การศึกษาอิทธิพลของตัวแปรส่งผ่านของการยอมรับระบบอีอาร์พีต่อความสัมพันธ์ระหว่างบริบททางเทคโนโลยีและผลการดำเนินงานขององค์กร

A Study of Mediating Effects of ERP Adoption on the Relationship between Technological Context and the Organizational Performance

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Abstract

The purpose of this study was to observe the mediating role of ERP adoption on the relationship between two latent variables, technological context, and organizational performance. The study compared the models with and without the presence of the mediator, emphasizing on the empirical data collected from 285 manufacturing industries in Thailand. The results suggested that ERP adoption had mediated the relationship between technological context and organizational performance with a positive impact on organizational performance. The research implied that ERP adoption had a crucial role in organizational performance.

Keywords: *Technological Context, ERP Adoption, Organizational Performance*

บทคัดย่อ

การศึกษาครั้งนี้มีวัตถุประสงค์เพื่อศึกษาบทบาทของตัวแปรส่งผ่านของการยอมรับระบบ
อีอาร์พีระหว่างตัวแปรแฝงสองตัว ได้แก่ บริบททางเทคโนโลยีและผลการดำเนินงานขององค์กร
การศึกษามุ่งเน้นการวิเคราะห์อิทธิพลของตัวแปรส่งผ่านของการยอมรับระบบอีอาร์พีผ่านการ
เปรียบเทียบแบบจำลองที่มีและไม่มีตัวแปรส่งผ่าน โดยเน้นการศึกษาเชิงประจักษ์จากข้อมูลที่เก็บ
รวบรวมจากอุตสาหกรรมการผลิตในประเทศไทย จำนวนทั้งสิ้น 285 บริษัท ผลการศึกษาแสดงให้
เห็นว่าการยอมรับระบบอีอาร์พีเป็นตัวแปรส่งผ่านที่มีอิทธิพลต่อความสัมพันธ์ระหว่างบริบททาง
เทคโนโลยีกับผลการดำเนินงานขององค์กร โดยส่งผลกระทบในทางบวกต่อผลการดำเนินงานของ
องค์กร การวิจัยนี้แสดงให้เห็นว่าการยอมรับระบบอีอาร์พีมีบทบาทสำคัญต่อผลการดำเนินงานของ
บริษัท

คำสำคัญ: *บริบททางเทคโนโลยี การยอมรับระบบอีอาร์พี ผลการดำเนินงานขององค์กร*

Introduction

The competition with the business world is always a match. When running a
business, it is essential to accept that the competition is increasing daily along with
fast moving changes. But if the organization has the tools to help smooth and exact
operations, it will give the organization a competitive advantage in the field. Helpful
tools to assist in this endeavor are inevitably information systems. They can help to
establish goals, strategize, and operationally plan as Melville, Kraemer, and Gurbaxani
(2004) stated that business conducting at recent shall rely on technology in order to
compete and stay survival. Since information systems are systematically gathered and
managed, this allows for continual history of information and can indicate operational
tendencies that decide whether things should head in a particular direction. In addition,
information systems help users analyze problems or obstacles to finding approaches
to control, improve and resolve problems. Information from the processing would
help management analyze how the implementation in each choice would help fix or
control the problem, and help make decisions regarding what businesses should do
to adjust or develop the operation according to the work plan or goals. Information
systems also help reduce costs for the organization. An efficient information system
can help reduce business time, labor and costs of operation. It could add more efficiency
and increase potential in business competition.

Enterprise Resource Planning (ERP) systems are accepted by large and medium-
sized organizations around the world (Liang, Saraf, Hu, & Xue, 2007). An ERP system is
the software kit mixed between any business processing activity such as production,
financial, sales, supply chain, customer service, budget arrangement, and human

resources (Amalnick, Ansarinejad, Nargesi, & Taheri, 2011). In the past few years, the ERP system has become the global tendency for organizations that are making huge investments (Nandi & Kumar, 2016). However, if there is no efficient system used, the expected benefits for better production and competitive advantage will not happen (Addo-Tenkorang & Helo, 2011). The ERP system is the integrative software with high flexibility and efficiency and is accepted globally. Although the ERP system has received widespread attention but there are still failures from the investment in ERP systems that occur in many organizations such as 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), 90% failed to deliver measurable ROI, this measure is essentially a direct failure of effective expectations management, and 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 (Carlton, 2017). From the failure of ERP, it is found that the organization had to plan and prepare carefully before implementing the ERP system within the organization. The organization must have careful planning and preparation before implementing an ERP system, with consideration of technology factors which must be studied in terms of what technologies are currently relevant and can be used to help increase the efficiency of the organization's operations. This must be based on technological readiness of the organization as well. Due to the failure of investment in the ERP system the researcher has conducted the research to 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. The motivation in this study is to test the impacts from a technological context via mediation of ERP adoption and the impact on the organizational performance.

Research Objectives

To evaluate the mediating effect of ERP adoption on the relationship between technological context and organizational performance.

Theory

A. Technological Context

Technological context is one component of the TOE framework. 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 (Tornatzky, Fleischer, & Chakrabarti, 1990). Technological context refers to all the information

technology related to the company, either those existing in the company or technologies in the market that have not been adopted for current use. Innovation dominated industries lead to increases though with changes but they would help measure acceptance. On the contrary, an innovation dominated industry that leads toward non-continual changes requires a company to quickly process and makes quick decisions on acceptance and add competitive potential. When evaluating technologies that create non-continual changes, the company will consider whether they increase or disrupt competence (Tushman & Anderson, 1986). The technology contained in the company is important in the acceptance process because they set a wide scope and pace of technological change that the company can make (Collins, Hage, & Hull, 1988). Innovation promotes the potential to help the company change toward expertise; however, destroying innovation can outdate existing technologies. Determining which technologies are available (Pan & Jang, 2008), IT capability levels (Schniederjans & Yadav, 2013), and compatibility (Xu, Ou, & Fan, 2017) were important indicators of the technological context leading to the ERP adoption in the study on technological context with an influence on the use of ERP consisting of technology readiness, IT capability level, and compatibility.

B. ERP Adoption

ERP adoption refers to the company deciding to implement the ERP system. The economic reason for the decision to use ERP is up to the perspective of resource use (Barney, 1991). A company that can develop and keep a competitive advantage by taking the benefits and developing the resources such as capacity, assets, knowledge, and ability are valuable and hard to copy (Mata, Fuerst, & Barney, 1995). ERP has the new ability that any organization can take the benefits and keep a competitive advantage (Parker & Castleman, 2009). The study on ERP acceptance is important to help alleviate the problem that a company has not selected the right choice for the acceptance process (Markus & Tanis, 2000). Furthermore, it is the accepting process required by the company to ensure that ERP system is suited to the business and needs of information. The implementation of the ERP system affects the organization's ability and competitive advantage (Le & Han, 2016). The ERP system has a positive relationship with the competitive advantage and has a positive impact on the firm's performance (Handoko, Aryanto, & So, 2015). In addition, the Kharuddin, Foong, and Senik (2015), found that ERP adoption extensiveness is highly correlated with organizational efficiency and supports the mediation role of system implementation and user satisfaction. The organization must understand how to use the system by considering from the user's perspective in order to prepare employees to face new challenges and learn how to leverage technology for tangible benefits. Therefore, the organization gives importance

to the following issues: the importance of implementing the ERP system and the benefits it receives from the ERP system, planning to use the ERP system and preparing budgets for investments in the ERP system, and trends and readiness in using ERP systems of employees.

C. Organizational Performance

Performance is a matter of using factors and processes in the operation with the output received as the indicator. The performance of any operation may be shown as a comparison between investment costs and profits received. If the profits are higher than the cost, it is indicative of efficient operations. Efficiency may not be expressed in numerical values but is recorded by saving money, materials, people, and working time in a cost-effective, economical way, including the use of strategies or techniques and appropriate practices that can lead to quality results. Gavrea, Ilies, and Stegerean (2011), gave the concept and definition for the company performance at that time, the efficiency assessment during the 1950s emphasized work, personnel, and organizational structure; thus, efficiency was seen as the social system to achieve the organizational objectives in the 1960s and 1970s, and efficiency was set to be the ability to take benefits from the environment from scarce resources. Efficiency during the 1980s and 1990s had a more complicated method with efficiency and effectiveness as the organization's success in achieving the goal (effectiveness) by using fewer resources (efficiency). Lin and Huang (2011) pointed out that performance is not only related to past successes but also expands to the ability to achieve future goals. Kitrangsikul and Kuntonbutr, (2017) defined the idea related to the efficiency of the company which was the effectiveness assessment in various business organization variables and divided into financial and non-financial index measurements. Financial efficiency is according to the following criteria: return of the investment, growth of sale rate, and income.

Clearly, ERP adoption was an important part in the competitive advantage and has a positive impact on the efficiency of the organization. The technological context was an important factor in accepting the ERP system for this study, identifying the importance of the ERP adoption and the role of mediation. The research question for this study was "does ERP adoption mediate the relationship between technological context and organizational performance?" Therefore, the following research hypotheses are used to model relationships.
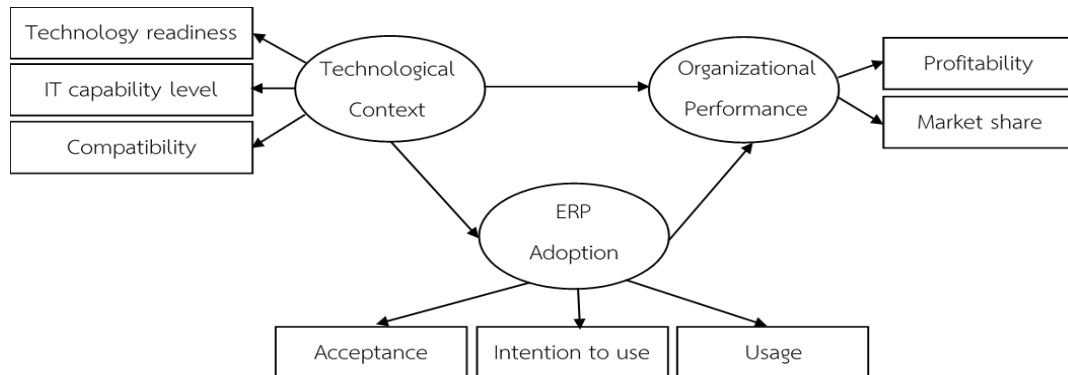
D. RESEARCH FRAMEWORK AND HYPOTHESIS

Fig. 1 Research Framework

H1: There is direct relationship between technological context and organizational performance.

H2: There is indirect relationship between technological context and organizational performance through ERP adoption.

H3: ERP adoption mediates relationship between technological context and organizational performance.

Research Methodology

A. Population and Sampling

CEOs and top managers were the respondents for this study. The study focused on the manufacturing industry, divided into 20 groups, and the data of the manufacturing organizations totaling 6,056 registered as the target population. The sample size calculated for this study included 285 subjects from the manufacturing industry in Thailand. The sample size was calculated according to the rule of structural equation model (Bentler & Chou, 1987) which considers the number of free parameters as a rule of thumb used to the determine the sample size for research studies that use SEM, the ratio of the sample size to number of free parameters of 10:1. Distribution of sampling from each manufacturing industry is on weighted proportional basis.

B. Data Collection

The data of the industrial companies were obtained from the database from of Department of Business Development. The CEO or top managers were the target informants. The mail survey methodology was implemented and compiled using a combination method that respondents had the option of returning questionnaires through prepaid mail, fax, or online. The final respondents included 285 (246 companies through prepaid mail, 1 company by fax, and 38 companies through the web) from

1,800 companies mailed, thus the response rate is 15.83 percent. The principal informant was required to have knowledge of the issues being studied and was willing and able to communicate this information. The data collection period was August 1, 2019 to August 31, 2019.

C. Latent Variables and Observed Variables

This study used a Likert scale ranging from 1 to 7, with 1 being "strongly disagree" and 7 as "strongly agree". The technological context latent variable comprised technology readiness, IT capability level, and compatibility as to measure the technological context of the company. The ERP adoption latent variable comprised acceptance, intention to use, and usage as to measure the acceptance of the ERP system for use in the company. The organizational performance latent variable comprised profitability and market share as to measure firm's efficiency and effectiveness on achieving the predetermined objectives. The sources of variables in this study are shown in table I.

Table I. The sources of variable

Latent Variables	Observed Variables	References	Measurement
Technological context	Technology readiness	Pan and Jang, 2008	Likert scale
	IT capability level	Schniederjans and Yadav, 2013	Likert scale
	Compatibility	Xu, Ou, and Fan, 2017	Likert scale
ERP adoption	Acceptance	Kharuddin et al., 2015	Likert scale
	Intention to use	Kharuddin et al., 2015	Likert scale
	Usage	Kharuddin et al., 2015	Likert scale
Organizational performance	Profitability	Kitrangsikul and Kuntonbutr, 2017	Likert scale
	Market share	Kitrangsikul and Kuntonbutr, 2017	Likert scale

D. Reliability and Validity

The questionnaires were reviewed and evaluated by 6 experts in the field for accuracy of the measurement content and used the Index of Item-Objective Congruence (IOC) method. The test of reliability used Cronbach's alpha. The scores were higher or equal to 0.7, which means the answer has conformity (George & Mallery, 2003). Multi-collinearity testing for unrelated relationships between variables via the Variance Instruction Factor (VIF) with values between 1.360 - 2.066 indicated that there was no multicollinearity between variables.

E. Convergent Validity and Discriminant Validity

Verification of convergence validity with Confirm Factor Analysis (CFA) was tested prior to the evaluation with SEM. Vanichbuncha (2000) proposed that the model can be considered if the factor loading values are greater than 0.6 and the AVE is greater than 0.5. For this study, the factor loading values ranged from 0.624 to 0.973 while the squared correlation values ranged from 0.389 to 0.947

The evaluation of discriminate validity was done by Average Variance Extracted (AVE) value and squared correlation between variables (Hair, Anderson, Babin, & Black 2010). The value of the square root AVE should be greater than squared correlation value as to be valid (Fornell & Larcker, 1981). The results shown in Table II indicate that the all values were supported. The correct classification of AVE values from each latent variable is greater than the relevant correlations.

Table II. Reliability, convergent validity and discriminate validity

Constructs	Items	Factor Loadings	Cronbach's Alpha	CR	AVE
Technological Context	Technology readiness	0.809	0.801	0.804	0.581
	IT capability level	0.836			
	Compatibility	0.624			
ERP Adoption	Acceptance	0.811	0.953	0.912	0.777
	Intention to use	0.932			
	Usage	0.897			
Organizational Performance	Profitability	0.973	0.921	0.860	0.757
	Market share	0.753			

F. Measurement of Model Fit

The model used in the study is a good model. The results from the measurement model show the Chi-Squared fit index obtained from the Chi-Square/degrees of freedom is 1.374, the Goodness of Fit (GFI) value is .985, the adjusted Goodness of Fit (AGFI) value is .957, the Value of Root Means Square Error of Approximation (RMSEA) is .036, the Normed Fit Index (NFI) value is .987 and the Comparative Fit Index (CFI) value is .996. All of the above information illustrates an acceptable model for this study (Byrne, 1994). The results from the measurement model show in table III.

Table III. Assessing the model fit indicators

Chi-square/Degree of freedom (CMIN/df)	1.374
Goodness of Fit Index (GFI)	.985
Adjusted Goodness of Fit Index (AGFI)	.957
The Root Mean Square Error of Approximation (RMSEA)	.036
Normed Fit Index (NFI)	.987
Comparative Fit Index (CFI)	.996

The Analysis of Structural Equation Model

The hypothesis of this study was tested by Structural Equation Models (SEM) (Moohebat, Jazi, & Asemi, 2011). To determine the presence of mediating the effect, the path coefficient was compared between the model with and without the mediating variable, which was ERP adoption in this study. The hypotheses set forth that H1 did not support that there was no direct relationship between technological context and organizational performance at .159 ($p>0.001$); H2 supported that there was an indirect relationship between technological context and organizational performance through ERP adoption at .536 ($p\leq0.001$); and H3 supported that ERP adoption mediated the relationship between technological context and organizational performance as the path coefficient between technological context and organizational performance at .437 ($p\leq0.001$).
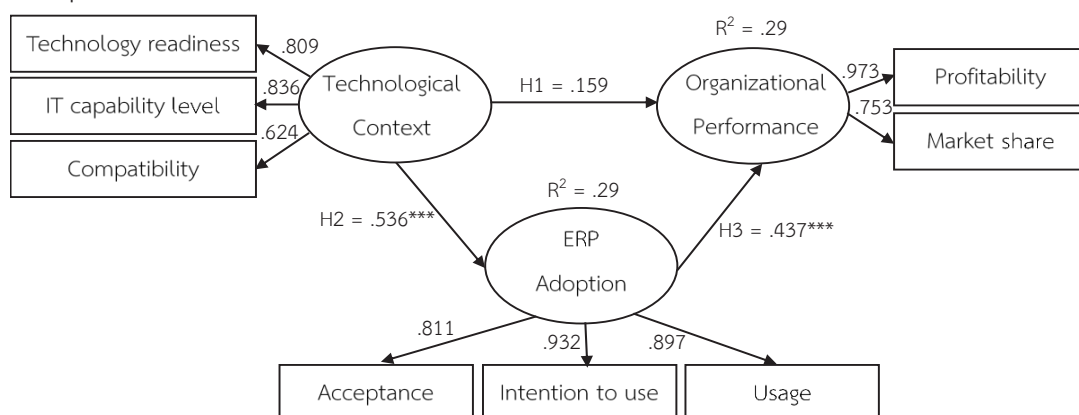

Fig. 2 Research Model Results

The model has reasonable predictive capability as 29 percent of ERP adoption variance and 29 percent of organizational performance variance.

The result standardized direct effect, indirect effect, and total effect show in table IV.

Table IV. Standardized direct effect, indirect effect, and total effect

	Direct Effect			Indirect Effect			Total Effect		
	TECC	ERPA	ORGP	TECC	ERPA	ORGP	TECC	ERPA	ORGP
ERPA	.536						.536		
ORGP	.159	.437		.234			.393	.437	

Discussion and Conclusions

This article provides information about the technological context factors that are one of the three factors in the TOE framework. An important finding is that technological context factors that include technology readiness, IT capability level, and compatibility affect the ERP adoption of the organization that will be a channel to the results of the organizational performance. The results supported that ERP adoption exhibited an important role in enhancing technological context to achieve superior performance of the organization. The result of the research shows that the ERP adoption is the mediator between technological context and organizational performance; this supports previous studies that ERP adoption is highly correlated with organizational performance (Kharuddin et al., 2015). The results also confirm the work of Handoko et al. (2015) that the ERP system has a positive impact on the firm performance, and Gupta, Qian, Bhushan, and Luo (2018) indicated that ERP which is positively related to firm performance. As for the text of the mediating effect, the path coefficient should ideally get smaller with the mediator being added into the model (Preacher & Hayes, 2008). The comparison of the path coefficients with and without the presence of ERP adoption showed that technological context direct effect to organizational performance at .159, indirect effect at .234 and total effect at .393. This shows that although the organization is strong in the technology context, a lack of ERP adoption cannot result in organizational performance. Finally found that the implementation of the ERP system within the organization, which the organization must pay attention to the benefits of the ERP system, planning and preparing budgets for investment in the ERP system. As well as giving importance to trends and readiness in using ERP systems of employees resulting in the operation of the organization to be more efficient. The organization must also be based on technology readiness, IT capability level, and compatibility of ERP systems and legacy systems.

The results of this study would be useful to a CEO or manager of an organization in order to plan and understand how to adoption in the organization to strengthen business operations and help to create a competitive advantage. In future studies, the researcher should study other factors that affect the acceptance of the ERP system such as organizational factors and environmental factors.

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