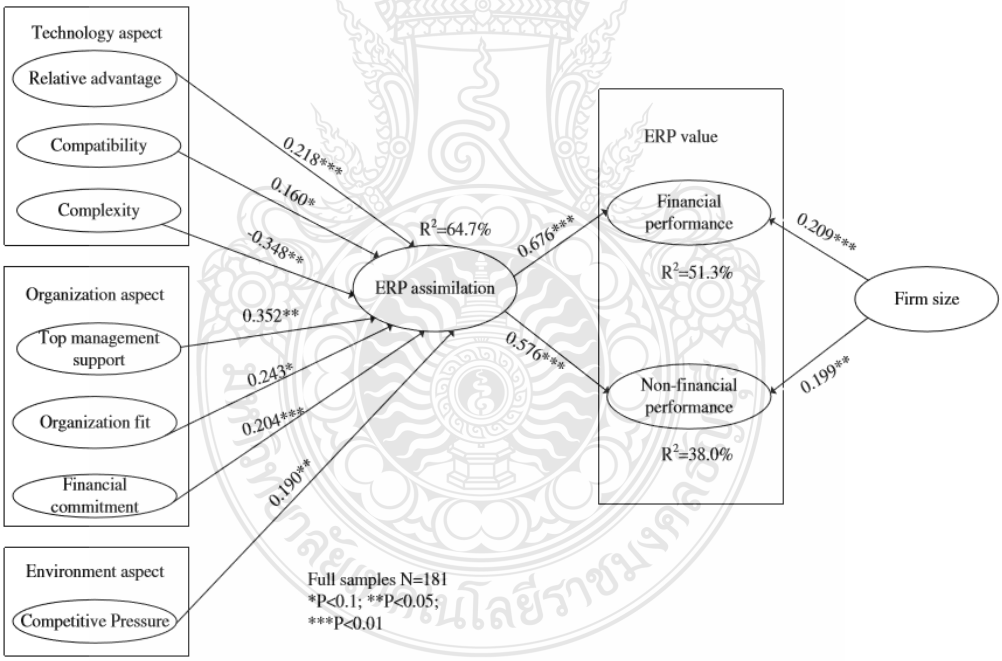

Figure 2.7 Research model for the Antecedents of ERP assimilation and its impact on ERP value: a TOE-based model and empirical test (Xu et al., 2017).

Handoko et al. (2015) studied on the impact of organization resources system and practice in supply chain system toward the competitive advantage and operational results of the company by studied from the companies in Indonesia. It is found from the study that ERP system helps the company reach to the pros in the competition by adding the information flow through the work system that connects between suppliers, production, distributors and the end users. ERP system has positive relationship with the competitive advantage. ERP system has the positive impact on the firm performance.

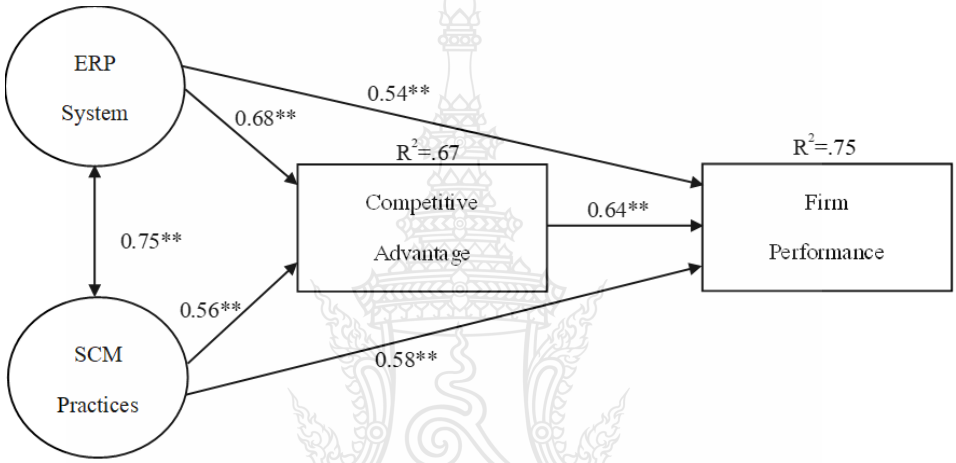

Figure 2.8 Research model for the impact of Enterprise Resources System and Supply Chain practices on competitive advantage and firm performance: case of Indonesian companies (Handoko et al., 2015).

Le and Han, (2016) studied on the impact of ERP using toward the company's performance. The aim is to study on the dimension of successful ERP usage and how the use of ERP affect on the company if aim at SMEs in Vietnam. It is found that successful use of ERP system to indirectly improve the company performance will affect on the ability of the organization and the competitive advantage in which personal aspect has the highest impact. Besides, it is also defined by the study that the business sector and age of the company have the impact on the conceptual framework.

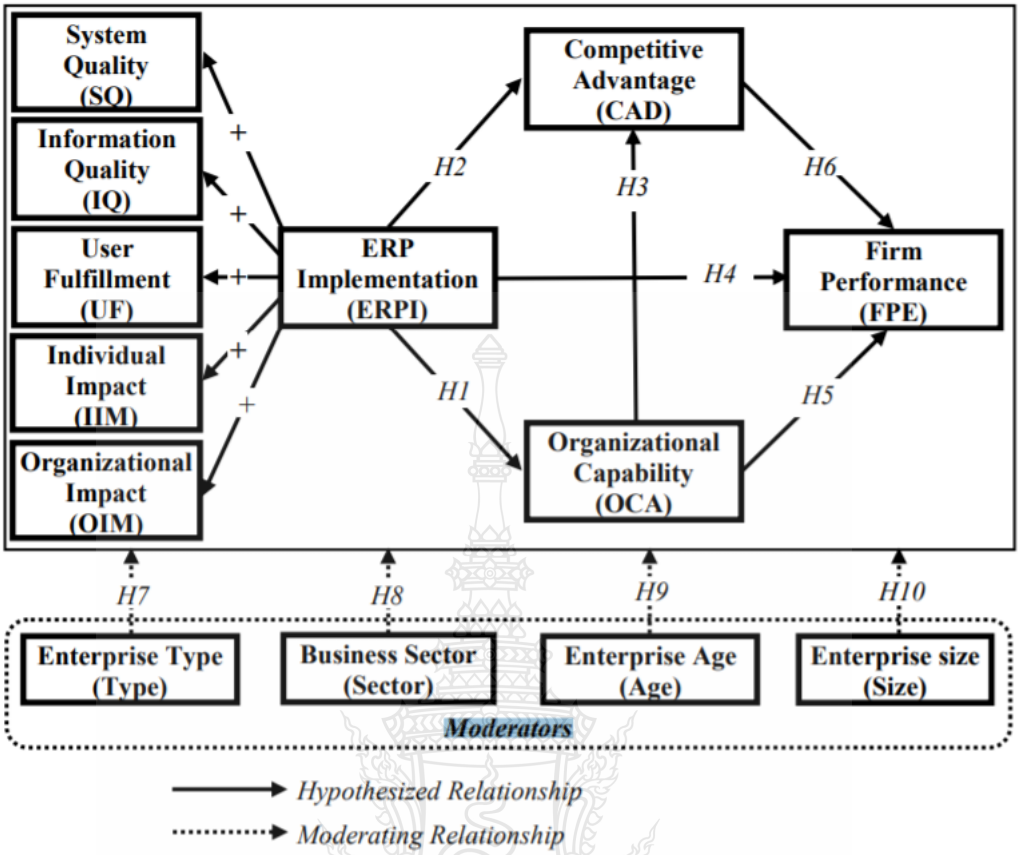

Figure 2.9 Research model for the understanding the impact of ERP system implementation on firm performance-focused on Vietnamese SMEs (Le & Han, 2016).

Srisawat and Jaturat, (2016) studied on the impact of ERP system running and the use of organization strategy related to information technology on the efficiency of the supply chain. It is found from the study that ERP running has no positive relationship with the supply chain efficiency and the strategic planning on organization IT is found with positive relationship to the supply chain efficiency. Besides, it is shown from the result of equally indirect positive relationship through the indirect management on logistics. This pointed out that the company that used ERP had no direct impact on the supply chain efficiency, but it had the indirect impact through the medium variable which was logistic. While in the part of IT strategy layout in the organization, it had both direct and indirect impact on the supply chain efficiency through the medium variable.

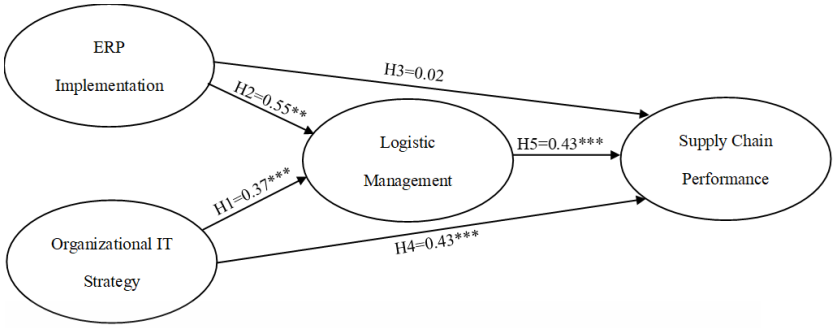

Figure 2. 10 Research model for the influence of ERP implementation and organization IT strategy on supply chain performance through logistic management: a case study of food industry in Thailand (Srisawat & Jaturat, 2016).

Kitrangsikul and Kuntonbutr, (2017) studied on both direct and indirect impact of the ability to manage on the information and logistics toward the company's efficiency. It was found from the result that there was the direct effect between the ability to gather logistics and supply chain management and the company efficiency. The ability to manage on information had influenced on the ability to gather logistics and supply chain management. Besides, the study pointed out that there was no direct relationship between the ability of information management and company's efficiency, but had an indirect effect on the logistics ability.

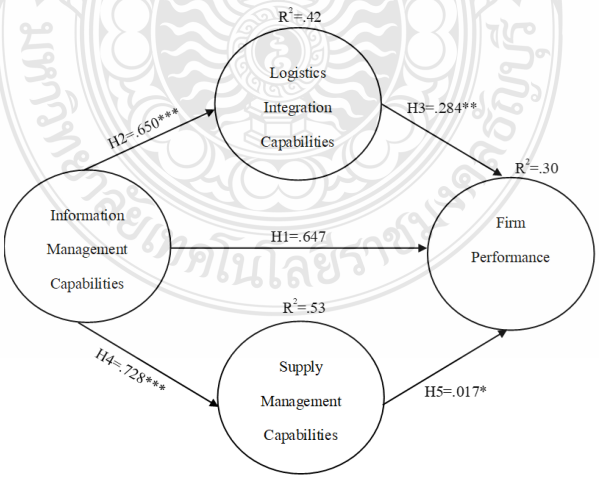

Figure 2.11 Research model for the analysis of direct and indirect effects of information management capabilities and logistics capabilities on firm performance (Kitrangsikul & Kuntonbutr, 2017).

Egdair et al. (2015) studied on the technology factors, ERP system and organization performance in developing countries. It is found from the study that the organizations that implement ERP have some technological factors that are used to improve performance. But the success of efficiency and effectiveness must be good, management and high culture and infrastructure that contribute to the success of new applications.

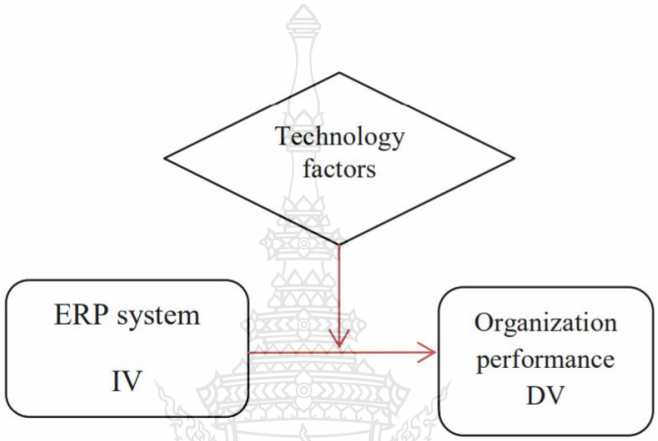

Figure 2.12 Research model for the technology factors, ERP system and organization performance in developing countries (Egdair et al., 2015).

ERP system added potential for the organization competitiveness (M. Beheshti et al., 2014; Vinatoru & Calota, 2014). ERP system helps adding competitive ability of the market and economic efficiency (Lance & Cook, 2013). Zeng and Skibniewski, (2013) stresses that ERP system help reducing the cost and production rounds thorough adding effectiveness and efficiency to the organization. ERP system helps adding flexibility, information gathering and processing as well as bringing accounting application to use in business process (Kanellou & Spathis, 2013). The factor results on bringing ERP to use in the organization can be explained by using TOE framework.

TOE framework is the theory at the organization level that is used to explain on the influence over the decision to accept innovation. TOE framework has three components such as Technological Context, Organizational Context, and Environmental Context. All three factors have influenced over technological innovation.

Though studies in the past pointed out the relationship with the significance and positivity between the use of ERP and the company performance, but there were the limitations for the research related to the ERP integration over the company efficiency. The previous researches conducted with the emphasis on each of process in ERP cycle such as ERP adoption, ERP implementation, and ERP assimilation. The motivation of this study is to reduce gap in the examining of relationship and the impact of the Technological Context, Organizational Context, and Environmental Context through the Mediating Model of ERP cycle and the influence on the company efficiency. Besides, it is the additional study on the factors resulting on the use of innovation in the organization at recent to conform with changes in current situation.

2.5 Research Model

The organization must plan and prepare before implementing the ERP system in order to take into account three important factors: technology, organization, and environment. However, it must be planned to be in line with the cycle of the ERP, thus leading to the firm performance of the organization, and from the relevant basic theories and empirical studies, there is the development of the research model as can be seen from figure 2.13. Technological Context, Organizational Context, and Environmental Context are the independent variables while ERP adoption, ERP implementation, and ERP assimilation are the passing variable, and company efficiency is the dependent variable.

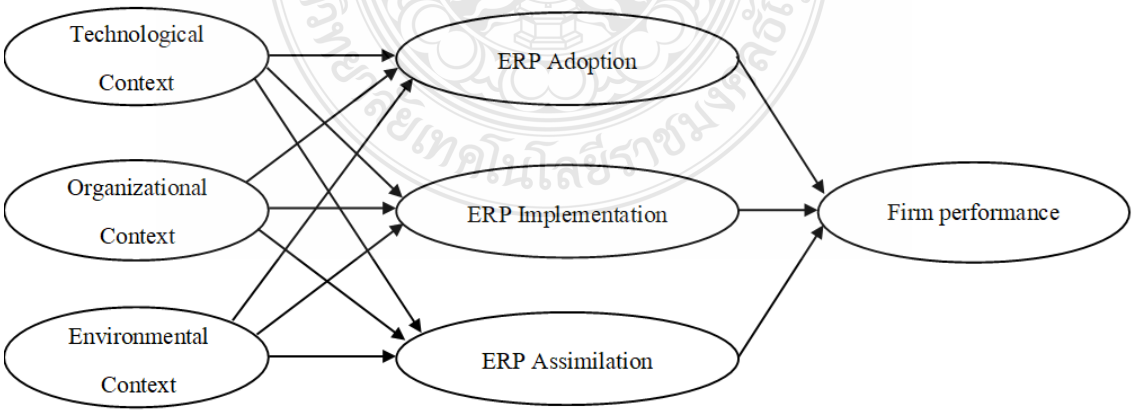

Figure 2.13 Research Model

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Introduction to the Research Methods

The researcher studied the relationship between TOE framework, ERP cycle, and firm performance. TOE framework were the independent variables affecting firm performance which were the dependent variable. These relationship were mediated the mediator variables which were the ERP cycle under the manufacturing business group in Thailand. This chapter covered the part of previous researches consisting of the model/ theoretical framework, research questions and hypotheses, studying area, population and sample selection, measurement instrument, data collection, and data analysis.

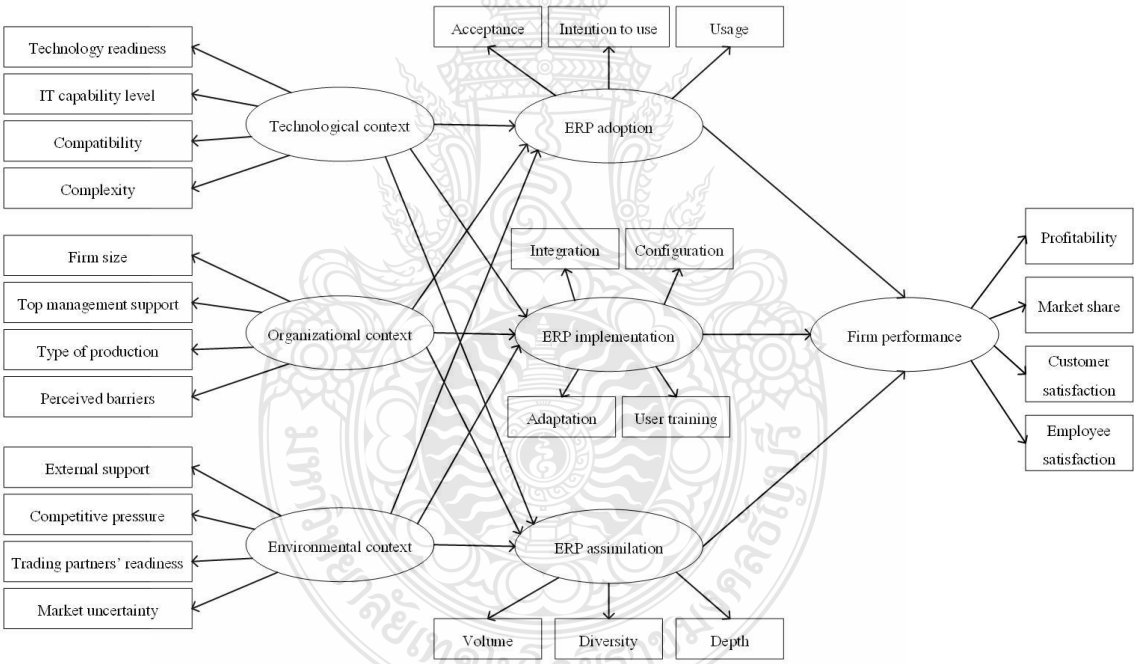

Figure 3.1 Conceptual Model

3.2 Research Design and Methodology

In the study, it required to check on the relationship between TOE framework, ERP cycle, and firm performance. Such relationship were investigated in manufacturing businesses in Thailand. This is the cross- sectional research conducted through two methodologies comprising both quantitative research and qualitative research. According to the quantitative research, data were collected from the questionnaire which was used as the research instrument, and the expected results the relationship among variables in the research framework. As for qualitative research, it was done through the in- depth interview with Chief Executive Officer (CEO) or Top manager. The interview information would be brought to confirm with the results of quantitative research.

3.3 Quantitative Methodology

3.3.1 Studying Area

In this study, the researcher chose to study the impact of TOE framework us firm performance through ERP adoption, ERP implementation, and ERP assimilation in the manufacturing industrial group. The listed companies were selected from the Department of Business Development under the Ministry of Commerce, Thailand. They were medium-size firms with a total fixed asset raging from 50 million baht to 200 million baht and large firms with a total fixed asset of over 200 million baht. The scale of the firm was categorized according to the SME service Center in which they were the crucial businesses for data collection.

3.3.2 Population and Sampling

The research objectives have focused on firm performance. The target population groups were CEO or Top manager who were responsible for the firm performance. The researcher selected twenty groups from manufacturing business groups within the industrial manufacturing base. After setting the population group, the sample size was calculated according to the rule of structural equation model (SEM) which consider the number of free parameters as a rule of thumb to the determine sample size for research studios that use SEM. The suggested ratio of the sample size to the number of free parameters might be able to go as low as 10: 1 under the normal and elliptical theory, especially when there are many indicators of latent variables, and the associated

factor loadings are large. Though, there is even less experience on which to base a recommendation. (Bentler & Chou, 1987). The amount of the sample size required by the researcher was 260 firms from 26 free parameters in this study.

3.3.3 Sampling Method

From the estimation of the information from 20 samples of industrial business groups used, the researcher selected the sample from each group in the industrial manufacturing by using the ratio of companies in each group as the ratio of the amount of the sample to collect the data as shown in table 3.1.

Table 3.1 The population and distribution of sample size

Division of Manufacturing	Population (N)	Sample (n)
Food products	1,094	47
Beverages	76	3
Textiles	311	14
Wearing apparel, except fur apparel	265	12
Tanning and dressing of leather; manufacturer of luggage, handbags, saddler, harness, and footwear	113	5
Wood and productions of wood and cork, except furniture; manufacturer of articles made from straw and plaiting materials	86	4
Pulp, paper, and paper products	127	5
Publishing, printing, and reproduction of recorded media	195	8
Coke, refined petroleum products, and nuclear fuel	147	6
Chemicals and chemical products	310	13
Rubber and plastics products	448	19
Other ono-metallic mineral products	560	24
Machinery and equipment	351	15
Office, accounting, and computing machinery	481	21

Table 3.1 The population and distribution of sample size (Cont.)

Division of Manufacturing	Population (N)	Sample (n)
Radio, television and communication equipment and apparatus	230	10
Medical, precision and optical instruments, watches and clocks	400	17
Motor vehicles, trailers, and semi-trailers	579	25
Transport equipment	61	3
Miscellaneous manufacturers	168	7
Machinery installation and repair services	54	2
Total	**6,056**	**260**

3.4 Research Instrumentation

The questionnaire for this study is thoroughly designed to address the research hypotheses formulated to develop a conceptual framework. The questionnaire is divided into eight sections; Section 1: Technological context, Section 2: Organizational context, Section 3: Environmental context, Section 4: ERP adoption, Section 5: ERP implementation, Section 6: ERP assimilation, Section 7: Firm performance, and Section 8: Demographic and background characteristics of the respondents.

Thus, Section 1 of the questionnaire is focused on the Technological context, the construct is measured by technology readiness, IT capability level, compatibility, and complexity, whit the objective to measure the technological context of the firm to the ERP adoption, ERP implementation, ERP assimilation, and firm performance. The following Seven-point Likert scales ranging from 1 to 7, are used to rate each question, where 1 = Strongly Disagree, 2 = Quite Disagree, 3 = Slightly Disagree, 4 = Neither Agree nor Disagree, 5 = Slightly Agree, 6 = Quite Agree, and 7 = Strongly Agree.

Section 2 of the questionnaire focused on the Organizational context, measured by top management support, type of production, and perceived barriers, with objective to measure the organizational context of the firm to the ERP adoption, ERP implementation, ERP assimilation, and firm performance. The following Seven-point Likert scales ranging from 1 to 7, are used to rate each question, where 1 = Strongly Disagree, 2 = Quite

Disagree, 3 = Slightly Disagree, 4 = Neither Agree nor Disagree, 5 = Slightly Agree, 6 = Quite Agree, and 7 = Strongly Agree.

Section 3 of the questionnaire focused on the Environmental context, measured by external support, competitive pressure, trading partners' readiness, and market uncertainty, with objective to measure the environmental context of the firm to the ERP adoption, ERP implementation, ERP assimilation, and firm performance. The following Seven-point Likert scales ranging from 1 to 7, are used to rate each question, where 1 = Strongly Disagree, 2 = Quite Disagree, 3 = Slightly Disagree, 4 = Neither Agree nor Disagree, 5 = Slightly Agree, 6 = Quite Agree, and 7 = Strongly Agree.

Section 4 of the questionnaire focused on the ERP adoption, measured by acceptance, intention to use, and usage, with objective to measure the decision to adopt an ERP system for use in an organization. The following Seven-point Likert scales ranging from 1 to 7, are used to rate each question, where 1 = Strongly Disagree, 2 = Quite Disagree, 3 = Slightly Disagree, 4 = Neither Agree nor Disagree, 5 = Slightly Agree, 6 = Quite Agree, and 7 = Strongly Agree.

Section 5 of the questionnaire focused on the ERP implementation, measured by integration, configuration, adaptation, and user training, with objective to measure the decision to use the ERP system of the user in the organization. The following Seven-point Likert scales ranging from 1 to 7, are used to rate each question, where 1 = Strongly Disagree, 2 = Quite Disagree, 3 = Slightly Disagree, 4 = Neither Agree nor Disagree, 5 = Slightly Agree, 6 = Quite Agree, and 7 = Strongly Agree.

Section 6 of the questionnaire focused on the ERP assimilation, measured by volume, diversity, and depth, with objective to measure the extent to which the use of ERP system diffuses across the organizational work processes and becomes routinized in the process activities. The following Seven-point Likert scales ranging from 1 to 7, are used to rate each question, where 1 = Strongly Disagree, 2 = Quite Disagree, 3 = Slightly Disagree, 4 = Neither Agree nor Disagree, 5 = Slightly Agree, 6 = Quite Agree, and 7 = Strongly Agree.

Section 7 of the questionnaire focused on the Firm performance, measure by profitability, market share, customer satisfaction, and employee satisfaction, with objective to measure the firm's efficiency and effectiveness on achieving the

predetermined objectives. The following Seven-point Likert scales ranging from 1 to 7, are used to rate each question, where 1 = Strongly Disagree, 2 = Quite Disagree, 3 = Slightly Disagree, 4 = Neither Agree nor Disagree, 5 = Slightly Agree, 6 = Quite Agree, and 7 = Strongly Agree.

The last section is a survey for the demographic and background characteristics including work experiences, educational qualification, position, company nationality, and company age. The researcher used these variables by collecting all the variables to analyze the characteristics of the respondents.

3.5 Data Collection

Regarding data collection, the researcher collected the companies' name information in order to distribute the questionnaire and the in-depth interview in the industrial manufacturing group from the database of the Department of Business Development under the Ministry of Commerce, Thailand. The criteria used to choose sample were firm size. Medium and large sized firms were chosen for the study dur to their ERP adoption, ERP implementation, and ERP assimilation. Medium sized firms were defined as firms with a total fixed asset ranging from 50 million baht to 200 million baht whereas large sized firms were defined as firms with a total fixed asset of over 200 million baht in year 2015. These medium and large firms were selected to answer the questionnaire.

The questionnaire was used as the research tool to collect the primary data. Data collection was conducted via 1,500 questionnaires distributed to the chosen firms in the group of manufacturing businesses in Thailand. The detail of the samples estimation was discussed in the topic of " Population and Sampling" and before distributing the questionnaire to the companies, the Rajamangala University of Technology Thanyaburi has made the letter to ask for the permission to answer the questionnaire in which attached to the questionnaire. All the questionnaires were to ask for the answers from CEO or Top manager. This questionnaire was divided into eight parts consisting of 1) Technological context, 2) Organizational context, 3) Environmental context, 4) ERP adoption, 5) ERP implementation, 6) ERP assimilation, 7) Firm performance, and 8) Demographic and background characteristics of the respondents.

3.6 Validity and Reliability

All of the tools used in this study referred to the were developed based as in the literature reviews related to the measurement of Technological context (Xu et al., 2017), Organizational context (Gutierrez et al., 2015), Environmental context (Awa et al., 2016), ERP adoption (Kharuddin et al., 2015), ERP implementation (Hwang, 2011), ERP assimilation (Liang et al., 2007), and Firm performance (Kitrangsikul & Kuntonbutr, 2017).

3.6.1 Content Validity Testing

The investigation to confirm the measuring tools' validity was conducted, and the questionnaire was evaluated by six specialists in the branch of information technology, and the assessment used IOC (Index of Item-Objective Congruence) method.

To content validity six specialists judged if the written questions were congruent with definitions identified from the theory and previous research using three levels consisting of congruent = +1, questionable = 0, and incongruent = -1. Moreover, the researcher asked specialists to improve the unclear questions. Later, the researcher revised them according to suggestions from specialists. Content validity indices were calculated by the following formula (Rovinelli & Hambleton, 1976).

$$IOC = \frac{\sum R}{N}$$

$\sum R$ = Sum of scores for each item checked by specialists

N = Number of specialist

3.6.2 Construct Validity

3.6.2.1 Convergent Validity

Convergent validity refers to the level of similarities within the science process skills that must be similar to the theory with high relationship. CFA (Confirmatory Factor Analysis) is the study to confirm on the relationship between observed variable according to the previous research theories. Besides, CFA is a technique of the Structural Equation Modeling (SEM) analysis (Vanichbuncha, 2009). After the CFA analysis, if variables can be arranged in the same group, they are the good representatives of latent variables. CFA

allows the researcher to test the hypothesis that a relationship between observed variables and their underlying latent constructs exists. The use of CFA could be impacted by such as the research hypothesis, the need of sufficient sample size, measurement tools, and missing data (Lomax & Schumacker, 2004). CFA procedure asked for the research from the related theoretical review of literature to support the model specification, specifying a model in order to determine whether the research model would be appropriate. Related indictors include *p*-value (Chi-square Probability Level), CMIN/df (Relative Chi-square), GFI (Goodness of Fit Index), RMSEA (Rot mean Square Error of Approximation), NFI (Normed Fit Index), and AGFI (Adjusted Goodness of Fit). *P*-value should be more than 0.05 while the value of CMIN/df should be less than 2. Moreover, RMR (Root Mean Square Residual) value should be less than 0.05, and GFI and NFI value shall be more than 0.9 while AGFI value should be more than 0.8. RMSEA value must be less than 0.10. Finally, Holelter value must be more than 200. If this value is satisfactory, the CFA would be considered as the data-fit model (Arbuckle, 2011). Convergent validity was evaluated with an average variance extracted (AVE). It was accepted when AVE was more than or equal to 0.5, (Fornell & Larcker, 1981; J. Hair, 2005).

3.6.2.2 Discriminate validity testing

This is the other test that required to be assessed while conducting the Structural Equation Modeling (SEM) analysis in the convergent validity testing. The SEM method was used to assess the correlation among latent variables to confirm that they indeed are the good representatives of the latent variables, and that they do not correlate with other latent variables.

This study has verified the discriminant validity of the instrument by examining based on the following criteria.

$\sqrt{AVE} > r^2$ $(correlation)$ (Fornell & Larcker, 1981).

Discriminant validity is met if $\sqrt{AVE} > r^2$ when considering all possible pairs of latent variables being accessed.

3.6.4 Reliability Testing

Reliability testing is to measure on the reliability in the qualification of measurement scale and things that prepare for the information related to the relationship between individual items in the scale of Cronbach's alpha coefficients to set the reliability

scale. If the result of the Cronbach's alpha testing showed scores higher or equal to 0.7, it means the answer has conformity (George & Mallery, 2003). However, if the alpha is lower than 0.7, the researcher had to cut that variable off from the questionnaire as distributed to 30 companies. The pilot test gave all of the Cronbach's alpha values more than 0.7. Composite reliability (CR) per factor. It was accepted when CR was more than or equal to 0.7 (Fornell & Larcker, 1981).

3.7 Qualitative Methodology

Qualitative methodology is the process to seek and develop the knowledge of human for the systematic advancement. This study used the widely adopting data collection technique which is an in-depth interview with CEO or Top manager.

3.7.1 Population and Sample

Qualitative research is the in-depth interview that was conducted with the small group of population like CEO or Top manager using the population from the same group of manufacturing industrial for quantitative research. Here, the researcher has not set the amount of interview population but conducted the interview to collect the information no matter the fact, opinion, and attitude information is. Besides, the interview would be conducted until the hypothesis is acceptable.

3.7.2 Research Instrument

In the in-depth interview, it was the video call and telephone interview. The questions of the in-depth interview comprised three part as follows:

1) General information of the interviewee

2) Organization information and guidelines for the use of the ERP system of the organization

3) Other suggestions

3.7.3 Items of interview questions

1. Is your organization technologically ready?

2. How do corporate and external organizations contribute to corporate technology?

3. Why does your organization choose ERP?

4. How does your organization have an ERP approach?

This research selected grounded theory to study and evaluate its effectiveness as a research methodology for the TOE framework (Tornatzky et al., 1990) and to present in the qualitative analysis for the interview results. For the interview data collection or intensive interviewing, it was the conversation to deeply seek for the ERP usage from CEO or Top manager by the interviewer would ask the interviewees to describe and reflect their own experiences (Charmaz, 2008). After interviewing the first CEO or Top manager, the result was used to form the working hypothesis. The result of the next interview with CEO or Top manager was used to test the next working hypothesis. Therefore, the results of all interviews were shown in Chapter four.

3.8 Sequence of Analysis

The analysis of the study was presented in the following sequence:

1. Quantitative Research
    - 1.1 Survey Pretesting
        - 1) Content Validity Testing
        - 2) Reliability Pretesting
        - 3) Adjustment of the questionnaire, if required
    - 1.2 Statistics Analysis
        - 1) Descriptive Statistics Analysis
        - 2) Normality Testing
        - 3) Structural Equation Modeling
        - 4) Quantitative Research Reporting
2. Qualitative Research
    - 2.1 Individual Interview
    - 2.2 Qualitative Research Report

CHAPTER 4
RESEARCH RESULT

4.1 Introduction

Chapter four presented the result from the statistical analysis on the research question, hypotheses, and data collection from 285 respondents in the group of manufacturing industrial in Thailand. The analysis results were divided into four parts consisting of (a) the response rate from population and sample, (b) statistical analysis in the eight parts of the questionnaires including technological context, organizational context, environmental context, ERP adoption, ERP implementation, ERP assimilation, firm performance, and demographic and background characteristics of the respondents, (c) statistical analysis on the answers toward the research questions and hypotheses, and (d) summary. Therefore, according to the research framework used in this study which is the structural equation model (SEM) analysis. It was an important tool for answering the research questions. This chapter illustrated the information related to data preparation, demographic summaries, and structural equation model analysis. Finally, the results of hypothesis testing were illustrated through the structural equation model analysis.

4.2 Data Preparation

This stage directly concerned about data arrangement including data screening, editing, and data coding and entry. The details were depicted below.

4.2.1 Data Screening and Editing

In order to obtain the completed data, the following process of data gathering was conducted. The questionnaires were distributed to the target group of population for 1,821 companies and arranged for the online questionnaire. A total of 327 questionnaires are received which accounts for 17.96 percent response rate. There are 42 returned questionnaires with insufficient data, skipping section or quit in the middle. These questionnaires are dropped from statistical analysis. In conclusion, there are total of 285 complete questionnaires received from 1,821 questionnaires mailed, thus the effective response rate is 15.65 percent.

4.2.2 Data Coding and Entry

All variables this study were named by using relevant abbreviations in order to simplify understanding and interpretation. All variables coding were illustrated in table 4.1. After that SPSS was used to analyze the item that assigned a number.

Table 4.1 Abbreviation of constructs and observed variables

Construct	Observe Variable	Type of Latent
Exogenous Latent Variables		
Technological context (TECC)	Technology readiness (TechR)	Independent
	IT capability level (ITcap)	
	Compatibility (Compb)	
	Complexity (Compl)	
Organizational context (ORGC)	Firm size (FirS)	Independent
	Top management support (TopM)	
	Type of production (TypP)	
	Perceived barriers (PerB)	
Environmental context (ENVC)	External support (ExtS)	Independent
	Competitive pressure (ComP)	
	Trading partners' readiness (TraP)	
	Market uncertainty (MktU)	
ERP adoption (ERPAD)	Acceptance (Accp)	Mediator
	Intention to use (IntU)	
	Usage (Usag)	
ERP implementation (ERPIM)	Integration (Integ)	Mediator
	Configuration (Conf)	
	Adaptation (Adap)	
	User training (UserT)	
ERP assimilation (ERPAS)	Volume (Volu)	Mediator
	Diversity (Dive)	
	Depth (Dept)	

Table 4.1 Abbreviation of constructs and observed variables (Cont.)

Construct	Observe Variable	Type of Latent
Endogenous Latent Variables		
Firm performance (FP)	Profitability (Prof)	Dependent
	Market Share (MktS)	
	Customer satisfaction (CusS)	
	Employee satisfaction (EmpS)	

4.3 Response Rate

For preventing the less of return, the questionnaires were mailed to 1,821 manufacturing firms that were more than sample size calculated from chapter three. The top five firm types which were the respondents of the study were as follow: 51 firms from motor vehicles, trailers, an semi-trailers, 40 firms from medical, precision and optical instruments, watches and clocks, 39 firms from office accounting, and computing machinery, 28 firms from rubber and plastics products, and 22 firms from food products.

Table 4.2 Firm respondent

Type of Firm	Sample Size	Sent	Return	Response Rate
Food products	47	159	22	13.84%
Beverages	3	7	0	0%
Textiles	14	78	11	14.10%
Wearing apparel, except fur apparel	12	32	0	0%
Tanning and dressing of leather; manufacturer of luggage, handbags, saddler, harness, and footwear	5	27	0	0%
Wood and productions of wood and cork, except furniture; manufacturer of articles made from straw and plaiting materials	4	22	1	4.55%

Table 4.2 Firm respondent (Cont.)

Type of Firm	Sample Size	Sent	Return	Response Rate
Pulp, paper, and paper products	5	53	15	28.30%
Publishing, printing, and reproduction of recorded media	8	26	8	30.77%
Coke, refined petroleum products, and nuclear fuel	6	20	1	5.00%
Chemicals and chemical products	13	119	16	13.45%
Rubber and plastics products	19	237	28	11.81%
Other ono-metallic mineral products	24	52	9	17.31%
Machinery and equipment	15	126	17	13.49%
Office, accounting, and computing machinery	21	186	39	20.97%
Radio, television and communication equipment and apparatus	10	102	16	15.69%
Medical, precision and optical instruments, watches and clocks	17	212	40	18.87%
Motor vehicles, trailers, and semi-trailers	25	264	51	19.32%
Transport equipment	3	27	1	3.70%
Miscellaneous manufacturers	7	44	5	11.36%
Machinery installation and repair services	2	28	5	17.86%
Total	**260**	**1,821**	**285**	**15.65%**

4.4 Demographic Data

The questionnaires which were sent to research sample were defined that the respondents were CEO or Top manager who were responsible for the firm performance. The questions asking about demographical consist of five parts including, work experiences, education qualification, position, company nationality, and company age.

After questionnaire return back, the summarized of demographic data and detail of companies were shown as table 4.3.

Table 4.3 Demography summary

Demographics	Frequency	Response Rate
Work experiences		
1 – 5 years old	76	26.70%
6 – 10 years old	86	30.20%
11 – 15 years old	55	19.30%
Over 15 years old	68	23.90%
Education qualification		
Below undergraduate degree	18	6.30%
Undergraduate degree	185	64.90%
Postgraduate degree	82	28.80%
Position		
Executives	53	18.60%
Departmental manager	110	38.60%
Divisional supervisor	75	26.30%
Others	47	16.50%
Company nationality		
Local company	102	35.80%
Foreign Direct Investment	183	64.20%
Company age		
1 – 5 years old	27	9.50%
6 – 10 years old	64	22.50%
11 – 15 years old	46	16.10%
Over 15 years old	148	51.90%

Due to table 4. 3, the results of demographic data of the respondents were discussed in the five parts below.

4.4.1 Work experiences. According to work experiences of the respondents, the results revealed that 86 respondents (30.20%) had the work experiences of 6 – 10 years old, followed by 76 respondents (26.70%) with the work experiences of 1 – 5 years old, 68 respondents (23.90%) with the work experiences of over 15 years old, and 55 respondents (19.30%) with the work experiences 11 – 15 years old. Thus, it showed that the majority of respondents had the work experiences of 6 – 10 years old.

4.4.2 Education qualification. Due to education qualification, it revealed that 185 respondents (64.90%) obtained the Undergraduate degree, followed by 82 respondents (28.80%) with the Postgraduate degree, and 18 respondents (6.30%) with the below undergraduate degree. Therefore, it showed that the majority of respondents were undergraduate.

4.4.3 Position. According to position, the respondents included 110 departmental managers (38.60), 75 divisional supervisors (26.30%), 53 executives (18.60%), and 47 persons from other (16.50%). Therefore, it showed that the majority of respondents were departmental managers.

4.4.4 Company nationality. Due to company nationality, it revealed that 183 respondents (64.20%) obtained the foreign direct investment, and 102 local company (35.80%).

4.4.5 Company age. Regarding the company age of the respondents, the results revealed that 148 respondents (51.90%) had the company age of over 15 years old, followed by 64 respondents (22.50%) with the company age of 6 – 10 years old, 46 respondents (16.10%) with the company age of 11 – 15 years old, and 27 respondents (9.50%) with the company age of 1 – 5 years old. Thus, is showed that the majority of respondents had the company age of over 15 years old.

4.5 Descriptive Statistics

The following section summarized features of data collected for the study and presented in quantitative and comparative terms.

4.5.1 Technological Context

The attributes of technological context construct were measured by four observed variables, which were technology readiness, IT capability level, compatibility,

and complexity. The statistical analysis of the minimum and maximum score, mean value and standard deviation value, as shown in table 4.4.

Table 4.4 Descriptive Statistics for Technological Context

Variable	Min	Max	Mean	SD
Technology readiness	3	7	5.93	1.01
IT capability level	3	7	5.81	1.03
Compatibility	1	7	5.38	1.32
Complexity	1	7	4.57	1.32

The variable with the highest mean value was technology readiness (M=5.93, SD=1.01). The variable with the lowest mean value was complexity (M=4.57, SD=1.32).

4.5.2 Organizational Context

The attributes of organizational context construct were measured by four observed variables, which were firm size, top management support, type of production, and perceived barriers. The statistical analysis of the minimum and maximum score, mean value and standard deviation value, as shown in table 4.5.

Table 4.5 Descriptive Statistics for Organizational Context

Variable	Min	Max	Mean	SD
Firm size	1	7	5.36	2.06
Top management support	1	7	5.34	1.31
Type of production	1	7	6.03	1.03
Perceived barriers	3	7	5.61	0.93

The variable with the highest mean value was type of production (M=6.03, SD=1.03). The variable with the lowest mean value was top management support (M=5.34, SD=1.31).

4.5.3 Environmental Context

The attributes of environmental context construct were measured by four observed variables, which were external support, competitive pressure, trading partners'

readiness, and market uncertainty. The statistical analysis of the minimum and maximum score, mean value and standard deviation value, as shown in table 4.6.

Table 4.6 Descriptive Statistics for Environmental Context

Variable	Min	Max	Mean	SD
External support	1	7	5.09	1.28
Competitive pressure	2	7	5.68	1.00
Trading partners' readiness	1	7	5.31	1.07
Market uncertainty	2	7	5.66	1.03

The variable with the highest mean value was competitive pressure (M=5.68, SD=1.00). The variable with the lowest mean value was external support (M=5.09, SD=1.28).

4.5.4 ERP Adoption

The attributes of ERP adoption construct were measured by three observed variables, which were acceptance, intention to use, and usage. The statistical analysis of the minimum and maximum score, mean value and standard deviation value, as shown in table 4.7.

Table 4.7 Descriptive Statistics for ERP Adoption

Variable	Min	Max	Mean	SD
Acceptance	1	7	5.46	1.30
Intention to use	1	7	5.23	1.33
Usage	1	7	5.21	1.31

The variable with the highest mean value was acceptance (M=5.46, SD=1.30). The variable with the lowest mean value was usage (M=5.21, SD=1.31).

4.5.5 ERP Implementation

The attributes of ERP implementation construct were measured by four observed variables, which were integration, configuration, adaptation, and user training.

The statistical analysis of the minimum and maximum score, mean value and standard deviation value, as shown in table 4.8.

Table 4.8 Descriptive Statistics for ERP Implementation

Variable	Min	Max	Mean	SD
Integration	1	7	5.08	1.32
Configuration	1	7	5.11	1.36
Adaptation	1	7	5.17	1.32
User training	1	7	5.11	1.37

The variable with the highest mean value was adaptation (M=5.17, SD=1.32). The variable with the lowest mean value was integration (M=5.08, SD=1.32).

4.5.6 ERP Assimilation

The attributes of ERP assimilation construct were measured by three observed variables, which were volume, diversity, and depth. The statistical analysis of the minimum and maximum score, mean value and standard deviation value, as shown in table 4.9.

Table 4.9 Descriptive Statistics for ERP Assimilation

Variable	Min	Max	Mean	SD
Volume	1	7	4.92	1.46
Diversity	1	7	5.18	1.11
Depth	1	7	5.25	1.20

The variable with the highest mean value was depth (M=5.25, SD=1.20). The variable with the lowest mean value was volume (M=4.92, SD=1.46).

4.5.7 Firm Performance

The attributes of firm performance construct were measured by four observed variables, which were profitability, market share, customer satisfaction, and employee satisfaction. The statistical analysis of the minimum and maximum score, mean value and standard deviation value, as shown in table 4.10.

Table 4.10 Descriptive Statistics for Firm Performance

Variable	Min	Max	Mean	SD
Profitability	1	7	4.73	1.22
Market share	1	7	4.66	1.19
Customer satisfaction	2	7	5.32	1.08
Employee satisfaction	2	7	5.28	1.13

The variable with the highest mean value was customer satisfaction (M= 5. 32, SD= 1. 08) . The variable with the lowest mean value was market share (M= 4. 66, SD=1.19).

4.6 Normality Testing

Normality testing are used to determine whether the data set is normally distributed. A good questionnaire design should provide a normal distribution of data. In statistically, the two general indicators referred to for evaluating a normal distribution are skewness and kurtosis. Skewness is a measure of symmetry with zero skewness for a data set, normal distribution. Curran, West and Finch (1996) suggested that if skewness greater than 3 means data is asymmetric or skewed, and if kurtosis is greater than 10, then there is a problem data doesn't have a normal distribution and if kurtosis is more than 20, the problem will be more severe. The result of the data set indicates that the skewness ranges from -0. 337 to 0. 348 with the standard error of skewness at 0. 144 and the kurtosis value is ranges from - 1. 117 to - 0. 451, with the standard error of kurtosis at 0. 288 in the case that all values fall within the limit which specifies the normal distribution of the data. The result of normality testing shown in table 4.11.

Table 4.11 Normality testing

Variable	Skewness		Kurtosis	
	Statistic	Std. Error	Statistic	Std. Error
TechR	-.172	.144	-1.117	.288
ITcap	-.053	.144	-.951	.288

Table 4.11 Normality testing (Cont.)

Variable	Skewness		Kurtosis	
	Statistic	**Std. Error**	**Statistic**	**Std. Error**
Compb	.213	.144	-1.035	.288
Compl	.348	.144	-.451	.288
TopM	.221	.144	-1.015	.288
TypP	-.337	.144	-.986	.288
PerB	.311	.144	-.536	.288
ExtS	.411	.144	-.606	.288
ComP	.150	.144	-.792	.288
TraP	.139	.144	-.793	.288
MktU	.169	.144	-.949	.288

4.7 Structural Equation Model

The Structural Equation Model (SEM) is the technique that integrated the various techniques of variances analysis by using its principle to apply together in the hypothesis testing. This study used SEM to test by using Confirmatory Factor Analysis (CFA), covariance, and correlation. Thus, SEM could either be the technique for cause or relationships finding.

SEM analysis contained two parts in composition including measurement model and structural model. The measurement model was assessed by using Confirmatory Factor Analysis (CFA). CFA is the study to confirm the relationship between observed variables according to the theories or previous research. Besides, CFA is another sub-technique for SEM analysis. In this stage, the construct validity was assessed by the parameter estimation method in each construct measurement model. For the structural model, it was assessed by homological validity and provided to capture the estimation of the measurement model and their structural relations. Additionally, SEM need to analyze the constructs by measuring on construct reliability and the Average Variance Extracted (AVE) measure. Average Variance Extracted (AVE) is the variance that in the indicators as explained by the common factor and average trait-related variance extracted. The reliability of a construct derives from the computing of Composite Reliability (CR) of a

construct. Composite Reliability (CR) is the measurement of the overall reliability from the heterogeneous collection from similar items. Composite reliability should be more than 0.70, and the average variance extracted should be more than 0.50. Moreover (J. F. Hair, Black, Babin, Anderson, & Tatham, 1998), (J. C. Anderson & Gerbing, 1988) stated that average variance extracted above 0.50 is indicated as convergent validity.

Before assessing the constructs by using Composite Reliability (CR) and Average Variance Extracted (AVE), each item should be assessed. The value of loading should be 0.60 (Nunnally, 1978). Therefore, each item should have a minimum factor loading of 0.60 on its hypothesized construct. The item that is lower than 0.60 will be dropped, and it must not exceed 0.85 in the discriminant validity testing.

AMOS statistical software is the graphics extension module of the SPSS module and has been widely used for Structural Equation Model, Path Analysis and Confirmation Factor Analysis. This software has visual and graphic features for model drawing, allowing direct model adjustment and analysis with rapid calculations for analyzing Structural Equation Models. AMOS as a statistical tool for SEM analysis in this study.

4.7.1 Reliability Testing

Reliability evaluation of variables used in the model is done by Cronbach's alpha analysis. Cronbach's alpha is a tool for measuring internal consistency and to analyze whether a set of items are used in a relative fashion (Cronbach, 1951). Alpha's theoretical values range from zero to one, of which the higher values indicating better survey quality and therefore more reliable. Suggest that the Cronbach's alpha coefficient is 0.7 or higher is considered acceptable (Carman, 2000). The results of the Cronbach's alpha coefficient analysis are shown in Table 4.12.

Table 4.12 Results Cronbach's Alpha Analysis

Construct	Item	Cronbach's Alpha	Mean	SD
TECC	TechR	.958	5.93	1.01
	ITcap	.958	5.81	1.03
	Compb	.956	5.38	1.32
	Compl	.962	4.57	1.32

Table 4.12 Results Cronbach's Alpha Analysis (Cont.)

Construct	Item	Cronbach's Alpha	Mean	SD
ORGC	TopM	.956	5.34	1.31
	TypP	.958	6.03	1.03
	PerB	.957	5.61	0.93
ENVC	ExtS	.959	5.09	1.28
	ComP	.957	5.68	1.00
	TraP	.957	5.31	1.07
	MktU	.958	5.66	1.03
ERPAD	Accp	.955	5.46	1.30
	IntU	.955	5.23	1.33
	Usag	.955	5.21	1.31
ERPIM	Integ	.955	5.08	1.32
	Conf	.955	5.11	1.36
	Adap	.955	5.17	1.32
	UserT	.955	5.11	1.37
ERPAS	Volu	.955	4.92	1.46
	Dive	.956	5.18	1.11
	Dept	.956	5.25	1.20
FP	Prof	.956	4.73	1.22
	MktS	.957	4.66	1.19
	CusS	.958	5.32	1.08
	EmpS	.959	5.28	1.13

Cronbach's alpha coefficient results for all items used in the model ranged from 0.955 to 0.962, the mean values ranged from 4.66 to 6.03, and the standard deviation ranged from 0.93 to 1.46.

Technological context construct consisted of four items which the overall Cronbach's alpha coefficient was 0.706, mean values ranged from 4.57 to 5.93, and

standard deviation ranged from 1.01 to 1.32, this explained the reliability of this construct and acceptable for the measurement of the technological context in the model.

Organizational context construct consisted of three items which the overall Cronbach's alpha coefficient was 0.766, mean values ranged from 5.34 to 6.03, and standard deviation ranged from 0.93 to 1.31, this explained the reliability of this construct and acceptable for the measurement of the organizational context in the model (firm size variable make the Cronbach's alpha coefficient to not reach 0.7, it is necessary to cut it out).

Environmental context construct consisted of four items which the overall Cronbach's alpha coefficient was 0.803, mean values ranged from 5.09 to 5.68, and standard deviation ranged from 1.00 to 1.28, this explained the reliability of this construct and acceptable for the measurement of the environmental context in the model.

ERP adoption construct consisted of three items which the overall Cronbach's alpha coefficient was 0.953, mean values ranged from 5.21 to 5.46, and standard deviation ranged from 1.30 to 1.33, this explained the reliability of this construct and acceptable for the measurement of the ERP adoption in the model.

ERP implementation construct consisted of four items which the overall Cronbach's alpha coefficient was 0.956, mean values ranged from 5.08 to 5.17, and standard deviation ranged from 1.32 to 1.37, this explained the reliability of this construct and acceptable for the measurement of the ERP implementation in the model.

ERP assimilation construct consisted of three items which the overall Cronbach's alpha coefficient was 0.895, mean values ranged from 4.92 to 5.25, and standard deviation ranged from 1.11 to 1.46, this explained the reliability of this construct and acceptable for the measurement of the ERP assimilation in the model.

Firm performance construct consisted of four items which the overall Cronbach's alpha coefficient was 0.833, mean values ranged from 4.66 to 5.32, and standard deviation ranged from 1.08 to 1.22, this explained the reliability of this construct and acceptable for the measurement of the firm performance in the model.

The total reliability statistics is 0.958 for 25 items. The Cronbach's alpha coefficient greater than 0.7 indicates reliability and is accepted for analysis.

4.7.2 Multicollinearity Testing

The testing for multicollinearity is an analysis for the non-relationships between variables. The tolerance value must be greater than 0.1 and the value of Variance Inflation Factor (VIF) must be less than 10 (R. Anderson, Babin, Black, & Hair, 2010). The analyzed tolerance values were in the range of 0.30 to 0.89 and the VIF values were between 1.13 and 3.32, indicated that there was no multicollinearity relationship between the variables.

4.7.3 Convergent and Construct Validity

Structural Equation Model (SEM) is a technique that integrated the techniques of analysis of variance by using principles to apply together to test the hypothesis. This study used SEM to test by using Confirmatory Factor Analysis (CFA), covariance, and correlation. Therefore, SEM could either be the technique for finding the cause or relationship.

SEM analysis contained two parts in composition including measurement model and structural model. The measurement model was assessed by using Confirmatory Factor Analysis (CFA). CFA is the study to confirm the relationship between observed variables according to the theories or previous research. Besides, confirmatory factor analysis is another sub-technique for SEM analysis. In this stage, the construct validity was assessed by the parameter estimation method in each construct measurement model. For the structural model, it was assessed by homological validity and provided to capture the estimation of the measurement model and their structural relations. Additionally, SEM needs to analyze the constructs by measuring on construct reliability and the Average Variance Extracted (AVE) measure. AVE is the variance that in the indicators as explained by the common factor and average trait-related variance extracted. The reliability of a construct derives from the computing of composite reliability (CR) of a construct. Composite reliability is the measurement of the overall reliability from the heterogeneous collection from similar items. Composite reliability should be more than 0.70, and the average variance extracted should be more than 0.50. Moreover Anderson and Gerbing (1988) stated that average variance extracted above 0.50 is indicated as convergent validity.

Before assessing the constructs by using composite reliability and average variance extracted, each item should be assessed. The value of loading should be 0.60 (Nunnally, 1978). Therefore, each item should have a minimum factor loading of 0.60 on its hypothesized construct. The item that is lower than 0.60 will be dropped, and it must not exceed 0.85 in the discriminant validity testing.

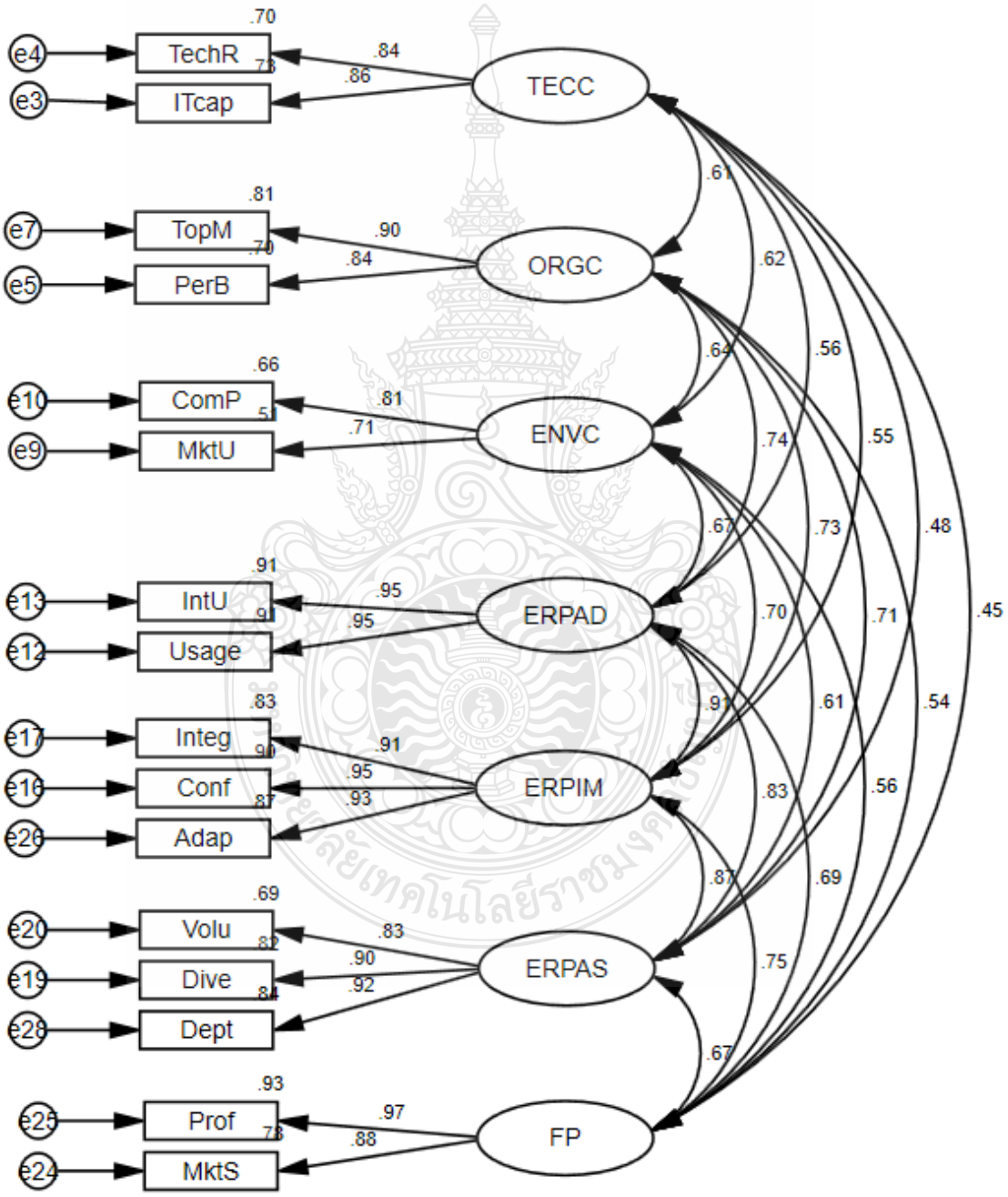

Figure 4.1 Factor Loading

Table 4.13 Factor loading of independent variable, R^2, critical reliability (CR), and average variance extracted (AVE)

Variable	Factor Loading	R^2	Composite Reliability	AVE
TEC			0.836	0.718
TechR	0.839	0.704		
ITcap	0.856	0.733		
ORC			0.863	0.759
TopM	0.901	0.812		
PerB	0.840	0.706		
ENC			0.738	0.585
ComP	0.813	0.661		
TraP	0.714	0.510		

Table 4.14 Factor loading of mediator variable, R^2, critical reliability (CR), and average variance extracted (AVE)

Variable	Factor Loading	R^2	Composite Reliability	AVE
ERPAD			0.953	0.910
IntU	0.954	0.910		
Usag	0.954	0.910		
ERPIM			0.952	0.868
Integ	0.911	0.830		
Conf	0.951	0.904		
Adap	0.933	0.870		
ERPAS			0.915	0.782
Volu	0.830	0.689		
Dive	0.905	0.819		
Dept	0.915	0.837		

Table 4.15 Factor loading of dependent variable, R^2, composite reliability (CR), and average variance extracted (AVE)

Variable	Factor Loading	R^2	Composite Reliability	AVE
FP			0.923	0.857
Prof	0.966	0.933		
MktS	0.884	0.781		

According to the testing results from table 4.13, 4.14, and 4.15, in the test of the model measurement, the researcher has assessed two type of validity: convergent validity and discriminant validity. The values from the convergent validity test on factor loading were above 0.6 where the loading ranged from 0.714 to 0.966, and each was more than 0.6 indicating that the result was accepted. Composite reliability ranged from 0.789 to 0.953, which suggested the acceptability of the construct reliability. Regarding the AVE, it was more than 0.5 and was also an acceptable value (Fornell & Larcker, 1981). The AVEs according to the test ranged from 0.585 to 0.910, which indicated the acceptability.

4.7.4 Discriminant Validity

The squared correlation values were ranged from 0.585 to 0.910 which were equal or more than 0.2 but not over 1.00. The testing result of squared correlation was then accepted. This kind of discriminant validity could be checked from the comparison between AVE value and the squared correlation. Finally, the researcher proved on the discriminant validity of the instrument by examining the AVE which should be more than the squared correlation as recommended by Fornell and Larcker (1981). The testing results showed that the values as obtained supported the discriminant validity as shown in table 4.16. The value of AVE for each construct was greater than the level of correlation involving the construct.

Table 4.16 Discriminant Validity

	TEC	ORC	ENC	ERPAD	ERPIM	ERPAS	FP
TEC	**0.718**						
ORC	0.371	**0.759**					
ENC	0.383	0.407	**0.585**				
ERPAD	0.311	0.554	0.453	**0.910**			
ERPIM	0.300	0.537	0.490	0.831	**0.868**		
ERPAS	0.229	0.497	0.368	0.689	0.757	**0.782**	
FP	0.204	0.294	0.309	0.477	0.567	0.453	**0.857**

4.7.5 Relationship among independent variable, Mediator variable, and Dependent variable

This section illustrated the assessment of the model proposed in this study. The concepts in this study were Improved firm performance after using ERP systems was divided into three operational phases: 1) Factors that affect acceptance consisting of technological context, organizational context, and environmental context, 2) Level of acceptance consisting of ERP adoption, ERP implementation, and ERP assimilation, and 3) Measurement and Delivery. The aim was to seek for the relationship between the technological context, organizational context, and environmental context to ward the firm performance through ERP adoption, ERP implementation, and ERP assimilation. Technological context, organizational context, and environmental context were the independent variables, and ERP adoption, ERP implementation, and ERP assimilation were the mediator variables while firm performance was the dependent variables.

The result of model fit testing was shown in table 4.17.

Table 4.17 Measuring of model fit of model

Model Fit Criteria	Value	Acceptable Level Value
Chi-Square	545.098	-
Degree of freedom	92	-
Chi-Square/Degree of freedom	5.925	Less than 2

Table 4.17 Measuring of model fit of model (Cont.)

Model Fit Criteria	Value	Acceptable Level Value
p-value	0.000	p < 0.001
GFI	0.795	>= 0.90
AGFI	0.697	>= 0.80
RMR	0.351	Close to Zero
RMSEA	0.132	< 0.10
NFI	0.899	> 0.90
CFI	0.889	> 0.90
Hoelter	66	> 200

According to table 4.17, the result of model fit testing showed that they were consistent with data. The diagram of the model one was depicted in figure 4.2.

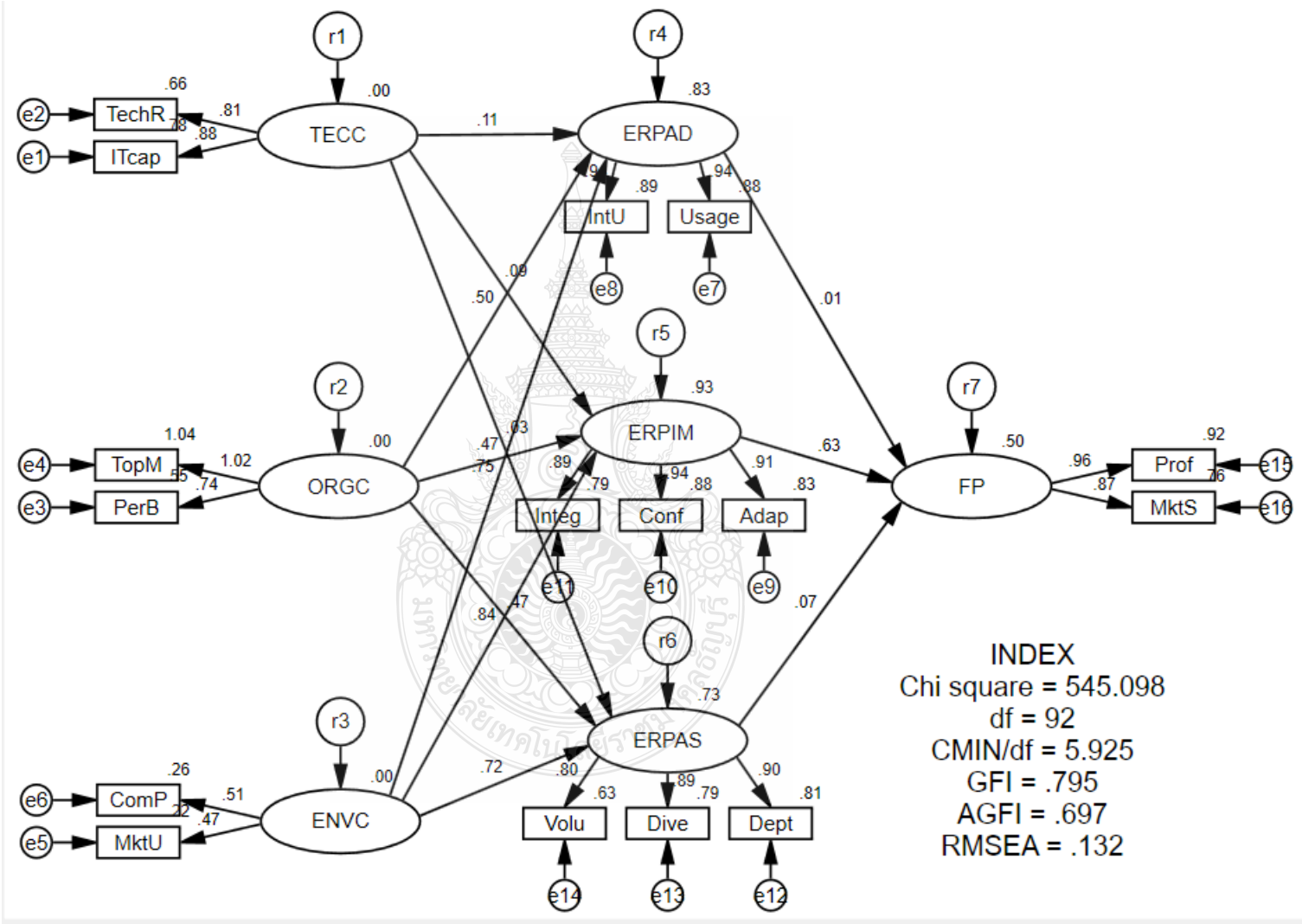

Figure 4.2 Construct Model

According to table 4.17, the parameter value of similarity model has not reached to many in model fit criteria such as Chi- Square/ Degree of freedom, GFI, AGFI, RMR, RMSEA, NFI, and CFI. The researcher adjusted the model by changing the Modification Index (MI) value which is the statistical value used for the decision to adjust the mode. The adjusting technique was to add the linking lines between the variable to reduce the degree of freedom as follows: e13 and e14, e12 and e14, e10 and e14, e9 and e14, e5 and e6, e3 and e6, e3 and e5, e2 and e6, e10 and e15, e10 and e12, e8 and e10, e4 and e16, e4 and e6, e1 and e6, e5 and r2, e7 and e11, e3 and r1, e4 and r1, e13 and r4.

Table 4.18 Measuring of model fit of modified model

Model Fit Criteria	Value	Acceptable Level Value
Chi-Square	122.758	-
Degree of freedom	73	-
Chi-Square/Degree of freedom	1.682	Less than 2
p-value	0.000	p < 0.001
GFI	0.952	>= 0.90
AGFI	0.911	>= 0.80
RMR	0.138	Close to Zero
RMSEA	0.049	< 0.10
NFI	0.973	> 0.90
CFI	0.989	> 0.90
Hoelter	241	> 200

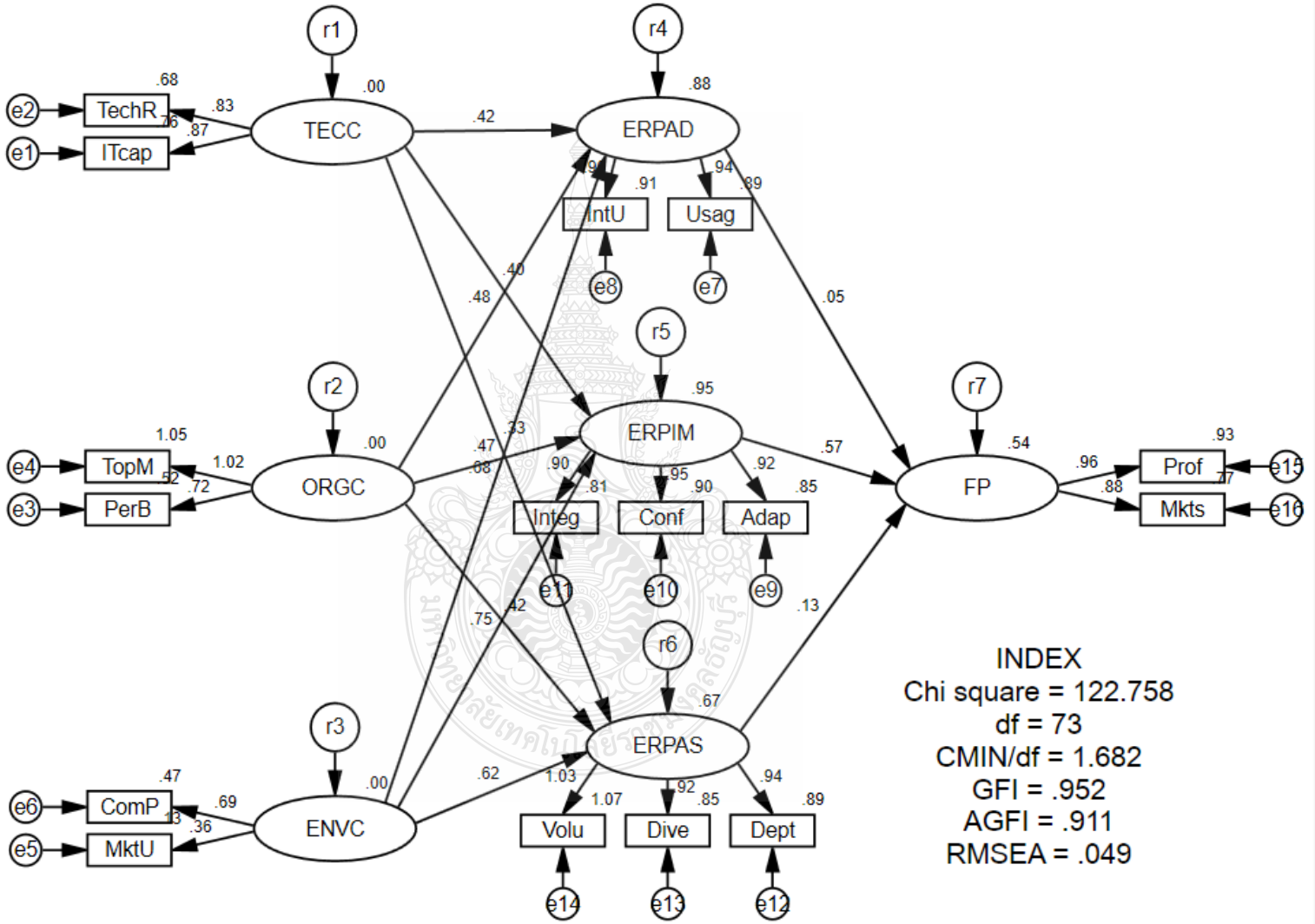

Figure 4.3 Modified Construct Model

Table 4.20 showed the direct and indirect effect of the model, it was found that technological context (TECC) had a positive direct effect on ERP adoption (ERPAD) (β = 0.328) (p-value <.001), technological context (TECC) had a positive direct effect on ERP implementation (ERPIM) (β = 0.404) (p-value < .001), technological context (TECC) had a positive direct effect on ERP assimilation (ERPAS) (β = 0.420) (p-value < .001), organizational context (ORGC) had a positive direct effect on ERP adoption (ERPAD) (β = 0.424) (p-value < .001), organizational context (ORGC) had a positive direct effect on ERP implementation (ERPIM) (β = 0.471) (p-value < .001), organizational context (ORGC) had a positive direct effect on ERP assimilation (ERPAS) (β = 0.482) (p-value < .001), environmental context (ENVC) had a positive direct effect on ERP adoption (ERPAD) (β = 0.616) (p-value < .001), environmental context (ENVC) had a positive direct effect on ERP implementation (ERPIM) (β = 0.750) (p-value < .001), environmental context (ENVC) had a positive direct effect on ERP assimilation (ERPAS) (β = 0.684) (p-value < .001), ERP adoption (ERPAD) had not a positive direct effect on firm performance (FP) (β = 0.053) (p-value = .687), ERP implementation (ERPIM) had a positive direct effect on firm performance (FP) (β = 0.575) (p-value < .001), ERP assimilation (ERPAS) had a positive direct effect on firm performance (FP) (β = 0.132) (p-value < .05), technological context (TECC) had a positive indirect effect on firm performance (FP) through ERP implementation (ERPIM) and ERP assimilation (ERPAS) (β = 0.298) (p-value < .001), organizational context (ORGC) had a positive indirect effect on firm performance (FP) through ERP implementation (ERPIM) ERP assimilation (ERPAS) (β = 0.352) (p-value < .001), environmental context (ENVC) had a positive indirect effect on firm performance (FP) through ERP implementation (ERPIM) ERP assimilation (ERPAS) (β = 0.549) (p-value < .001). Therefore, it indicated that technological context, organizational context, and environmental context with the context of ERP implementation and ERP assimilation had positive effects on firm performance.

Table 4.19 Hypothesis testing of model

				Estimate	S.E.	C.R.	p-value
H1	ERPAD	←	TECC	.420	.080	6.884	***
H2	ERPIM	←	TECC	.404	.080	6.611	***
H3	ERPAS	←	TECC	.328	.068	5.817	***
H4	FP	←	ERPAD	.053	.128	0.402	.687
H5	ERPAD	←	ORGC	.482	.106	8.390	***
H6	ERPIM	←	ORGC	.471	.106	8.159	***
H7	ERPAS	←	ORGC	.424	.092	7.816	***
H8	FP	←	ERPIM	.575	.134	4.156	***
H9	ERPAD	←	ENVC	.684	.330	6.484	***
H10	ERPIM	←	ENVC	.750	.357	6.544	***
H11	ERPAS	←	ENVC	.616	.283	6.292	***
H12	FP	←	ERPAS	.132	.061	2.285	*

***p-value < .001

*p-value < .05

Table 4.20 The standard indirect, direct, and total effect of model

Dependent Variable	R^2	Direct Effect							Indirect Effect							Total Effect						
		TEC	ORC	ENC	ERPAD	ERPIM	ERPAS	FP	TEC	ORC	ENC	ERPAD	ERPIM	ERPAS	FP	TEC	ORC	ENC	ERPAD	ERPIM	ERPAS	FP
TEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ORC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ENC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ERPAD	0.88	.328	.424	.616	-	-	-	-	-	-	-	-	-	-	-	.328	.424	.616	-	-	-	-
ERPIM	0.95	.404	.471	.750	-	-	-	-	-	-	-	-	-	-	-	.404	.471	.750	-	-	-	-
ERPAS	0.67	.420	.482	.684	-	-	-	-	-	-	-	-	-	-	-	.420	.482	.684	-	-	-	-
FP	0.54	-	-	-	.053	.575	.132	-	.298	.352	.549	-	-	-	-	.298	.352	.549	.053	.575	.132	-

The coefficient of determinant (R^2) indicated that technological context, organizational context, and environmental context had a positive effect on ERP adoption with the accuracy 88%, technological context, organizational context, and environmental context had a positive effect on ERP implementation with the accuracy 95%, technological context, organizational context, and environmental context had a positive effect on ERP assimilation with the accuracy of 67%, technological context, organizational context, and environmental context had a positive effect on firm performance through ERP assimilation with the accuracy 54%.

4.8 Summary of Model Analysis

According to the model, the research findings of the relationship between technological context, organizational context, environmental context, and firm performance with ERP adoption, ERP implementation, and ERP assimilation were shown. First of all, technological context had a positive effect on ERP adoption (H1), technological context had a positive effect on ERP implementation (H2), technological context had a positive effect on ERP assimilation (H3), ERP adoption had a positive effect on firm performance (H4), and organizational context had a positive effect on ERP adoption (H5), organizational context had a positive effect on ERP implementation (H6), organizational context had a positive effect on ERP assimilation (H7, ERP implementation had a positive effect on firm performance (H8). Besides, environmental context had a positive effect on ERP adoption (H9), organizational context had a positive effect on ERP implementation (H10), environmental context had a positive effect on ERP assimilation (H11), and ERP assimilation had a positive effect on firm performance (H12).

After empirically testing and analyzing the proposed model was finished, it was found from the study that each theory was used in testing and set as H1, H2, H3, H4, H5, H6, H7, H8, H9, H10, H11, and H12 with the direct effect. Indirect effects were seen in technological context that had an indirect effect on firm performance through ERP implementation and ERP assimilation ($\beta = 0.298$), organizational context had an indirect effect on firm performance through ERP implementation and ERP assimilation ($\beta =$

0.352), and environmental context had an indirect effect on firm performance through ERP implementation and ERP assimilation (β = 0.549) (see figure 4.4).

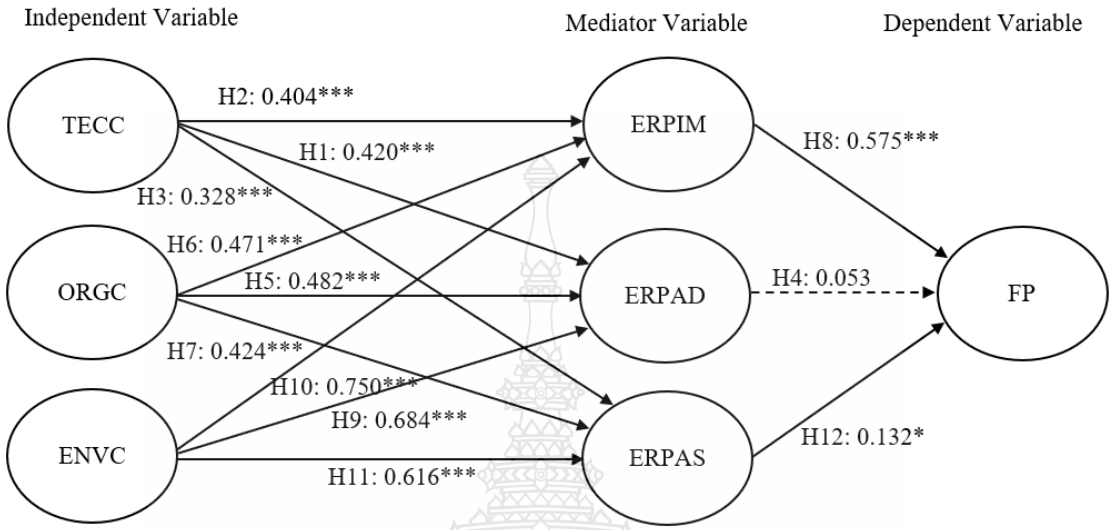

Figure 4.4 Model Analysis

4.9 Hypothesis Testing

According to the three research questions including 1) Does technological context, organizational context, and environmental context affect the firm performance and through ERP adoption? 2) Does technological context, organizational context, and environmental context affect the firm performance and through ERP implementation? 3) Does technological context, organizational context, and environmental context affect the firm performance and through ERP assimilation? The hypotheses shown in figure 4.4 were then conducted to answer the research questions, and these hypotheses were in the following:

H1: Technological context had a positive effect on ERP adoption,

H2: Technological context had a positive effect on ERP implementation,

H3: Technological context had a positive effect on ERP assimilation,

H4: ERP adoption had a positive effect on firm performance,

H5: Organizational context had a positive effect on ERP adoption,

H6: Organizational context had a positive effect on ERP implementation,

H7: Organizational context had a positive effect on ERP assimilation,

H8: ERP implementation had a positive effect on firm performance,

H9: Environmental context had a positive effect on ERP adoption,

H10: Environmental context had a positive effect on ERP implementation,

H11: Environmental context had a positive effect on ERP assimilation, and

H12: ERP assimilation had a positive effect on firm performance.

H1: Technological context had a positive effect on ERP adoption

The result of the analysis of the relationship between TECC and ERPAD showed that the adjusted model had $\beta = 0.420$ ($p < .001$). It indicated that technological context had a positive effect on ERP adoption, thus hypothesis H1 was supported.

According to the relationship above, it indicated that the importance is given from the business to the use of technology in operations (TechR) and standard software to use in the business firm (ITcap). Thus, all of these have the influences on ERP adoption.

H2: Technological context had a positive effect on ERP implementation

The result of the analysis of the relationship between TECC and ERPIM showed that the adjusted model had $\beta = 0.404$ ($p < .001$). It indicated that technological context had a positive effect on ERP implementation, thus hypothesis H2 was supported.

According to the relationship above, it indicated that the importance is given from the business to the use of technology in operations (TechR) and standard software to use in the business firm (ITcap). Thus, all of these have the influences on ERP implementation.

H3: Technological context had a positive effect on ERP assimilation

The result of the analysis of the relationship between TECC and ERPAS showed that the adjusted model had $\beta = 0.328$ ($p < .001$). It indicated that technological context had a positive effect on ERP assimilation, thus hypothesis H3 was supported.

According to the relationship above, it indicated that the importance is given from the business to the use of technology in operations (TechR) and standard software to use in the business firm (ITcap). Thus, all of these have the influences on ERP assimilation.

H4: ERP adoption had a positive effect on firm performance

The result of the analysis of the relationship between ERPAD and FP showed that the adjusted model had $\beta = 0.053$ ($p = .687$). It indicated that ERP adoption had not a positive effect on firm performance, thus hypothesis H4 was not supported.

According to the relationship above, it indicated that importance is given from the planning to use the ERP system (IntU) and availability of ERP system (Usage). Thus, all of these have not the influences on firm performance.

H5: Organizational context had a positive effect on ERP adoption

The result of the analysis of the relationship between ORGC and ERPAD showed that the adjusted model had $\beta = 0.482$ ($p < .001$). It indicated that organizational context had a positive effect on ERP adoption, thus hypothesis H5 was supported.

According to the relationship above, it indicated that importance is given from the targeting and monitoring ERP projects from senior management (TopM) and resistance to change among employees (PerB). Therefore, these have the influences on ERP adoption.

H6: Organizational context had a positive effect on ERP implementation

The result of the analysis of the relationship between ORGC and ERPIM showed that the adjusted model had $\beta = 0.471$ ($p < .001$). It indicated that organizational context had a positive effect on ERP implementation, thus hypothesis H6 was supported.

According to the relationship above, it indicated that importance is given from the targeting and monitoring ERP projects from senior management (TopM) and resistance to change among employees (PerB). Therefore, these have the influences on ERP implementation.

H7: Organizational context had a positive effect on ERP assimilation

The result of the analysis of the relationship between ORC and ERPAS showed that the adjusted model had $\beta = 0.424$ ($p < .001$). It indicated that organizational context had a positive effect on ERP assimilation, thus hypothesis H7 was supported.

According to the relationship above, it indicated that importance is given from the targeting and monitoring ERP projects from senior management (TopM) and resistance to change among employees (PerB). Therefore, these have the influences on ERP assimilation.

H8: ERP implementation had a positive effect on firm performance

The result of the analysis of the relationship between ERPIM and FP showed that the adjusted model had $\beta = 0.575$ ($p < .001$). It indicated that ERP implementation had a positive effect on firm performance, thus hypothesis H8 was supported.

According to the relationship above, it indicated that importance is given from the integrating ERP systems with other business software (Intg), ERP system in responding to all the needs of the organization's process (Conf), and ability of the ERP system to edit data items to meet the needs of the organization (Adap). Thus, all of these have the influences on firm performance.

H9: Environmental context had a positive effect on ERP adoption

The result of the analysis of the relationship between ENC and ERPAD showed that the adjusted model had $\beta = 0.684$ ($p < .001$). It indicated that environmental context had a positive effect on ERP adoption, thus hypothesis H9 was supported.

According to the relationship above, it indicated that importance is given from the business competition in the same industry (ComP) and ability to anticipate customer needs (MktU). Therefore, these have the influences on ERP adoption.

H10: Environmental context had a positive effect on ERP implementation

The result of the analysis of the relationship between ENC and ERPIM showed that the adjusted model had $\beta = 0.750$ ($p < .001$). It indicated that environmental context had a positive effect on ERP implementation, thus hypothesis H10 was supported.

According to the relationship above, it indicated that importance is given from the business competition in the same industry (ComP) and ability to anticipate customer needs (MktU). Therefore, these have the influences on ERP implementation.

H11: Environmental context had a positive effect on ERP assimilation

The result of the analysis of the relationship between ENC and ERPAS showed that the adjusted model had $\beta = 0.616$ ($p < .001$). It indicated that environmental context had a positive effect on ERP assimilation, thus hypothesis H11 was supported.

According to the relationship above, it indicated that importance is given from the business competition in the same industry (ComP) and ability to anticipate customer needs (MktU). Therefore, these have the influences on ERP assimilation.

H12: ERP assimilation had a positive effect on firm performance

The result of the analysis of the relationship between ERPAS and FP showed that the adjusted model had $\beta = 0.132$ ($p < .05$). It indicated that ERP assimilation had a positive effect on firm performance, thus hypothesis H12 was supported.

According to the relationship above, it indicated that importance is given from the use of ERP systems covering business processes (Volu), using ERP system all department (Dive), and using the ERP system as a daily routine (Dept). Thus, all of these have the influences on firm performance.

All hypothesis testing revealed that hypothesis 4 was not significant. From the perspective of the researcher, it is believed that ERP adoption is only a decision to implement an ERP system within the organization. This involves planning the implementation of the ERP system, preparing the budget for investing in the ERP system, preparing for the implementation of the ERP system, the realization of the potential benefits received from the ERP system, as well as to focus on the growing trend of employee adoption of the ERP system. Therefore, it assumes that an ERP adoption is only the first or the initial step in implementing an ERP system which does not affect the performance of the organization efficiency. This is why ERP adoption has not a positive effect on firm performance.

The summary of hypothesis testing.

Table 4.21 Summary of hypothesis testing

Hypothesis	Result
H1: Technological context had a positive effect on ERP adoption.	Supported
H2: Technological context had a positive effect on ERP implementation.	Supported
H3: Technological context had a positive effect on ERP assimilation.	Supported
H4: ERP adoption had a positive effect on firm performance.	Not supported
H5: Organizational context had a positive effect on ERP adoption.	Supported
H6: Organizational context had a positive effect on ERP implementation.	Supported

Table 4.21 Summary of hypothesis testing (Cont.)

Hypothesis	Result
H7: Organizational context had a positive effect on ERP assimilation.	Supported
H8: ERP implementation had a positive effect on firm performance.	Supported
H9: Environmental context had a positive effect on ERP adoption.	Supported
H10: Environmental context had a positive effect on ERP implementation.	Supported
H11: Environmental context had a positive effect on ERP assimilation.	Supported
H12: ERP assimilation had a positive effect on firm performance.	Supported

The results of the model testing show that ERP adoption does not affect on firm performance, while the ERP implementation and ERP assimilation had positive affect on firm performance. This shows that implementing an ERP system within an organization does not guarantee that the organization will be efficient in its operation, because ERP adoption is just the first step in implementing an ERP system within an organization only. Therefore, ERP adoption does not affect on firm performance. Which corresponds to the study of Nicolaou and Bhattacharya (2006), stating that early use of the ERP system did not have a positive impact on firm performance. Studies have shown that The ERP system will affect the efficiency of the company when an organization integrates the ERP system with other business software so that the ERP system in responding to all the needs of the organization's process and the use of ERP systems covering business processes. As well as promoting the use of the ERP system as a daily routine. From the results of the study. The researcher found that the ERP may be the starting point for the ERP implementation and the ERP assimilation. The researcher therefore prescribes additional assumptions as follows:

H13a: ERP adoption had a positive effect on ERP implementation.

H13b: ERP adoption had a positive effect on ERP assimilation.

The result of model fit of modified model two testing was shown in table 4.22.

Table 4.22 Measuring of model fit of modified model two

Model Fit Criteria	Value	Acceptable Level Value
Chi-Square	100.326	-
Degree of freedom	71	-
Chi-Square/Degree of freedom	1.413	Less than 2
p-value	0.000	$p < 0.001$
GFI	0.961	>= 0.90
AGFI	0.925	>= 0.80
RMR	0.030	Close to Zero
RMSEA	0.038	< 0.10
NFI	0.978	> 0.90
CFI	0.993	> 0.90
Hoelter	288	> 200

According to table 4.22, the result of model fit testing showed that they were consistent with data. The diagram of the model two was depicted in figure 4.5.

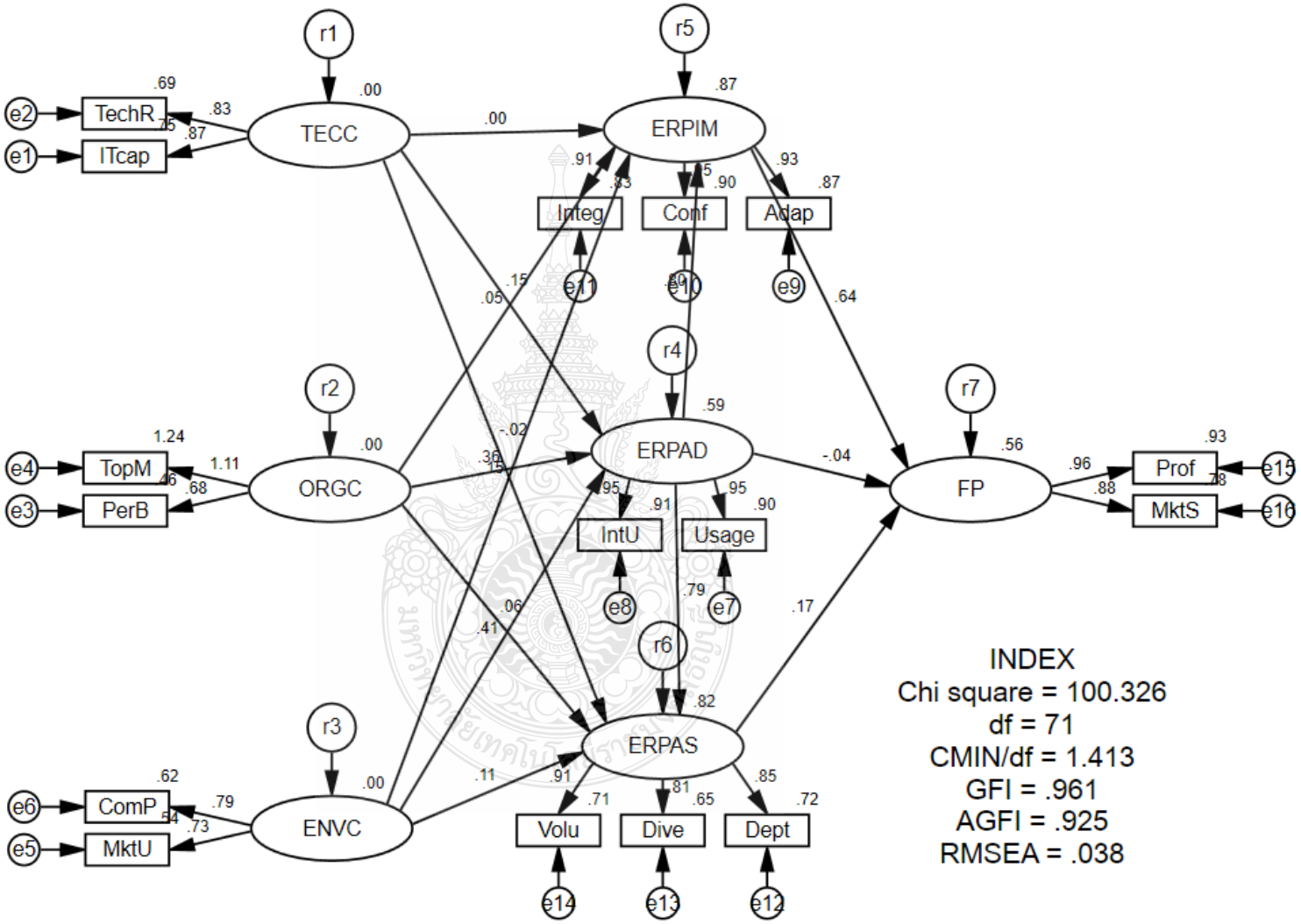

Figure 4.5 Modified Construct Model two

Table 4.24 showed the direct and indirect effect of the model two, it was found that ERP adoption (ERPAD) had a positive direct effect on ERP implementation (ERPIM) (β = 0.795) (p-value < .001), ERP adoption had a positive direct effect on ERP assimilation (ERPAS) (β = 0.794) (p-value < .001), ERP adoption (ERPAD) had not a positive direct effect on firm performance (FP) (β = -0.042) (p-value = .926), ERP implementation (ERPIM) had a positive direct effect on firm performance (FP) (β = 0.637) (p-value < .001), ERP assimilation (ERPAS) had not a positive direct effect on firm performance (FP) (β = 0.175) (p-value = .736), ERP adoption (ERPAD) had a positive indirect effect on firm performance (FP) through ERP implementation (ERPIM) (β = 0.645) (p-value < .001). Therefore, it indicated that ERP adoption with the context of ERP implementation had positive effects on firm performance.

Table 4.23 Hypothesis testing of model two

				Estimate	S.E.	C.R.	p-value
H1	ERPAD	←	TECC	.150	.102	2.048	*
H2	ERPIM	←	TECC	-.003	.058	-.082	.935
H3	ERPAS	←	TECC	-.019	.056	-.386	.700
H4	FP	←	ERPAD	-.042	.420	-.093	.926
H5	ERPAD	←	ORGC	.360	.121	5.841	***
H6	ERPIM	←	ORGC	.045	.058	1.522	.128
H7	ERPAS	←	ORGC	.062	.057	1.722	.085
H8	FP	←	ERPIM	.637	.149	4.047	***
H9	ERPAD	←	ENVC	.413	.140	4.859	***
H10	ERPIM	←	ENVC	.155	.086	2.921	**
H11	ERPAS	←	ENVC	.114	.083	1.823	.068
H12	FP	←	ERPAS	.175	.596	.337	.736
H13a	ERPIM	←	ERPAD	.795	.052	15.234	***
H13b	ERPAS	←	ERPAD	.794	.053	12.222	***

***p-value < .001

**p-value < .01

*p-value < .05

Table 4.24 The standard indirect, direct, and total effect of model two

	R^2	Direct Effect				Indirect Effect				Total Effect			
		ERPAD	**ERPIM**	**ERPAS**	**FP**	**ERPAD**	**ERPIM**	**ERPAS**	**FP**	**ERPAD**	**ERPIM**	**ERPAS**	**FP**
ERPAD	0.59												
ERPIM	0.87	.795								.795			
ERPAS	0.82	.794								.794			
FP	0.56	-.042	.637	.175		.645				.603	.637	.175	

The coefficient of determinant (R^2) indicated that ERP adoption had a positive effect on ERP implementation with the accuracy 87%, ERP adoption had a positive effect on ERP assimilation with the accuracy 82%, and ERP adoption had a positive effect on firm performance through ERP implementation with the accuracy 56%.

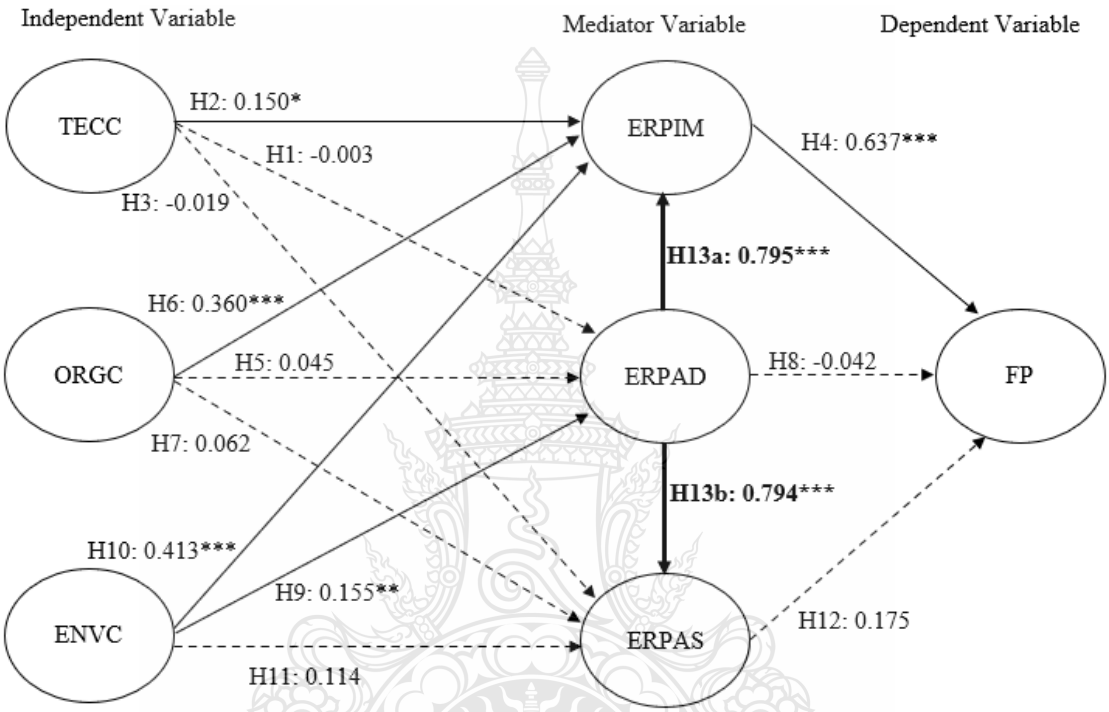

Figure 4.6 Model two Analysis

H13a: ERP adoption had a positive effect on ERP implementation

The result of the analysis of the relationship between ERPAD and ERPIM showed that the adjusted model had $\beta = 0.795$ ($p < .001$). It indicated that ERP adoption had a positive effect on ERP implementation, thus hypothesis H13a was supported.

According to the relationship above, it indicated that importance to planning and preparing budgets for investing in ERP systems (IntU), and important to the trends in the use of better ERP systems (Usage). Thus, all of these have the influences on ERP implementation.

H13b: ERP adoption had a positive effect on ERP assimilation

The result of the analysis of the relationship between ERPAD and ERPAS showed that the adjusted model had $\beta = 0.794$ ($p < .001$). It indicated that ERP adoption had a positive effect on ERP implementation, thus hypothesis H13b was supported.

According to the relationship above, it indicated that importance to planning and preparing budgets for investing in ERP systems (IntU), and important to the trends in the use of better ERP systems (Usage). Thus, all of these have the influences on ERP assimilation.

4.10 Qualitative Results

This was the part of qualitative research. This study was an in-depth interview guideline on the CEO and Top manager from five manufacturing industry in Thailand. The results from the interview were summarized and brought to confirm the quantitative research. The qualitative research results through in-depth interviews confirming the quantitative research results.

4.10.1 Research Tools

The research tool here was the semi-structured interview which is the interview that is previously set for the main questions as the guideline to conduct the interview by it can be added or adjusted according to the properness during the interview. There were 4 items of interview questions explained in chapter 3.

4.10.2 The CEO or Top Manager In-dept Interview Results

The following is a detailed explanation through interviews with CEO and Top manager from five manufacturing industry in Thailand.

Table 4.25 Results of the In-Depth Interview Question 1

"Is your organization technologically ready?"

Paticipant	Answer for the question
Top manager company 1	Very ready, because the organization is a German company and it is a large organization. Therefore, we focus on technology in the use of technology in business operations very much.

Table 4.25 Results of the In-Depth Interview Question 1

"Is your organization technologically ready?" (Cont.)

Paticipant	Answer for the question
Top manager company 2	Are technologically ready. The subsidiary is from Japan and has a headquarter in Singapore, an engineering office in Thailand for resource management and manpower, uses computer programming technology and uses corporate knowledge from sharing knowledge from around the world.
Top manager company 3	Are technologically ready, because it is a foreign company. The firm is already using platform technology in its operations. Whether it is a matter of using ERP in manufacturing, purchasing, finance and human resource.
Top manager company 4	Quite ready.
Top manager company 5	Quite ready.

Table 4.26 Results of the In-Depth Interview Question 2

"How do corporate and external organizations contribute to corporate technology?"

Paticipant	Answer for the question
Top manager company 1	The company has business dealings with various manufacturing industries, including large organizations. All of these companies use management technology, such as sending orders to a supplier or manufacturer, planning stock management. These systems must have a connection between the partners. Third-party companies play a very active role in how they consider using software on compatible platforms for efficient communication or data transfer.

Table 4.26 Results of the In-Depth Interview Question 2

"How do corporate and external organizations contribute to corporate technology?" (Cont.)

Paticipant	Answer for the question
Top manager company 2	Normally, the company will import two types of technology: 1) bring basic technology from Japan (Technology is imported through 2 methods: 1. The parent company developed it by itself and 2. Developed in conjunction with a world-class organization with technology) 2) The company allows to develop and think policies to suit Thailand. If accepted, the company will allow its own development.
Top manager company 3	Because it is a foreign company therefore, major policies related to the use of information technology systems have been adopted mainly in Denmark. Currently, the company is a production unit and all policies must be approved by Denmark.
Top manager company 4	Corporate and external organizations contribute to corporate technology, as it is a joint venture with Switzerland. Therefore, all system-subject technologies are transferred in the same system.
Top manager company 5	Executives place great importance on in-house information technology because they are at the heart of the company's operations. Because all the work is done through the whole system. Whether it's budget and improvement, it's done in part of the system every year, which the management supports well.

Table 4.27 Results of the In-Depth Interview Question 3

"Why does your organization choose ERP?"

Paticipant	Answer for the question
Top manager company 1	ERP is a management system that has been fairly established in the industry for more than 20-30 years, it is widely and well known in the industry. Therefore, there are many organizations that use ERP because ERP is a system that can be widely and comprehensively linked to the software of multinational client companies.
Top manager company 2	Everyone has to use it because of its complexity and competition. Therefore, every form of ERP development occurs because of the cost. High competition and market evolution. In the past, the market might have thought that we had unlimited resources. The cost might not be the issue, but in the last 20 years the cost has been rising. The profit per unit is also reduced. So how do you reduce costs? If the competition is higher, it means that the price cannot be increased. Therefore, when the price cannot be raised, it must turn to the development of cost efficiency or cost reduction.
Top manager company 3	Due to the parent company to use and the organization sees that the ERP system is international because it is prevalent with many organizations, especially those that are internationally, the ERP system allows organizations to link data from each unit together.
Top manager company 4	ERP is a global system used by the Omya Group of venture capital firms around the world.
Top manager company 5	Because the ERP system is an enterprise management program. The reason why companies need to use it is because ERP systems can integrate data from every segment together. And can be processed according to the requirements. ERP system allows data to be in the same database for further use in order to make the data flow according to the production and distribution process.

Table 4.28 Results of the In-Depth Interview Question 4

"How does your organization have an ERP approach?"

Paticipant	Answer for the question
Top manager company 1	Use ERP to manage all enterprise resources such as stock management, customer order acceptance, customer shipment planning, accounting document issuing, and consignment delivery. Everything runs in all ERP systems.
Top manager company 2	ERP systems have been used for at least 15-20 years, but it appears that the current trend of sharing knowledge, sharing technology is evolving. In Thailand, if each person will invest himself in each company, it will increase the cost, especially software cost is quite high, therefore, nowadays, using sharing resource (1 company may take multiple units that are repetitive to join as one. A new company, or a virtual company, and then takes care of all affiliates). This is one of the ways that use co-technology and reduce operating costs. This approach began to be concrete for about three years, and during COVID, it encouraged faster decision-making. Which in the past might say that wait and see the result Due to the economic problems caused by COVID, decision-making has been forced to speed up decision-making. Which may not have to wait and see results and then go ahead and solve the problem
Top manager company 3	The company uses an ERP system for both the production line and the back office. Currently, the production line is used in conjunction with the Antara system. Which is the basic function All information logged into Antara will be linked to ERP system (Antara is a software used in the dye industry. Which spread throughout the world, the data from Antara is sent to ERP by production and will continue to generate into other systems of the company).

Table 4.28 Results of the In-Depth Interview Question 4

"How does your organization have an ERP approach?" (Cont.)

Paticipant	Answer for the question
Top manager company 4	The organization will focus on the areas that are on digital, for example, the current production system will be all AI Control in the control room, so it will be a production system that uses almost all computer control systems.
Top manager company 5	The organization's approach is to try to keep everything in the system and not try to manual anything outside, as all the data will be stored in the same database. And able to process and store Log and be able to analyze anything with more accuracy try to get everything into the ERP system in order to get information in every part to analyze about the business.

4.10.3 Working Hypothesis

After interviewing the first CEO or top manager, the working hypothesis was created as shown in the following.

Working Hypothesis 1: The firm was technologically ready for used as a tool in the operations of the company. Working hypothesis 1 was analyzed based on answer 1, as question 1 demonstrated that the firm was ready and focused on technology to be used in its operations, especially the ERP system.

Working Hypothesis 2: The firm places great emphasis on the support of top management and from outside organizations. This working hypothesis was analyzed from question number 2, where the question number 2 pointed out that senior management of the firm and external organizations such as trading partners play an important role in driving the adoption of the ERP system.

Working Hypothesis 3: The firm pays attention to the use of the ERP system for the operations of the firm. This working hypothesis is analyzed from two questions. First of all, as question number 3 shows, the company believes that the ERP system can truly meet the firm's operations. As for question number 4, it shows that the firm values the

implementation of the ERP system by pushing all parts of the firm's operations through the ERP system.

Therefore, the interview with the second CEO or top manager on the working hypothesis had showed that all hypotheses were suppoted

CEO or top manager 3, 4, and 5 were tested on this working hypothesis, And the results were confirmed as well encouraged, indicating tthat the result of the interviewing was justified. The summary of hypothesis testing was shown in table. The summary of hypothesis testing was shown in table 4.29.

Table 4.29 Working Hypotheses Testing

Working Hypothesis	**First CEO or top manager**	**Second CEO or top manager**	**Third CEO or top manager**	**Fourth CEO or top manager**	**Fifth CEO or top manager**
The firm was technologically ready for used as a tool in the operations of the company.	Supported	Supported	Supported	Supported	Supported
The firm places great emphasis on the support of top management and from outside organizations.	Supported	Supported	Supported	Supported	Supported
The firm pays attention to the use of the ERP system for the operations of the firm.	Supported	Supported	Supported	Supported	Supported

CHAPTER 5
CONCLUSION AND RECOMMENDATIONS

Chapter five presents the conclusions and discussion of the findings. In addition, the chapter links the results with technological context, organizational context, and environmental context (TOE framework) areas for the firm performance by focusing the study on a group of manufacturing industrial business in Thailand. This chapter is organized into four sections. The first covers methodology and a summary of research findings. The second section contains discussion of the research findings. The third section focuses on the implications and benefits derived from the study findings as well as business guidelines for firm operations, and the last section discusses the limitations of the study and future research recommendations.

5.1 Conclusion

This study aimed to investigate whether Enterprise Resource Planning (ERP) adoption, ERP implementation, and ERP assimilation (mediator) are variables that result from technological context, organizational context, and environmental context (independent) toward firm performance (dependent). This study presents the assumption that firm performance results from several major factors as follows: 1) The technological context of an organization is measured by its technology readiness, IT capability level, and compatibility; 2) The organizational context of an organization is measured by top management support and perceived barriers; 3) The environmental context is measured by competitive pressure, trading partners' readiness, and market uncertainty; 4) ERP assimilation refers to the scope of technology usage, which expands to all the processes in the organization's operations and encompasses the regular activities in the work processes that consist of implementing ERP systems in all departments, implementing ERP systems to cover business processes, and using the ERP system as an integral part of daily routines; and 5) Firm performance is measured by profitability and market share. All the first four factors will result in better performance of firms (the fifth and final factor).

There were three research questions, including 1) Do technological context, organizational context, and environmental context affect the firm performance through ERP adoption? 2) Do technological context, organizational context, and environmental context affect the firm performance through ERP implementation? 3) Do technological context, organizational context, and environmental context affect the firm performance through ERP assimilation?

This study applied both quantitative and qualitative methodologies to analyze the results. Quantitative research was conducted by using the questionnaires as a tool for surveying Chief Executive Officers (CEO) or top managers who represented the business firms. The questions focused on the importance placed on technological context, organizational context, environmental context, ERP adoption, ERP implementation, ERP assimilation, and firm performance. Research findings indicate that technological context, organizational context, and environmental context had positive effects on firm performance through ERP implementation and ERP assimilation.

Independent variables consisted of technological context, organizational context, and environmental context, whereas firm performance was a dependent variable. The mediator comprised ERP implementation and ERP assimilation.

There were fourteen hypotheses: H1: Technological context has a positive effect on ERP adoption; H2: Technological context has a positive effect on ERP implementation; H3: Technological context has a positive effect on ERP assimilation; H4: ERP adoption has a positive effect on firm performance; H5: Organizational context has a positive effect on ERP adoption; H6: Organizational context has a positive effect on ERP implementation; H7: Organizational context has a positive effect on ERP assimilation; H8: ERP implementation has a positive effect on firm performance; H9: Environmental context has a positive effect on ERP adoption; H10: Environmental context has a positive effect on ERP implementation; H11: Environmental context has a positive effect on ERP assimilation; H12: ERP assimilation has a positive effect on firm performance; H13a: ERP adoption has a positive effect on ERP implementation; and H13b: ERP adoption has a positive effect on ERP assimilation.

The population comprised medium-size firms with total fixed assets ranging from 50 million baht to 200 million baht, and large firms with total fixed assets of over

200 million baht listed on the database of the Department of Business Development under the Ministry of Commerce, Thailand. The overall number of subjects were 260 firms from 6,050 firms on the list. The list was divided into twenty groups of sub industries; thus, the sample size was defined according to percentage of the total for each group. However, to prevent low return rate, the researcher distributed 1,821 questionnaires, which was four times the required sample size.

The questionnaire was assessed for content validity by six IT experts and was tested for reliability before being mailed to subjects. The 285 returned questionnaires represented a 15.65% response rate.

The results of the hypotheses testing are presented in Table 5.1.

Table 5.1 The results of hypotheses testing for research questions

Research Question	Hypothesis	Statistic Technique	Result
1) Do technological context, organizational context, and environmental context affect the firm performance through ERP adoption?	H1: Technological context has a positive effect on ERP adoption.	SEM	Supported
	H5: Organizational context has a positive effect on ERP adoption.		Supported
	H9: Environmental context has a positive effect on ERP adoption.		Supported
	H4: ERP adoption has a positive effect on firm performance.		Not supported
2) Do technological context, organizational context, and environmental context affect the firm performance through ERP implementation?	H2: Technological context has a positive effect on ERP implementation.	SEM	Supported

Table 5.1 The results of hypothesis testing for research questions (Cont.)

Research Question	Hypothesis	Statistic Technique	Result
	H6: Organizational context has a positive effect on ERP implementation.		Supported
	H10: Environmental context has a positive effect on ERP implementation.		Supported
	H8: ERP implementation has a positive effect on firm performance.		Supported
	H13a: ERP adoption has a positive effect on ERP implementation.		Supported
3) Do technological context, organizational context, and environmental context affect the firm performance through ERP assimilation?	H3: Technological context has a positive effect on ERP assimilation.	SEM	Supported
	H7: Organizational context has a positive effect on ERP assimilation.		Supported
	H11: Environmental context has a positive effect on ERP assimilation.		Supported
	H12: ERP assimilation has a positive effect on firm performance.		Supported
	H13b: ERP adoption has a positive effect on ERP assimilation.		Supported

5.2 Discussion

This section provides research discussions regarding the research questions from Chapter One.

5.2.1 The Effect of Technological Context, Organizational Context, and Environmental Context on the Firm Performance through ERP Adoption

The results of H1, H4, H5, and H9 testing illustrate that technological context, organizational context, and environmental context has an influential impact on ERP adoption. Technological context includes technological readiness and levels of IT capability to support the entire process of firm operations. Organizational context includes top management support and perceived barriers. Top management must give importance to developing and monitoring the ERP project, and, in addition, must discourage resistance to change among employees. Environmental context includes competitive pressure and market uncertainty. However, ERP adoption has not had an influential impact on firm performance.

Findings show that technological context, organizational context, and environmental context has an influence on ERP adoption, which conforms to the research of Awa and Ojiabo (2016), which found that ERP adoption receives positive support from the technology factor, organization factor, and environment factor. These conform to H1, H5, and H9 of this study, respectively.

The study of Kharuddin, Foong, and Senik (2015) found that the extent of ERP adoption is significantly associated with firm performance, which is not congruent with the result of H4. This study found that ERP adoption did not have a positive effect on firm performance. This result may be because the organizations were not giving importance to the implementation of ERP systems and not giving importance to the process of planning to use ERP systems. Furthermore, because the organization is unable to determine the final image of success, the employees may not have had to modify their work process, which caused the organizations to miss out on the potential benefits of the new solution. In short, there a number of possible reasons why ERP adoption had not had a positive effect on firm performance.

5.2.2 The Effect of Technological Context, Organizational Context, and Environmental Context on the Firm Performance through ERP Implementation

The results of H2, H6, H8, and H10 testing illustrate that technological context, organizational context, and environmental context has an influence on ERP implementation. Technological context includes technological readiness and levels of IT capability to support the entire process of firm operations. Organizational context includes top management support and perceived barriers. Top management must give importance to developing and monitoring the ERP project, and, in addition, must discourage resistance to change among employees. Environmental context includes competitive pressure and market uncertainty. ERP implementation has an influential impact on firm performance. The results of H13a testing, illustrates that the ERP adoption context has had an influence on ERP implementation.

Findings show that technological context, organizational context, and environmental context has an influence on ERP implementation, which conforms to the study of Garg and Chauhan (2015) found that the organization factor and technology factor has resulted in successful ERP implementation. Schniederjans and Yadav (2013) found that the environment factor has resulted in successful ERP implementation. It was also found that ERP adoption has a positive impact on ERP implementation. These conform to H2, H6, H10, and H13a of this study, respectively.

The study of Hwang (2011) found that ERP implementation has a positive impact on organizational performance. According to the result of H8, which is congruent with the study of Le and Han (2016), it was found that ERP implementation mediates the effect of the enterprise systems adoption on business performance. This study found that ERP implementation had a positive effect on firm performance.

5.2.3 The Effect of Technological Context, Organizational Context, and Environmental Context on the Firm Performance through ERP Assimilation

The results of H3, H7, H11, and H12 testing illustrate that technological context, organizational context, and environmental context has an influence on ERP assimilation. Technological context includes technological readiness and levels of IT capability to support the entire process of firm operations. Organizational context includes top management support and perceived barriers. Top management must give importance to

developing and monitoring the ERP project, and, in addition, must discourage resistance to change among employees. Environmental context includes competitive pressure and market uncertainty. ERP assimilation, which consists of giving importance to the use of ERP systems covering business processes, giving importance to using ERP systems in all departments, and giving importance to using the ERP system as a daily routine, has an influence on firm performance. The results of H13b testing, illustrate that the ERP adoption context has an influence on ERP assimilation.

Findings show that technological context, organizational context, and environmental context has an influence on ERP assimilation, which conforms to the research of Xu, Ou, and Fan (2017) found that technology aspect, organization aspect, and environment aspect are key for ERP assimilation. It was also found that ERP adoption had a positive impact on ERP assimilation. These conform to H3, H7, H11, and H13b of this study, respectively.

The study of Xu, Ou, and Fan (2017) supports that ERP assimilation affects firm performance. The result of H12 is congruent with the study of Chang and Seow (2016), which found that ERP assimilation mediates the effect of the enterprise systems adoption on business performance. This study found that ERP assimilation had a positive effect on firm performance.

5.3 Contributions of the Study

5.3.1 Theoretical Contributions

Implication for theory, the study is significant since it further the studies and extend an understanding of TOE framework consisting of technological context, organizational context, and environmental context. The results of the study confirm that all three elements of the TOE framework affect ERP adoption, ERP implementation, and ERP assimilation.

This supported Tornatzky et al (1990) that technological context, organizational context, and environmental context (TOE) framework had influences the adoption and use of innovation. The results from this study indicated positive relationship between TOE framework and ERP cycle implementation, as well as, the positive relationship between ERP cycle implementation and firm performance, which and affirmed the studies

of Le and Han (2016), Xu et al (2017), and Chang and Seow (2016) that the use of the ERP system was an important factor in enhancing the firm performance.

5.3.2 Managerial Implications / Practical Contributions

This study examines the relationship between the TOE framework and firm performance within the context of the ERP application cycle of the manufacturing industry. The effective use of ERP systems is a vital source of competitive advantage and is a versatile way to increase efficiency and productivity in the manufacturing industry. The results of the study suggest that the ERP system can provide the foundation for superior firm performance. The factors contributing to the effective use of ERP for this study include the technological context, the organizational context, and the environmental context.

Technological context is an organizational technology factor that affects the adoption and implementation of the ERP system within the organization for operational efficiency. Managers must know all the technology available to plan for implementing the ERP system as the core of the organization in order to enable the integration of the ERP system across the organization to create efficient work processes that will lead to a competitive advantage over competitors. Elements within a technological context include technology readiness and IT capability level.

The organizational context is the organizational factor that leads to the adoption and implementation of the ERP system for the efficiency of the organization. Managers need to look at the organization overview in order to plan for the implementation of the ERP system by taking into account the management structure of the organization, including the type of enterprise production, which is the driving force behind the implementation of the ERP system within the organization, to create efficient work processes, as well enhancing the effectiveness of the organization's work. Elements within an organizational context are top management support and perceived barriers.

The environmental context is an external environmental factor that affects the adoption and implementation of the ERP system within the organization to achieve effective performance. Managers need to understand the changing external environment technology, marketplace, and business competitors. This is an important reason for implementing the ERP system; that is, so that organizations can plan to cope with change

as well as being able to operate efficiently, and gaining an edge over competitors. The organization operates in an environmental context, including competitive pressures and market uncertainty.

However, the TOE framework helps in planning and implementing an ERP system within the organization to create operational efficiencies and gain a competitive advantage. Kharuddin et al. (2015) have insisted that widespread use of ERP systems impacts organizational performance, and Handoko et al. (2015) stated that ERP systems have a positive impact on the performance and operations of the company. Therefore, corporate executives should consider and pay attention to the implementation of ERP systems that cover the entire organization's processes rather than implementing an ERP system to only a portion of the operation.

The results of the study suggest that efficient use of the ERP system is the most important driver for business as it can play a critical role in improving firm performance. Hence, managers must have a good understanding of the adoption and implementation of the ERP system in the organization as the success of the company depends on the level of system implementation. Organizations should be aware of the role of the ERP in their business. It is evident that the effective use of the ERP system leads to improvements in profitability and market share.

Furthermore, implementation of the ERP system helps in improving the efficiency of the company. Therefore, corporate executives must have a good understanding of how to implement an ERP system within the organization. As the success of a company depends on their implementation approach to ERP systems, company executives and managers should be aware of the role and importance of ERP systems by planning and budgeting for investments in ERP systems, including training and change management. It is evident that the implementation of ERP systems to cover the operational processes of an organization has resulted in performance improvements in both profitability and market share.

ERP systems should be introduced as a component of the organization's legacy systems to support the integration of the ERP system into the overall operations of the organization. ERP should also be linked to the systems of the partner companies as the consolidation of the organization's operations also helps in reducing duplication of work.

The importance of implementing an ERP system as the core system of an organization's operations is evident in the integration of information. Establishing a connection with business partners improves operational efficiency. The focus on operating an ERP system can improve a company's internal capabilities, and connecting the ERP system to the partner's system will increase external capabilities. In addition, managers can encourage employees to become accustomed to using the ERP system in their day-to-day operations. The results of this study indicate that routine daily use of the ERP system in all departments has a positive effect on the company's operational efficiency.

On the part of national policymakers, the results of this study can be extended to support policies of the Thai government by encouraging the manufacturing industry in Thailand to focus more heavily on investing in intangible assets such as software, copyrights, patents, etc. to help the company to operate efficiently. This is because the industrial sector is a major driver of the Thai economy in terms of added value and employment. In the coming years, Thai industry is likely to face more serious challenges such as global trade conflicts, technological changes, etc. The implementation of ERP systems in the manufacturing industry will play a significant role in significantly improving the overall productivity of the manufacturing industry.

The government can consider two steps in implementation. In the first step, governments can underscore the importance of implementing ERP in manufacturing industry operations to keep businesses competitive. The framework for implementing an ERP system in the manufacturing industry from this study can be adapted and put into practice at the manufacturing industry level. This will create and enhance long-term competitiveness for medium and large sized companies in the manufacturing industry in Thailand. The government could be a key driver in fostering the adoption of ERP by formulating policies that encourage the adoption of ERP systems to cover business processes, as well as supporting ICT infrastructure to stimulate the full use of the ERP system. This will improve the operational efficiency of operators in the manufacturing industry in Thailand. The second step entails assisting manufacturing and related industries and their partners to link the systems together to increase the long-term operational efficiency of the manufacturing industry. The government may provide

knowledge and technical support such as training or financial assistance for the manufacturing industry as needed.

This will improve operational efficiency and maintain market competitiveness for the manufacturing industry in Thailand. To realize the full potential of this effort, cooperation between the government and the private sector must be emphasized, leading to new synergies that enhance the potential of the manufacturing industry in Thailand. On the part of the private sector, systems must be linked together until software integration or information integration leads to the efficiency of the organization's operations that will lead to mutual benefit.

5.4 Research Limitations and Suggestions for Future Research

5.4.1 Limitation of the Study

The study focuses on the effect of technological context, organizational context, and environmental context (TOE framework) on firm performance through ERP adoption, ERP implementation, and ERP assimilation. The researcher was conscientious in making every effort to conduct the study in such a way as to achieve an accurate result; however, some limitations should be considered, as explained below.

1. Firm performance in this study was measure by profitability, market share, customer satisfaction, and employee satisfaction. Some companies may measure firm performance by various other variables not included in this study.

2. The group of samples used in this research comprised medium and large sized companies. Thus, the results of the research may not apply to small businesses.

3. The technological context, organizational context, and environmental context may differ according to the type of industry and organization culture. This study investigated only the manufacturing industry in general. This should be kept in mind when considering or making use of the study's results.

4. This research had only a single respondent for each organization in the survey. Individual perceptions and opinions may not represent the perception of the collective organization. The survey might have been more accurate if more than one person in the company had answered the survey.

5. Some of the organizations that answered the questionnaire had used ERP for less than five years. Therefore, it was not easy to accurately measure the impact of ERP on those organizations. It may have been more accurate for this study to have only involved organizations that had been using the ERP system for more than five years.

6. The sample group used in this research may have different supply chains since the respondents were from 20 manufacturing industries.

5.4.2 Future Research

For future studies, other scholars should focus their efforts on different industry sectors. Since this study clarified the relationship of technological context, organizational context, environmental context, ERP adoption, ERP implementation, and ERP assimilation to firm performance in the manufacturing industry, the application of ERP systems in other industry sectors needs to be explored. The difference in organizational structure, culture, and data needed for implementation in each industry may be different. Future studies might also add observable variables to the context of the three aspects of the TOE framework by adding variables such as internet skills, ease of use, and technical know-how in technological context, variables financial resources, human resources, and project management in organizational context, and adding variables networking intensity, industry environment, and overall environment in environmental context, future researchers can extend the knowledge base developed in this study.

In addition, another area that should be investigated is the measurement of firm performance, which may use other measurements, as follows:

1. Cash flow, which means the amount of cash received and paid out of a company over a period of time. When cash comes in, it is recorded as positive cash flow, and when cash is paid out, it is recorded as negative cash flow.

2. Customer loyalty and customer retention, which are important factors for business success. Customer loyalty is more valuable than an exquisite marketing strategy. Satisfied customers influence the decisions of other customers and can also help create a positive image for the business as well.

3. Customer Lifetime Value (CLV) and Customer Acquisition Cost (CAC) are measures of the cost of creating a new customer base. How these factors affect a growing

business needs to be thoroughly studied to be able to assess whether a business is moving in the right direction.

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Appendices

Appendix A

Questionnaire

Questionnaire survey on the opinion towards

ERP implementation cycle and firm performance.

Title: "The Influence of Technology-Organization-Environment (TOE) on Firm Performance by ERP Cycle Implementation"

Instruction: Please indicate your input ✓ in an appropriate box

Section 1: Technological Context

Please indicate your level of agreement with the below statements

Your company's technological context have the following attributes:

1 = Strongly Disagree, 2 = Quite Disagree, 3 = Slightly Disagree, 4 = Neither Agree nor Disagree, 5 = Slightly Agree, 6 = Quite Agree, and 7 = Strongly Agree

Statement	Level of agreement						
	1	2	3	4	5	6	7
Technology Readiness							
1. Your company gives important to the use of technology in production operations.							
2. Your company gives important to to technology infrastructure. (Such as equipment, software and ICT networks)							
IT Capability Level							
3. Your company gives important to use standard software in the organization.							
4. Your company gives important to IT capabilities.							
Compatibility							
5. Your company gives important to the implementation of the ERP system as a component of the original system.							
6. Your company gives important to the implementation of ERP systems combined with the overall operations of the organization.							
Complexity							
7. Your company realizes that learning to use ERP systems is difficult for employees.							

Statement	Level of agreement						
	1	2	3	4	5	6	7
8. Your company realizes that ERP systems are difficult to use compared to traditional systems.							

Section 2: Organizational Context

Please indicate your level of agreement with the below statements

Your company's technological context have the following attributes:

1 = Strongly Disagree, 2 = Quite Disagree, 3 = Slightly Disagree, 4 = Neither Agree nor Disagree, 5 = Slightly Agree, 6 = Quite Agree, and 7 = Strongly Agree

Statement	Level of agreement						
	1	2	3	4	5	6	7
Top Management Support							
9. Your company gives important to having a collective from top management in the ERP system.							
10. Your company gives important to targeting and monitoring ERP projects from senior management.							
Type of Production							
11. Your company gives important to producing a variety of products according to the needs of customers.							
12. Your company gives important to producing identical products in large quantities.							
Perceived Barriers							
13. Your company gives important to resistance to change among employees.							
14. Your company gives important to the complexity of ERP systems.							

Section 3: Environmental Context

Please indicate your level of agreement with the below statements

Your company's technological context have the following attributes:

1 = Strongly Disagree, 2 = Quite Disagree, 3 = Slightly Disagree, 4 = Neither Agree nor Disagree, 5 = Slightly Agree, 6 = Quite Agree, and 7 = Strongly Agree

Statement	Level of agreement						
	1	2	3	4	5	6	7
External Support							
15. Your company gives important to loan guarantees and product insurance.							
16. Your company gives important to providing technical assistance.							
Competitive Pressure							
17. Your company gives important to business competition in the same industry.							
18. Your company gives important to the pressure from the industry to use the ERP system as an industry standard.							
Trading Partners' Readiness							
19. Your company gives important to partners who believe in the value of ERP systems.							
20. Your company gives important to partners who have technical resources.							
Market Uncertainty							
21. Your company gives important to the ability to anticipate customer needs.							
22. Your company gives important to the uncertainty of market competition.							

Section 4: ERP Adoption

Please indicate your level of agreement with the below statements

Your company's technological context have the following attributes:

1 = Strongly Disagree, 2 = Quite Disagree, 3 = Slightly Disagree, 4 = Neither Agree nor Disagree, 5 = Slightly Agree, 6 = Quite Agree, and 7 = Strongly Agree

Statement	Level of agreement						
	1	2	3	4	5	6	7
Acceptance							
23. Our company gives important to the implementation of ERP systems.							
24. Your company gives important to the benefits that will be gained from the ERP system.							
Intention to Use							
25. Your company gives important to planning to use the ERP system.							
26. Your company gives important to preparing budgets for investing in ERP systems.							
Usage							
27. Your company gives important to the trends in the use of better ERP systems.							
28. Your company gives important to the availability of ERP systems.							

Section 5: ERP Implementation

Please indicate your level of agreement with the below statements

Your company's technological context have the following attributes:

1 = Strongly Disagree, 2 = Quite Disagree, 3 = Slightly Disagree, 4 = Neither Agree nor Disagree, 5 = Slightly Agree, 6 = Quite Agree, and 7 = Strongly Agree

Statement	Level of agreement						
	1	2	3	4	5	6	7
Integration							
29. Your company gives important to integrating ERP systems with other business software.							
30. Your company gives important to all transactions in the ERP system.							
Configuration							
31. Your company gives important to the ERP system in responding to all the needs of the organization's process.							
32. Your company gives important to the ERP system to support the changes required by the organization's processes.							
Adaptation							
33. Your company gives important to the ability of the ERP system to edit data items to meet the needs of the organization.							
34. Your company gives important to the ability of the ERP system to modify the process to meet the needs of the organization.							
User Training							
35. Your company gives important to training users of ERP systems.							
36. Your company gives important to evaluating users of ERP systems to ensure that users receive the proper training.							

Section 6: ERP Assimilation

Please indicate your level of agreement with the below statements

Your company's technological context have the following attributes:

1 = Strongly Disagree, 2 = Quite Disagree, 3 = Slightly Disagree, 4 = Neither Agree nor Disagree, 5 = Slightly Agree, 6 = Quite Agree, and 7 = Strongly Agree

Statement	Level of agreement						
	1	2	3	4	5	6	7
Volume							
37. Your company gives important to the use of ERP systems covering business processes.							
Diversity							
38. Your company gives important to using ERP system all department.							
Depth							
39. Your company gives important to using the ERP system as a daily routine.							

Section 7: Firm Performance

Please indicate your level of agreement with the below statements

Your company's technological context have the following attributes:

1 = Strongly Disagree, 2 = Quite Disagree, 3 = Slightly Disagree, 4 = Neither Agree nor Disagree, 5 = Slightly Agree, 6 = Quite Agree, and 7 = Strongly Agree

Statement	Level of agreement						
	1	2	3	4	5	6	7
Profitability							
40. Your company becomes more profitable after implementing ERP systems in major departments.							
41. Your company's financial results is better than those of your competitors in the same industry.							
Market Share							
42. Your company has a higher market share after implementing ERP systems in major departments.							
43. Your company has a better competitive position than those of your competitors in the same industry.							
Customer Satisfaction							
44. The level of customer satisfaction with a product or service from your business meet the goal.							
45. The retention rate of customers of your business is higher compared to the last 3 years.							
Employee Satisfaction							
46. Your company has employee relations activities.							
47. Your company has a lower turnover rate than those of your competitors in the same industry.							

Section 8: Demographic and background characteristics of the surveyed respondent

48. Number of employees in your organization……..people

49. Working experiences in the organization

□ 1 – 5 years old □ 6 – 10 years old

□ 11 – 15 years old □ More than 15 years old

50. Educational qualification

□ Below undergraduate degree □ Undergraduate degree

□ Postgraduate degree

52. Position / Responsibility

□ Executives □ Departmental manager

□ Divisional supervisor □ Other, please specify.....

53. Nature of investment

□ Local company □ Foreign Direct Investment

53. Age of establishment

□ 1 – 5 years old □ 6 – 10 years old

□ 11 – 15 years old □ More than 15 years old

--- Thank you for your kind participation ---

Appendix B

In-Depth Interview Questions

Research Interview

Title: "The Influence of Technology-Organization-Environment (TOE) on Firm Performance by ERP Cycle Implementation"

Instruction:

1. This interview form is used to interview executives of organizations in the manufacturing industry in Thailand.
2. Information obtained from the interview form It is used to study the influence of technology, organization, environment on organizational performance by deploying ERP cycle only. The information obtained will be confidential without revealing from any organization and will send the data analysis results to the organization that provides information for the benefit of the organization's operations in the future.
3. This series of in-depth interview questions is an interview format. There are 3 parts of the comment-based response form as follows:

   Part 1 General information of the interviewee.

   Part 2 Information about the organization and guidelines for using the organization's ERP system.

   Part 3 Other Suggestions.

Part 1 General information of the interviewee.

1. Name - Surname.....

2. Position.....

3. Experience working in the organization .....

Part 2 Information about the organization and guidelines for using the organization's ERP system.

1. Is your organization technologically ready and how, and how are the organization's executives and external organizations involved in the organization's technology?

2. Why does your organization choose to use ERP system?

3. What is your organization's guidelines for using the ERP system?

Part 3 Other Suggestions.

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Interviewer.....

Interview date.....

Interview time.....

Biography

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(Mrs. Janjira Deelert)