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Conference Paper

Empirical Analysis on Human Resource Management and ICT Use for Product Innovation among Firms in ASEAN Economies

27th European Regional Conference of the International Telecommunications Society (ITS): "The Evolution of the North-South Telecommunications Divide: The Role for Europe", Cambridge, United Kingdom, 7th-9th September, 2016

Provided in Cooperation with:

International Telecommunications Society (ITS)

Suggested Citation: Idota, Hiroki; Ueki, Yasushi; Shigeno, Hidenori; Bunno, Teruyuki; Tsuji, Masatsugu (2016) : Empirical Analysis on Human Resource Management and ICT Use for Product Innovation among Firms in ASEAN Economies, 27th European Regional Conference of the International Telecommunications Society (ITS): "The Evolution of the North-South Telecommunications Divide: The Role for Europe", Cambridge, United Kingdom, 7th-9th September, 2016, International Telecommunications Society (ITS), Calgary

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Empirical Analysis on Human Resource Management and ICT Use for Product Innovation among Firms in ASEAN Economies

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Abstract

To achieve successful innovation, firms in ASEAN countries have to elevate their innovation capability including human resources, business structure of firms, technologies including ICT use by collaborating with outside organizations such as MNCs (Multi-national companies) and university/public research institutes. These outside organizations are termed as external linkages. Based on authors' survey data of five ASEAN economies such as Vietnam, Indonesia, the Philippines, Thailand, and Laos from 2014 to 2015, this paper examines how internal innovation capability such as human resource management (HRM), organizational learning and ICT use enhance product innovation. These factors are used as latent variables in analysis and consist of the following variables: (i) HRM such as recruitment, job training and rewards and 5S; (ii) organizational learning including QC and cross-functional teams; (iii) ICT use such as B2B, B2C, EDI, SCM, ERP, CAD/CAM, groupware, SNS; and (iv) external linkages. This study employs SEM (Structural equation modeling) to analyze the causal relationships not only among the above four latent variables but also between these and innovation. The six hypotheses were postulated. Estimation results demonstrate that organization learning and ICT use enhance product innovation, and particularly, human resource management enhances organization learning.

Key words: ICT use, human resource management, external linkages, cross-functional teams, QC, SEM

JEL classification: O32, O31, O19

1. Introduction

In recent years, East Asian economies have been rapidly developing. The reason is that East Asian firms have been successfully achieving product and process innovation by introducing advanced technologies and know-how from MNCs (Multi-national corporations). In order to achieve innovation, firms have to own technology, capability and ICT use. In particular, collaborations with outside organizations such as MNCs, universities/public research institutes and other local firms are indispensable for firms in developing economies (Cohen and Levinthal, 1990; Zahra and George, 2002). Authors' previous researches clarified external linkages enhance organizational learning and ICT use, and they promote product innovation (Idota et al., 2014; 2015). Traditionally innovation is thought to be a learning process which identifies the relevant new information on innovation, adopting and combining it with existing knowledge inside the firms, and transforming this knowledge into innovation or competitive advantage (Cohen and Levinthal, 1990; Zahra and George, 2002). For this purpose, the knowledge level of managers and employees must be improved by HRM (Human Resource Management). This study is focused on human resource management and ICTs. Based on survey data from five ASEAN economies such as Indonesia, the Philippines, Thailand, Vietnam and Laos from 2014 to 2015, this study clarifies how HRM such as recruitment new employees, job training, 5S, rewards for incentives, ICTs such as internal ICTs use and External ICTs use, and organizational learning such as QC and cross-functional team enhance product innovation.

2. Literature view

Firms in developing economies have their own problems; a weak basis for internal capability, particularly due to a lack of technology, human resources, and knowledge infrastructure. The strategy of firms or governments in developing economies is different from those in the developed economies. There is a body of literature concerning knowledge transfer from these external linkages to locals, such as Ernst (2002), Caloghirou, Kastelli, & Tsakanikas (2004), Liao, Fei, & Chen (2007), and Srholec (2011). Kesidoua and Szirmai (2008), on the other hand, specifies two types of knowledge spillover in the cluster taking the Uruguay software industry as an example; local and international. They came to the conclusion that the former is more important than the latter, that is, they identify knowledge transfer among locals in the cluster via labor mobility and informal flow of information not involving transactions as the sources of innovation. Local knowledge spillovers through transactions which traditionally emphasized by previous literature did not promote innovation.

Pietrobelli and Rabellotti (2011) shows international knowledge spillover via the global value chain, which enhances innovation in developing economies. Srholec (2011) takes social factors such as human capital or skill formation in the innovation process into consideration.

This paper attempts to identify the factors behind innovation in individual firms of ASEAN economies. The most important factor is referred to as the innovation capability, which is defined as the ability to continuously transform knowledge and ideas into new products, processes, and systems for the benefit of the firm and its stakeholders (Lawson and Samson, 2001). This paper focused on parts of internal capability such as HRM and ICT use. HRM is considered as key elements of successful innovation, since the human factor is involved in the whole innovation process (Galbraith, 1984; Vrakking, 1990; Jimenez-Jimenez & Sanz-Valle, 2005). HRM consists of the following factors; (i) recruitment (employee selection and placement);

(ii) job training (human development); (iii) appraisal (evaluation and promotion); (iv) rewards (pay and benefits); and (v) others (5S, career planning, job enrichment, etc.) (Devanna et al., 1981, Jimenez-Jimenez & Sanz-Valle, 2005). (i) Recruitment is related to labor mobility and includes recruiting a new production line manager or a new accounting manager from MNCs or other locals, which is useful for absorbing new information and resources. (ii) Job training such as OJT (On-the-Job Training) and Off JT (Off-the-Job Training) upgrade workers' skills for the production process and creation of new idea. (iii) Appraisal and (iv) rewards for suggestions related to QC activities of groups or individual employees provide incentives for them to participate in those activities. (v) 3S or 5S (*Seiri, Seiton, Seisou, Seiketsu, and Shitsuke*) are the basic work ethics for business activities and production, which have the similar effect. Thus HRM is considered as indispensable for innovation.

ICTs also are indispensable for Innovation. ICTs contribute to firms in the following processes: (i) improving the efficiency of management and communication inside the firm; (ii) enabling networking and collaboration with external linkages by reducing the time, effort and other costs required for communication and overcoming geographical constrains; and (iii) creating new markets for business such as e-commerce. Thus ICT supports for firms to absorb technology, know-how, and information from outside. This study refers these functions to as "ICT use inside the firm" and "ICT use outside the firm." Taking two ICT uses into consideration, ICT influences the promotion of innovation through the following two channels: (i) enhancing internal innovation capability; and (ii) supporting internal capabilities leading to innovation. In this study, examples of the former consist of ERP (Enterprise Resource Planning) packages, groupware, CAD/CAM and Intra-SNSs. The latter consist of B2B e-commerce, B2C e-commerce, EDI (Electronic Data Interchange), SCM (Supply Chain Management) and public SNSs.

Based on the above literature, this paper examines how internal capability such as HRM, organizational learning, and ICT use enhance product innovation.

3. Hypotheses and Methodology

3.1 Hypotheses

According to the above discussions, there are four latent variables which affect to innovation, namely external linkages, HRM, organizational learning, ICT use. Here their causality is examined. This paper places external linkages as an originating variable, since in developing economies, MNCs have superiority in technology, know-how, and management, and local firms are required to absorb those capabilities from them. In so doing, local firms must initiate connectivity with MNCs for locals to obtain the necessary information. There is a body of literature concerning knowledge transfer from these external linkages to locals, such as Caloghirou, Kastelli, & Tsakanikas (2004), Liao, Fei, & Chen (2007), and Srholec (2011), Tsuji et al, (2016). Among these previous studies, connectivity is the center of the issues, and personnel who fulfilled functions such as connecting with external linkages and introducing new information were termed “gatekeepers” (Allen & Cohen, 1969; Allen, 1977). Gatekeepers have sufficient professional skills and knowledge to avoid misunderstandings and can connect organizations by dissolving the barriers between them.

New information obtained from external linkages includes those related to technology and know-how, method of R&D, HRM, business management related to decision-making, QC and related practices, business ethics such as procurement. This paper focuses on information related to HRM which consists of five factors already explained. This discussion proposes the following first hypothesis:

H1: External linkages enhance HRM of locals.

The other important latent variables are organizational learning and ICT use. The role of the latter is to absorb new information obtained, assimilate it with their capability, and exploit to innovation. This process conducted by related sections or whole firms is termed by organizational learning which consists of cross-functional teams and QC. The former is team consists of different kinds of members or specialists, namely those who have come from the (a) manufacturing, (b) technology, and (c) marketing sections. The members from (a) are in charge of a particular section of the manufacturing process, those from (b) are specialists in wider or general production technology, and those from (c) are sales personnel who take responsibility for selling the particular materials or parts. This team works together to handle claims or proposals from customers. The latter is QC activities to improve the quality of product and to reduce the failure rate of defective products or shipment, etc. These cooperative works of different sections or team workers lead to idea of innovation as well as improvement or process innovation. This discussion proposes the second hypothesis implying that local firms learn these from external linkages:

H2: External linkages improve organizational learning

The same argument is applicable to ICT use. Since MNCs have advantage to utilize ICT and locals learn how to utilize ICT for business. This postulates the third hypothesis:

H3: External linkages improve ICT use

This paper particularly analyzes the role of the human factor in the innovation process, and thus assumes that elevated ability of employees due to HI promotes organizational learning and ICT use, and this leads to the following third and fourth hypotheses:

H4: HRM improves organizational learning

H5: HRM improves ICT use

To conclude the innovation process, the final hypothesis is postulated:

H6: Organizational learning and ICT use enhance product innovation

(H6) Organizational learning and ICT use enhance product innovation

The relationships among the above variables and hypotheses are summarized in Figure 1.

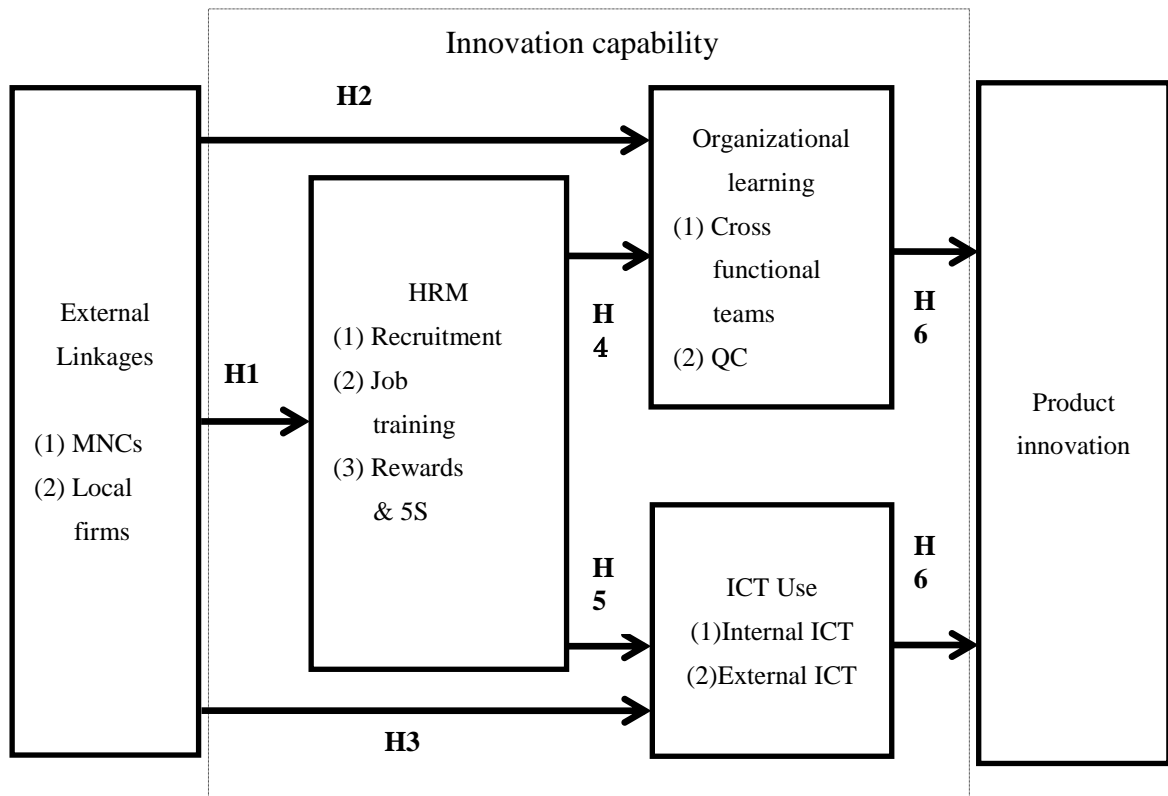


Figure 1: Causal relationships

3.2 Methodology

This study employs SEM (Structural Equation Modeling), which enables a study of the relationship among various variables that are related to each other. SEM is said to be a mixture of factor analysis and regression analysis; the former constructs latent variables

from observed variables by using factor analysis, while the latter examines the causal relationship between latent variables by regression analysis. Thus, SEM analysis can be used even for cases in which the variables are endogenous and the usual Least Squares cannot be applied. The idea of SEM was proposed as CSA by Bock (1960) initially and developed by Bock and Bargmann (1966) in order to solve issues related to multivariate analysis. Later Bagozzi (1980) and Bollenn (1989) termed this as SEM.

The merits of SEM are summarized as follows: regression analysis, which enables the causal relationship between variables, can handle only the observed variables, that is, endogenous variables, which are referred to as “latent variables” in SEM. Factor analysis can construct latent variables, which are common nature behind observed variables, but it cannot analyze their causal relationship. SEM can solve the issues related to factor and regression analysis and integrate these two methods. In other words, SEM introduces latent variables which are not observable, and by fixing the causal relationship between latent and observed variables, statistically examines the social as well as natural phenomena.

3.3 Surveys conducted

This study is based on mail surveys to firms in the Batangas areas in the Philippines, in the Jabodetbek area in Indonesia, in Greater Bangkok in Thailand, in Hanoi and Ho Chi Minh City in Vietnam and in Vientiane in Laos. The surveys were conducted from 2014 to 2015. The numbers of valid responses were 1,061, as 152 from the Hanoi area (14.3%), 161 from Ho Chi Minh City (15.2%), 181 from Indonesia (17.1%), 200 from the Philippines (18.9%), 160 from Thailand (15.1%) and 207 from Laos (19.5%).

4. Construction of latent variables

4.1 Product innovation

In this section, the situation of product innovation in each economy is presented and

used as the explained variables in the analysis in this study. Table 1 shows the number of trials conducted concerning product innovation over the last two years (2014-15).

(1) Innovation Type I: Redesigning packaging and appearance

This category of innovation contains the lowest novelty level such as changing packaging and appearance. Table 2 shows that 57.5% of firms achieved this type of innovation in all industries. Vietnam is ranked top (74.7%), followed by Indonesia (71.7%) , the Philippines (65.5%), and Thailand (41.1%) but Laos remains at 30.3%.

(2) Innovation Type II: Improvement type of innovation

This innovation is categorized for new products, or significantly improving existing products, and Table 2 shows that more than 80% of the firms in all industries attempted and 51.9% of them achieved innovation. Indonesia (72.8%), the Philippines (62.1%), Vietnam (56.8%), and Thailand (41.1%) show the best achievement performance, while Laos has the lowest level at 34.8%.

(3) Innovation Type III: New products based on existing technology

The development of new products based on the firms' existing technology has been attempted by slightly less than half the firms in all industries and in all these economies, and the average success rate is 39.6%. Among these economies, Indonesia achieved the best (65.2%), second is the Philippines (47.1%) and third is Thailand (41.1%). Vietnam (32.7%) and Laos (32.0%) follow.

(4) Innovation Type IV: New products based on new technology

This innovation has the highest category using new technology. Table 2 shows that in all industries and all economies, more than half of firms attempted this type of innovation but that only 25.4% of them achieved innovation. Indonesia is ranked best in the success rate (45.7%), followed by the Philippines (38.6%), Thailand (29.5%) and Laos (29.2). Vietnam is the lowest (9.3%).

For each category, the respondents were asked whether they had achieved, attempted, or not attempted the innovation. If respondents had achieved the innovation, two points are given; if they had attempted the innovation, one point is given; and those who had not yet attempted the innovation are indicated by zero. With respect to the above four questions, promax rotation by factor analysis is employed. Consequently, the variables converge to one factor, called “product innovation.” The innovation situation in each individual country is summarized in Figure 2, which shows that the quality of innovation increases from Type I to Type IV, The average of the four countries is indicated by “Total.” The distribution of the above four categories of product innovation is shown in Figure 2 for all industries. From this figure, the number of innovations is decreasing generally from Type I to Type IV.

Table 1. Product innovation

		Vietnam		Indonesia		Thailand		Philippines		Laos		Total	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Redesigning packaging or significantly changing appearance design	Achieved	192	74.7	66	71.7	39	41.1	57	65.5	54	30.3	408	57.5
	Tried	49	19.1	13	14.1	36	37.9	21	24.1	53	29.8	172	24.3
	Not tried yet	16	6.2	13	14.1	20	21.1	9	10.3	71	39.9	129	18.2
	Total	257	100	92	100	95	100	87	100	178	100	709	100
Introduced a new product, significantly improving existing products	Achieved	146	56.8	67	72.8	39	41.1	54	62.1	62	34.8	368	51.9
	Tried	76	29.6	18	19.6	41	43.2	26	29.9	51	28.7	212	29.9
	Not tried yet	35	13.6	7	7.6	15	15.8	7	8	65	36.5	129	18.2
	Total	257	100	92	100	95	100	87	100	178	100	709	100
Development of a totally new product based on the “existing” technologies	Achieved	84	32.7	60	65.2	39	41.1	41	47.1	57	32	281	39.6
	Tried	86	33.5	17	18.5	42	44.2	27	31	54	30.3	226	31.9
	Not tried yet	87	33.9	15	16.3	14	14.7	19	21.8	67	37.6	202	28.5
	Total	257	100	92	100	95	100	87	100	178	100	709	100
New product based on new technologies	Achieved	24	9.3	42	45.7	28	29.5	34	38.6	52	29.2	180	25.4
	Tried	73	28.4	20	21.7	46	48.4	26	29.5	43	24.2	208	29.3
	Not tried yet	160	62.3	30	32.6	21	22.1	28	31.8	83	46.6	322	45.4
	Total	257	100	92	100	95	100	88	100	178	100	710	100

Source: Authors.

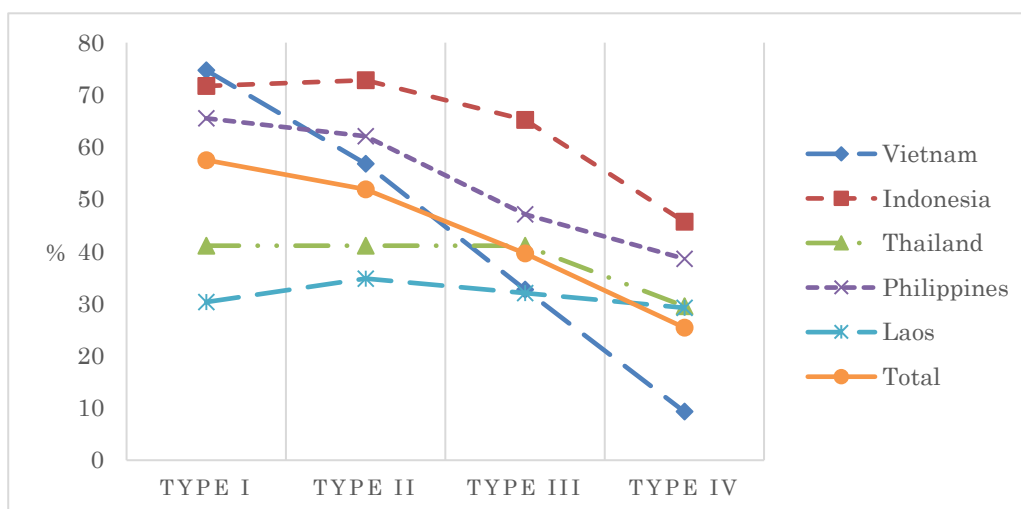


Figure 2: Product innovation

4.2 External linkages

The questions related to external linkages are shown in Q23 consisting of the following organizations (see Table 2 in detail). This paper does not include universities/public research institutions, since this variable does not yield a good result. :

D: External Sources of new technology and information for upgrading and innovation

Q23. Which external source is the most important for upgrading/innovation?

Q23.5. Local customer (100% local capital)

Q23.6. Local supplier

Q23.7. MNC (100% non-local capital)/Joint Venture (JV) customer located in your country

Q23.8. MNC/JV supplier located in your country

Q23.9. MNC/JV customer located in a foreign country

Q23.10. MNC/JV supplier located in a foreign country

Firms were asked to reply according to the Likert Four scale such as “0. Not practicing,” “1. Not important,” “2. Not very important,” “3. Somewhat important,” and “4. Very important.” The maximum likelihood and Promax rotation were employed to identify the factors. The result of the factor analysis is shown in Table 3. The following two factors were identified and they are called (1) MNCs; and (2) Local firms.

Table 3. Result of factor analysis

	Common Factors	
	MNCs	Local firms
Q23.5. Local customer (100% local capital)	-.071	.753
Q23.6. Local supplier	.013	.719
Q23.7. MNC (100% non-local capital)/Joint Venture (JV) customer located in your country	.678	.238
Q23.8. MNC/JV supplier located in your country	.701	.237
Q23.9. MNC/JV customer located in a foreign country	.978	-.166
Q23.10.MNC/JV supplier located in a foreign country	.926	-.123
Sums of squares of loadings	3.003	1.754
Factor Correlation Matrix		
	1	1.000
	2	.428
		1.000
Cronbach's α	.905	.732

Source: Authors

4.3 Internal capability

Internal capability, which plays an essential role for creating innovation, was assumed to consist of the following factors (see Table 2 in detail): (1) HRM, (2) Organization learning, and (3) ICT use. In what follows, let us explain how these are constructed one by one.

(1) HRM

This variable is based on the following questions, which aimed to ask about human factors:

Recruitment

Q34. Have you recruited a new production line manager from MNCs or JVs last three years?

Q35. Have you recruited a new accounting manager from MNCs or JVs last three years?

Job Training

Q32. Do you have a training program for workers to upgrade reading, writing, and calculating?

Q33. Do you have a HRD program for blue-collar workers to provide cross-training/job rotation?

Rewards & 5S

Q22.1. Has your establishment adopted so called 3S or 5S (*Seiri, Seiton, Seisou,*

Seiketsu, and Shitsuke)?

- Q22.6. Does your establishment have employee suggestion programs for improvements?
- Q22.7. Does your establishment provide groups of employees with rewards for suggestions/QC activities?
- Q22.8. Does your establishment provide individual employees with rewards for suggestions/QC activities?

HRM consists of three composite variables, such as recruitment, job training and Rewards and 5S. The first factor consists of questions Q34, and Q35, the second factor Q32, and Q33, while the third factor Q22.1, Q22.6, Q22.7 and Q22.8. The values of these three variables are determined by the number of Yes answers and thus the first and second factors have a value from 0 to 3, while the third factor from 0 to 4.

(2) Organization learning

This latent variable is constructed by questions related to QC and cross-functional teams. These two questions indicate whether and how much knowledge management or learning process has been established in the firm. The former is based on Q22 and the latter on Q21 (see Table 2 in detail). The score of the two variables is determined by the number of Yes answers to each question.

Q22. Quality Control (QC) and delivery management

- Q22.2. Does your establishment operate a QC circle?
- Q22.3. Does your establishment have a system/practice to disseminate successful experiences of a QC circle group across your establishment?
- Q22.4. Does your establishment have a system/practice to learn from successful experiences of a QC circle group of your customers/suppliers?
- Q22.5. Does your establishment have a system/practice to share successful experiences of a QC circle group of your establishment with your customers/suppliers?

Q21. Cross-functional teams for introduction of new products: Which departments / who are involved in the cross-functional teams that your establishment organizes to introduce a new product?

Engineering

Manufacturing
Sales & Marketing

Again QC has five points from 0 to 4 and Cross-functional teams have four points from 0 to 3. Organization learning thus consists of these two observed variables.

(3) ICT use

This latent variable consists of internal use of ICT and external use of ICT, and the former relates to ICT use inside the firm, while the latter relates to collaboration with agents outside the firm. The related questions are in Q28 as shown below (see Table 2 in detail).

Q28. Has your established introduced the following IT systems?

Internal ICT use

- Enterprise Resources Planning (ERP)
- Customer Relationship Management (CRM)
- Computer Aided Design (CAD)/ Computer Aided Manufacturing (CAM)
- Groupware
- Intra-Social Networking Services (SNS)

External ICT use

- Business-to-Business Electronic commerce (B2B E-commerce)
- Business to Consumer (B2C) E-commerce
- Electronic Data Interchange (EDI)
- Supply Chain Management (SCM)
- Public SNS

The variables of internal and external use of ICT have five points from 0 to 5. ICT use is thus based on these two variables. Table 2 shows basic statistics those variables.

Table 2. Basic Statistics

			N	Ave.	Std. Dev.	Min	Max	
Product innovation		Q13.1. Introduced a new product, redesigning packaging or significantly changing appearance design of your existing products	645	1.39	.784	0	2	
		Q13.2. Introduced a new product, significantly improving your existing products with respect to its capabilities, user friendliness, components, subsystems, etc.	645	1.33	.778	0	2	
		Q13.3. Development of a totally new product based on the “existing” technologies for your establishment	645	1.10	.823	0	2	
		Q13.4. Development of a totally new product based on “new” technologies for your establishment	645	.79	.818	0	2	
External linkages	Local firms	Q23.5. Local customer (100% local capital)	645	3.09	1.162	0	4	
		Q23.6. Local supplier	645	2.83	1.138	0	4	
	MNCs	Q23.7. MNC (100% non-local capital)/Joint Venture (JV) customer located in your country	645	2.60	1.440	0	4	
		Q23.8. MNC/JV supplier located in your country	645	2.44	1.368	0	4	
		Q23.9. MNC/JV customer located in a foreign country	645	2.46	1.420	0	4	
		Q23.10. MNC/JV supplier located in a foreign country	645	2.42	1.369	0	4	
HRM	Recruitment	Recruitment	645	.49	.765	0	2	
		Q34. Have you recruited a new production line manager from MNCs or JVs last three years?	645	.30	.458	0	1	
		Q35. Have you recruited a new accounting manager from MNCs or JVs last three years?	645	.20	.397	0	1	
	Job Training	Job training	645	1.09	.830	0	2	
		Q32. Do you have a training program for workers to upgrade reading, writing, and calculating?	645	.50	.500	0	1	
		Q33. Do you have a HRD program for blue-collar workers to provide cross-training/job rotation?	645	.60	.491	0	1	
	Rewards & 5S	Rewards & 5S		645	2.14	1.614	0	4
			Q22.1. Has your establishment adopted so called 3S or 5S (Seiri, Seiton, Seisou, Seiketsu, Shitsuke)?	645	.51	.500	0	1
			Q22.6. Does your establishment have employee suggestion programs for improvements?	645	.58	.493	0	1
			Q22.7. Does your establishment provide groups of employees with rewards for suggestions/QC activities?	645	.50	.500	0	1
		Q22.8. Does your establishment provide individual employees with rewards for suggestions/QC activities?	645	.54	.498	0	1	

		Cross functional team(Engineering Manufacturing Sale & Marketing)	645	.99	.967	0	3
	Cross functional team	Q21.5. Cross functional team(Engineering)	645	.28	.447	0	1
		Q21.6. Cross functional team(Manufacturing)	645	.35	.478	0	1
		Q21.11. Cross functional team(Sale & Marketing)	645	.36	.481	0	1
		QC	645	2.15	1.624	0	4
		Q22.2. Does your establishment operate a QC circle	645	.65	.478	0	1
Organizational learning		Q22.3. Does your establishment have a system/practice to disseminate successful experiences of a QC circle group across your establishment?	645	.51	.500	0	1
	QC	Q22.4. Does your establishment have a system/practice to learn from successful experiences of a QC circle group of your customer/supplier?	645	.55	.498	0	1
		Q22.5. Does your establishment have a system/practice to share successful experiences of a QC circle group of your establishment with your customer/supplier?	645	.44	.497	0	1
		Internal ICT use	645	.89	1.098	0	5
		Q28.2.5. Enterprise Resources Planning (ERP)	645	.18	.386	0	1
	Internal ICT use	Q28.2.6. Customer Relationship Management (CRM)	645	.22	.416	0	1
		Q28.2.7. Computer Aided Design (CAD)/ Computer Aided Manufacturing (CAM)	645	.29	.453	0	1
		Q28.2.8. Groupware	645	.07	.263	0	1
		Q28.2.9. Intra-Social Networking Services (SNS)	645	.13	.335	0	1
ICT use		External ICT use	645	1.25	1.267	0	5
		Q28.2.1. Business-to-Business Electronic commerce (B2B E-commerce)	645	.42	.494	0	1
	External ICT use	Q28.2.2. Business to Consumer (B2C) E-commerce	645	.34	.473	0	1
		Q28.2.3. Electronic Data Interchange (EDI)	645	.21	.405	0	1
		Q28.2.4. Supply Chain Management (SCM)	645	.23	.419	0	1
		Q28.2.10. Public SNS	645	.06	.236	0	1

Source: Authors

5. Results of the estimations

5.1 Path diagram

This study employs SEM which can examine the relationships between various variables which are related to each other. This analysis can be used even if they are

endogenous and usual least squares analysis cannot be applied. The variables such as External linkages (MNCs and local firms), innovation capability (HRM, organizational learning, and ICT use), and innovation are used.

Since factor analysis discussed in the previous section shows the correlation among the latent variables, in the following detailed path diagram the arrows move in both a simplified diagram is shown in Figure 3.

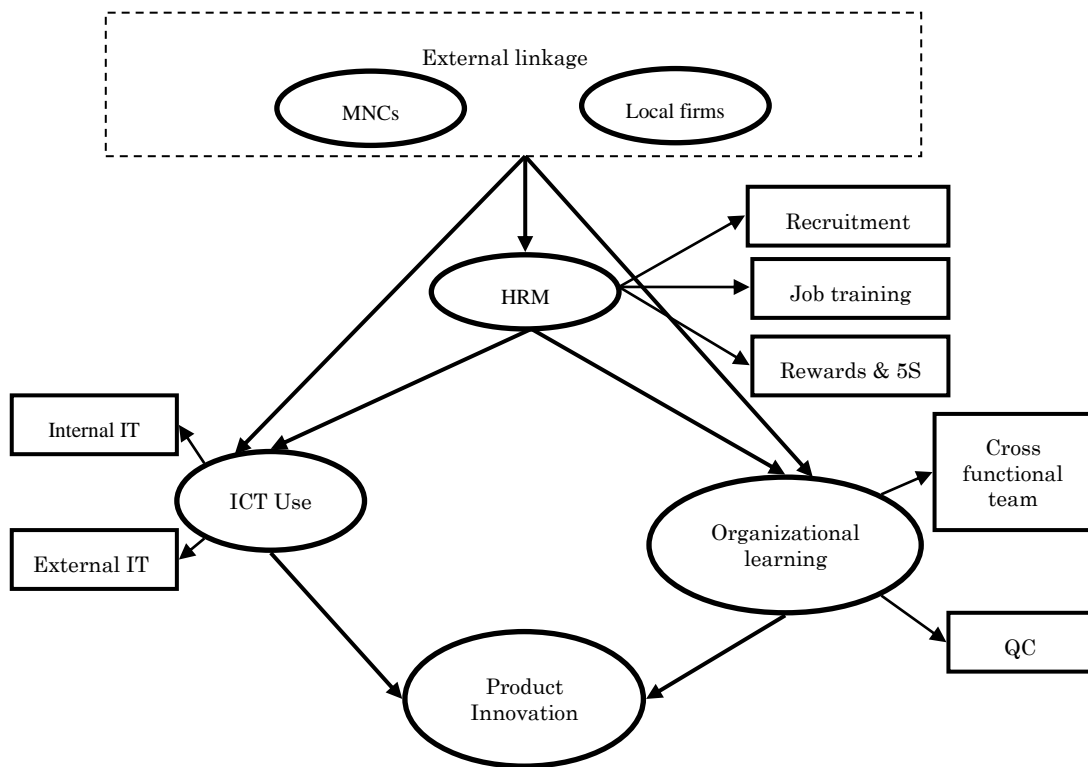


Figure 3: path diagram

5.2 Fitness of the model

Tables 4 and 5 indicate the fitness of the two SEM models for full model and selected model of product innovation. The former model consists of paths of all hypothesis. In contrast, the latter model consists of the only significant paths. GFI (Goodness of Fit Index) and AGFI (Adjusted Goodness of Fit Index) take the values between 0 and 1, which indicate the criteria of the explanatory power of the model. If $GFI \geq AGFI$ and

both indices are 0.9 or more, the model can be judged as a good fit. The CFI (Comparative Fit Index) evaluates the model in terms of goodness-of-fit, which indicates how much the model has improved in comparison with the independent model estimated under the assumption that there is no correlation among the observed variables. It takes the values from 0 to 1, and the model is judged as being a good fit if the CFI is 0.9 or more. Moreover, the RMSEA (Root Mean Square Error of Approximation) is an index that expresses the divergence between the estimated and actual distribution of the model expressed in terms of the amount of degree of freedom. The model can be judged as a good fit if it is 0.1 or less. The values of these indices for full model show values such as GFI (0.94 \geq 0.9), AGFI (0.907 \geq 0.9), CFI (0.943 \geq 0.9), RMSEA (0.061 \leq 0.1). The values of these indices for selected model have values such as GFI (0.944 \geq 0.9), AGFI (0.915 \geq 0.9), CFI (0.951 \geq 0.9), RMSEA (0.056 \leq 0.1). Thus these tests do show that the goodness-of-fit of the two models is high. However, AIC (446.884) of full model is higher than AIC (411,756) of selected model. Since the low AIC model is higher goodness of fit than others, the result of analysis of the selected model is showed in the following.

Table 4. Fitness of model (full model)

χ^2 value	Degree of freedom	p value	GFI	AGFI	CFI	RMSEA	AIC
338.884	99	0	0.94	0.907	0.943	0.061	446.884

Table 5. Fitness of model (selected model)

χ^2 value	Degree of freedom	p value	GFI	AGFI	CFI	RMSEA	AIC
307.756	101	0	0.944	0.915	0.951	0.056	411.756

5.3 Result of product innovation

We conducted SEM regarding product innovation. The result is summarized in Table 6, and the following results were obtained: (i) MNCs promote ICT use; (ii) Local firms

enhance HRM; (iii) HRM enhances Organization learning; and (iv) Organizational learning and ICT use enhance product innovation finally. The path diagram is shown in Figures 4.

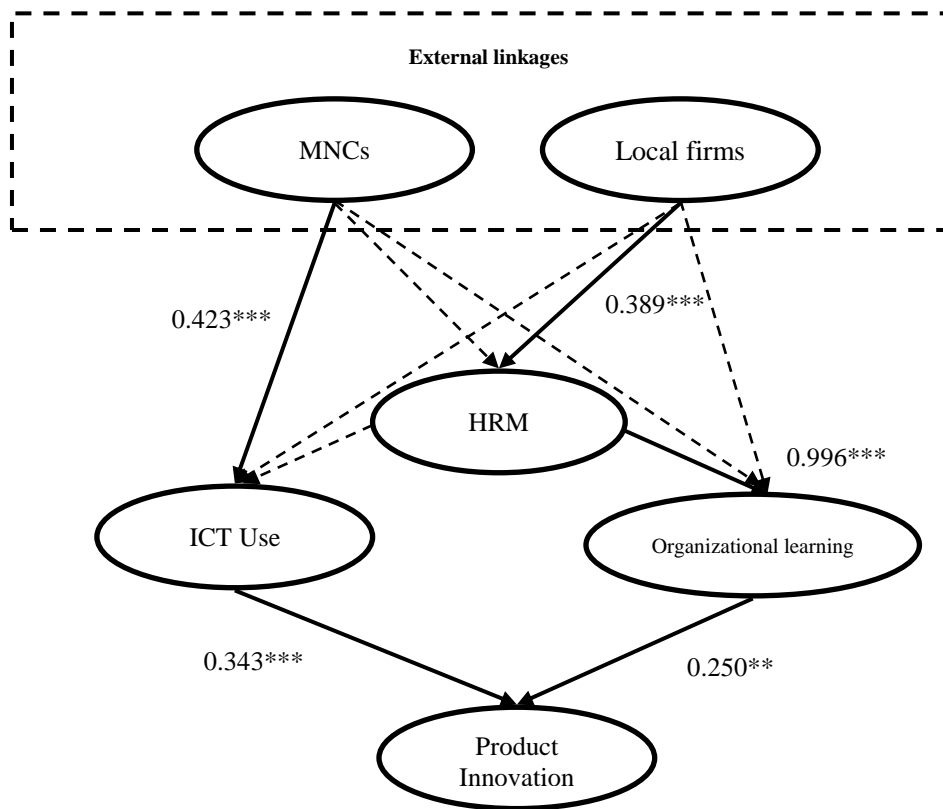
Table 6. Result of SEM: selected model

From	To	Std. Coef.	SE	Test statistic	p value
Local firms	HRM	0.389	0.175	4.707	0.000***
HRM	Organizational learning	0.996	0.035	7.531	0.000***
MNCs	ICT use	0.423	0.035	6.31	0.000***
Organizational learning	Product innovation	0.25	0.098	3.902	0.000***
ICT use	Product innovation	0.343	0.057	6.128	0.000***
Local firms	Local customer (100% local capital)	0.554			
Local firms	Local supplier	0.64	0.114	9.89	0.000***
MNCs	MNC (100% non-local capital)/Joint Venture (JV) customer located in your country	0.727			
MNCs	MNC/JV supplier located in your country	0.779	0.037	27.346	0.000***
MNCs	MNC/JV customer located in a foreign country	0.952	0.057	22.914	0.000***
MNCs	MNC/JV supplier located in a foreign country	0.853	0.052	21.657	0.000***
HRM	Rewards & 5S	0.837			
HRM	Recruitment	0.239	0.026	5.23	0.000***
HRM	Job training	0.495	0.03	9.962	0.000***
Organizational learning	Quality Control	0.372			
Organizational learning	Cross-functional team	0.612	0.352	7.896	0.000***
ICT use	Internal ICT use	0.498			
ICT use	External ICT use	0.827	0.256	7.457	0.000***
Product innovation	Introduced a new product, redesigning packaging or significantly changing appear	0.706			
Product innovation	Introduced a new product, significantly improving your existing products	0.859	0.082	14.625	0.000***
Product innovation	Development of a totally new product based on the existing technologies	0.568	0.067	12.568	0.000***
Product innovation	Development of a totally new product based on new technologies	0.4	0.066	8.978	0.000***

Note 1: ***, ** and * indicate levels of significance of 1%, 5%, and 10%, respectively.

Note 2: P value of “from local firms to local customer,” “from MNCs to MNC (100% non-local capital)/Joint Venture (JV) customer located in your country,” “from HRM to 5S & rewards,” “from organizational learning to quality control,” “from ICT use to internal ICT use,” and “from product innovation to introduced a new product, redesigning packaging or significantly changing appear” cannot be calculated, since these path coefficients are fixed to 1.

Source: authors



Note: Dashed arrows indicate significant path, while solid arrows indicate no significant path.

Figure 4. Result of SEM: Product innovation

5.4 Discussions on the results of the pass analysis

Product innovation can be explained by all latent variables except the path from “MNCs” to “HRM” and to “organizational learning,” from “local firms” to “ICT use” and to “organizational learning”. Most significant levels are smaller than 1%. The hypotheses postulated in this study have been demonstrated except **(H2)** “External linkages improve organizational learning” and **(H5)** “Human resource management improves ICT use.”

From these results, the following are clarified: **(H1)** “External linkages enhance human resource management” is partly supported. Human resource management is promoted by local firms, while it is not promoted by MNCs. **(H2)** “External linkages

improve organizational learning” is directly denied. However, local firms enhance organizational learning via the human resource management. **(H3)** “External linkages improve ICT use” is partly supported. MNCs promote ICT use, while local firms do not promote it. **(H4)** “Human resource management improves organizational learning” is supported. Especially, human resource management enhances organization learning, because the standard coefficient value is very high (0.996). **(H5)** “Human resource management improves ICT use” is denied. And **(H6)** “Organizational learning and ICT use enhance innovation” is completely supported. Consequently, “External linkages (origin) promote innovation (final outcome)” is demonstrated.

7. Conclusions

This study examines innovation activity in five economies in ASEAN based on mail/phone surveys. In order to examine their potential, basic research on their internal innovation capability, external linkages to promote innovation, or how they are integrated into the global supply chain constructed by MNCs, for example, is required. For this purposes, a rigorous statistical method such as SEM should be employed to obtain the correct results. We postulate the theory that external linkages promote internal capability and then finally enhance innovation. The results obtained indicate that MNCs affect ICT use and local firms promote HRM, which enhances organization learning, and then all these three factors that construct internal capability can also promote product innovation. Form the result, East Asian firms have been successfully achieving product innovation by introducing advanced technologies and know-how from not only MNCs but also other local firms. In particular, this study clarifies that the linkage with the local firms is to promote product innovation. Local firms have become one of the driving factors of HRM and ICT use.

Acknowledgement

This paper is partly supported by JSPS grants (c-24530435, c-26380346) and the Ministry of Education, Culture, Sports, Science and Technology, Japan (MEXT) Program for Strategic Research Bases at Private Universities (2012-16) project “Organizational Information Ethics” S1291006. This paper is a product of an ERIA research project. The support of these organizations is gratefully acknowledged.

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