The Mediating Role of Innovation Capabilities between IT Investment and Organizational Performance of the Electronic Industry in Thailand

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บทคัดย่อ --- อุตสาหกรรมอิเล็กทรอนิกส์ของไทยกำลังได้รับผลกระทบจากสภาพแวดล้อมการแข่งขันทางการแข่งขันธุรกิจ วิจัยครั้งนี้มีวัตถุประสงค์เพื่อศึกษาถึงผลกระทบของการลงทุนด้านเทคโนโลยีสารสนเทศ(ITI) ต่อประสิทธิภาพการดำเนินงานขององค์กร(ORP) ผ่านความสามารถด้านนวัตกรรม (INC) ในอุตสาหกรรมอิเล็กทรอนิกส์ของประเทศไทย งานวิจัยนี้เป็นการศึกษาในระดับองค์กร ผู้ตอบแบบสอบถามเป็นผู้บริหารหรือผู้จัดการฝ่ายไอทีจาก 255 บริษัท ในอุตสาหกรรมอิเล็กทรอนิกส์ของประเทศไทย ผู้ตอบแบบสำรวจคือผู้ที่เกี่ยวข้องโดยตรงกับการจัดการด้านไอทีของบริษัท ผู้วิจัยใช้ฐานข้อมูลกรมพัฒนาธุรกิจการค้ากระทรวงพาณิชย์ ผลการศึกษาพบว่าการลงทุนด้านไอที (ITI) มีความสัมพันธ์โดยตรงกับความสามารถด้านนวัตกรรม (INC), รวมทั้งการลงทุนด้านไอที (ITI) มีความสัมพันธ์โดยตรงกับผลการดำเนินงานขององค์กร(ORP) และการลงทุนด้านไอที (ITI) มีความสัมพันธ์ทางอ้อมกับองค์กรประสิทธิภาพ(ORP) ผ่านความสามารถด้านนวัตกรรม (INC) ซึ่งผลการวิจัยชี้ให้เห็นว่าการบริหารจัดการองค์กรของอุตสาหกรรมอิเล็กทรอนิกส์ ควรให้ความสำคัญกับการลงทุนด้านเทคโนโลยีสารสนเทศ เพื่อสนับสนุนนวัตกรรมและเทคโนโลยีที่มีประสิทธิภาพต่อการผลิตภัณฑ์และบริการ

คำสำคัญ--- การลงทุนเทคโนโลยีสารสนเทศ, ประสิทธิภาพขององค์กรและความสามารถของนวัตกรรม

Abstract --- The purpose of this paper is to study the effect of IT investment (ITI) on organizational performance (ORG) through innovation capabilities (INC) in the electronic industry of Thailand. This research is a study at the organizational level. The respondents were managers or IT executive managers from 255 firms in the electronics industry of Thailand. The questionnaire respondents were those directly engaged in their company's IT management. The researcher used the database of the Department of Business Development, Ministry of Commerce of Thailand. The results of this study revealed that IT investment (ITI) has positive direct relationship with innovation capabilities (INC), IT investment (ITI) has positive direct relationship with organizational performance (ORP), and IT investment (ITI) has indirect relationship with organizational performance (ORP) through innovation capabilities (INC). The results suggest that the management of the electronics industry should pay attention to IT investment in order to support for technology innovation both the products and services.

Keyword--- IT investment, organizational performance and innovation capabilities.

I. INTRODUCTION

Changes in technology is so challenging for business competition in the 21st century. In which it has the violence and quick business competition in accordance with the information technology and communication revolution. Technology is then the final determinant of organizational competitive ability. Technology has increased its main role until it can form innovation which is to create new things and it is a concept that could lead to the competitive advantage of the organization. Innovation is the concept that being accepted as part of strategic management [1]. Organization with innovation or ability to innovate and create on new things is usually a successful business organization [2].

Electronics manufacturing industry in Thailand is going to be violently affected in business environment either in economic, politic or technology. Especially, the impact of modern technological changes in the age of the internet of things and digital economy. According to the group of electric and electronics industry in Thailand, the

export value of the manufacturing industry among the groups of the electric and electronics industry in 2012-2016 in some groups had an ongoing reduction rate. For example, the group of housing electric appliances and the group of computer parts production industry. This was caused by the high cost of production and moving the production base into neighbor countries to form the opportunity to expand the future business toward AEC.

The main problems with current impact on the electric and electronic industry can be summarized as follows:

- Most of the productions are middle and end stream production.
- The Thai electronics export is still cratered computer accessories and parts.
- Changes in consumption behavior in the Internet of Things era.
- Lack of highly skill labor in the development.

Looking at the problems of the electronics industry in Thailand as the industry need to adjust into the business competitive situation. This also includes business competitive environment that has influence on business either directly and indirectly. To become a leader in business competition, the organization shall learn to adjust to changes in environment and develop the organization to have a sustainable ability to compete[3].

Thus, the organizational management shall pay attention to IT investment to support innovative ability for efficient and effective organization of performance.

II. BACKGROUND THEORIES AND HYPOTHESES DEVELOPMENT

A. IT Investment (ITI)

IT investment is more than just running business because it has the ability to push the business toward changes in innovative forms of products and service[4]. IT investment requires capital to arrange the supporting resources for organizational processes[5]. IT investment aims to enhance organizational productivity and the ability to compete for good organizational performance [6]. IT investment as the information technology investment related to physical assets [7]. While IT investment can be divided into four types, which are innovation, management support, process automation and infrastructure [8].

B. Innovation Capabilities (INC)

Innovation is the concept, process, and work approach as accepted as new thing for an organization [9]. It brings significant benefit for the organization and being it's concept that rises from new creation and influences organizational performance[10]. Technology and innovation is the main elements that leads to discovery and new presentation into the market [11]. The ability of innovation can reflect ability of business to form and use new way of thinking to form and use new idea for product and service development and the work procedure that can affect organizational performance [12].

C. Organizational Performance (ORP)

Organizational performance is the level of operation expected or planned by the organization for goal achievement [13]. Organizational performance is the ability to achieve goals set by the organization from resources use. This is to increase business competitive potential and form customer satisfaction [14] . Thus, IT investment is crucial for innovative potential development; the tool for product and procedural innovation development. The acquisition and use of IT makes firm competitive and stay ahead of competitors [15]. This is to form business competitive advantage in the dynamic changing environment.

The importance of innovation capabilities and its potential mediating role on organizational performance have been emphasized per the aforementioned. Therefore, the following hypotheses are put forth to establish the model relationship.

H1: IT investment has positive effect on innovation capabilities.

H2: Innovation capabilities has positive on organizational performance.

H3: IT investment has positive effect on organization performance.

III. RESEARCH METHODOLOGY

A. Population and Sampling

The study examined the effect of innovation capabilities (INC) on organizational performance (ORP) in the Thai electronic industry; the target respondents were IT managers. These respondents were considered as having adequate knowledge about their company's IT investment and innovation capabilities. The sample size was calculated according to Bentler and Chou [16] who offered a simplified guideline for the trustworthiness of parameter estimates. The ratio of sample size to number of free parameters was 5:1 ratio, the calculated sample size for this study was 204 samples from electronic industry in Thailand.

B. Data Collection

This study adopted the key informant survey research methodology for data collection, the key informant survey research strategy suggested that the key informants

must be knowledgeable on issues being studied and willing and able to communicate this information [17]. The data was collected through a combination of approaches. The respondents was provided with options to complete and return the questionnaires: through a postage-paid, addressed return envelope, by fax or through web-based questionnaire. A total of 1,250 companies are selected and mailed, the final respondents was 255 companies.

C. Measurement

The latent variables for this study are based on literature review of the relevant research works which comprises of: IT Investment (ITI) measured by innovation, management support, process automation and infrastructure; innovation capabilities (INC) measured by product capabilities and process capabilities and organizational performance (ORP) measured by organizational productivity, organizational effectiveness, market share and customer satisfaction as observed variables.

D. Reliability and Validity

The questionnaire was reviewed and assessed using Index of Item - Objective Congruence (IOC) method by six subject-matter experts. The test of reliability of the variables was by using Cronbach's alpha measure internal consistency. The alpha value was not less than .8. Data within normal distribution with the Kurtosis value was between -2 to +2. The testing of Multi-collinearity by Variance Instruction Factor (VIF) were lower than 10 which reflects no multi-collinearity among all variables.

Table 1. Variables Dimensions

Variable Label	Descriptions	Mean	Std. Deviation	Cronbach's Alpha
INSAv	Innovation Support	4.98	1.23	0.913
INFAv	Infrastructure	4.48	1.26	0.917
MASAv	Management	4.48	1.23	0.915
AUSAv	Process Automation	4.40	1.10	0.912
PDCAv	Product Capabilities	4.84	1.17	0.903
PCCAv	Process Capabilities	4.99	1.14	0.905
ORPAv	Productivity	5.20	1.09	0.905
OREAv	Effectiveness	5.17	1.06	0.905
MKSAv	Market Share	4.59	1.03	0.908
CUSAv	Cus. Satisfaction	5.05	1.05	0.908

E. Convergent validity and discriminant validity

The convergent validity was tested prior to the evaluation with SEM, [18]. If the factor loading values was greater than .6 and the AVE were higher than .5, the model was considered converged. The loading factors ranged from .66 to .90 while the squared correlation values from the study ranged from .66 to .79.

The assessment of discriminant validity was evaluated by comparing the Average Variance Extracted (AVE) value with the squared correlation between variables. Fornell [19] suggested that the values of the squared root AVE should be higher than the squared correlation values as to be valid. The result, as shown on table 3 indicates that all the values mentioned supported the discriminant validity. The AVE values from each latent variable were greater than the level of correlation involved.

Table 2. Factor loading of the latent variables

Latent Variables	Observed Variables	Factor Loading	Composite Reliability	AVE
ITI			0.894	0.678
	INSAv	0.76		
	INFAv	0.88		
	MASAv	0.83		
	AUSAv	0.82		
INC			0.884	0.792
	PDCAv	0.90		
	PCCAv	0.88		
ORP			0.883	0.657
	ORPAv	0.89		
	OREAv	0.88		
	MKSAv	0.66		
	CUSAv	0.79		

Table 3. The squared correlation between variables

	ITI	INC	ORP
ITI	**0.823**		
INC	0.74	**0.889**	
OPR	0.62	0.77	**0.810**

The Squared root AVE in diagonal

F. Measurement of Model Fit

The results of the measurement model indicated the Normed Chi-Squared fit index derived from Chi-Square/degrees of freedom (χ^2/df) as 1.987, indicating a good model fit between the data and the hypothetical model. The Goodness of Fit (GFI) value is .950 and the Adjusted Goodness of Fit (AGFI) value was .920. The Value of Root Means Square Error of Approximation was .062. The Normed Fit Index (NFI) and Comparative Fit Index (CFI) value were .969, and .984 respectively. All of the data mentioned above demonstrate an acceptable model for this study.

Table 4.1 Standardized Direct Effect

Standardized Direct Effect			
	ITI	INC	ORP
ITI	-	-	-
INC	.746	-	-
ORP	.042	.770	-

Table 4.2 Standardized Indirect Effect

Standardized Indirect Effect			
	ITI	INC	ORP
ITI	-	-	-
INC	-	-	-
ORP	.575	-	-

Table 4.3 Standardized Total Effect

Standardized Total Effect			
	ITI	INC	ORP
ITI	-	-	-
INC	.746	-	-
ORP	.617	.770	-

Table 5. Assessment of the model fit indicators

Chi-square / Degree of freedom (CMIN/df)	1.987
Goodness of Fit Index (GFI)	0.959
Adjusted Goodness of Fit Index (AGFI)	0.920
The Root Means Square Error of Approximation (RMSEA)	0.062
Normed Fit Index (NFI)	0.969
Comparative Fit Index (CFI)	0.984

IV. THE ANALYSIS OF STRUCTURAL EQUATION MODEL

Structural Equation Model (SEM) was constructed for the test of the proposed hypotheses. To determine the relationship between latent variables, the hypotheses was developed that the ITI affects INC (H1), INC affects ORP (H2) and ITI affects ORP (H3).

The standardized direct effect coefficients associated with the SEM is shown below.

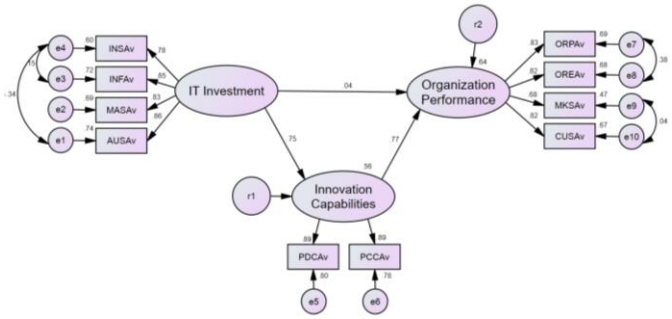

Figure 1. Measurement Model

In considering the presence of the standardized indirect effect of IT investment on organizational performance through innovation capabilities, the result indicated that there is an indirect effect at .575.

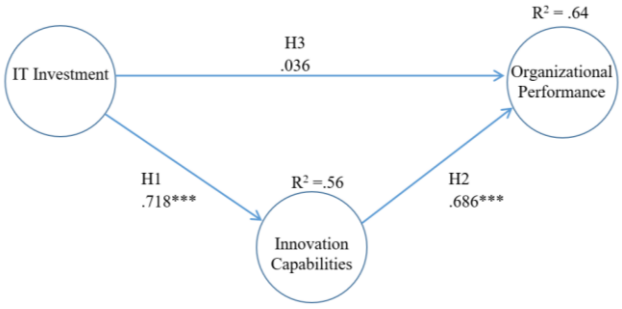

Figure 2. Research Model Results

The result indicates that ITI affects INC at .718 ($p<0.001$), INC affects ORP at .686 ($p<0.001$) and ITI no effect ORP at .036 but ITI has indirect on ORP through INC. The relationships hypothesized for between latent variables in this empirical study were found to be supported. The regression weights between latent variables in the model are shown in table 6.

Table 6. Regression weights between latent variables in the model

Latent Variables	Regression Weights
ITI ---> INC	.718***
INC ---> ORP	.686***
ITI ---> ORP	.036

V. DISCUSSION AND CONCLUSION

This research was conducted by collecting data through questionnaire from 255 companies in the electronics manufacturing industry in Thailand. The conclusion from this study was that firms should pay attention to IT investment. It comprises innovation support, infrastructure, management and process automation support and the most important factor which firms focused on was

process automation support while innovation investment was the least important. This conclusion was in line with the statistical data from the office of the National Research Council of Thailand (NRCT). From the data, the Thai Electronics industry should prioritize research and development on innovation for products and services so as to support the changing to Internet of thing (IOT). The hypotheses set forth for this study showed that H1: IT investment (ITI) has a positive effect on innovation capabilities (INC) consisting of product capabilities and process innovation (β=.718, $p<0.001$), H2: IT investment has a positive effect on organizational performance (ORP) (β=.686, $p<0.001$). This indicates that IT investment (ITI) has positive relationship on innovation capabilities (INC) and innovation capabilities (INC) has positive relationship on organizational performance (ORP). Moreover, H3: IT investment (ITI) has no positive direct effect on organizational performance (ORP) but rather has indirect effect on organizational performance (ORP) thought innovation capabilities (INC); this was supported by the study of [20] who studied the direct and indirect relationships between IT investment and firm performance though innovation. It can by concluded that IT investment has indirect relationship with firm performance through innovation. Porter supported asserted that IT investment has an aim to increase organizational productivities, competitiveness, and profitability for the organization which is the most important factor for innovation [6].

VI. MANAGERIAL IMPLICATIONS

Understanding of the industry context will enhance the organization to have organizational management advantage and enable for a greater performance than others. Therefore, the leader of the organization must analyze the industry in order to understand the infrastructure, competitive landscape and the nature of the electronics industry. IT investment plays a crucial part in the organizational performance, as an important tool for innovation capabilities development. Creating business competitive advantage as well as marketing opportunity, preventing risk and consequently brings to a business success.

As for the electronics manufacturing industry, it is necessarily to expedite and develop their potential so as to cope with the fast-growing information technology advancement with the changing era of technology. This research implies the lack of attention on innovation investment such as investment in product research and development, but rather, focus on the investment and IT infrastructure so as to support the operation procedure of the electronics manufacturing industry. Therefore, management at all levels should understand and pay attention to innovation development as well as the analysis of the competitive environment impact. Innovation will definitely help to facilitate competitiveness, provide better products and service and lead to better performance than the competitors the industry.

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