Chapter 7

Empirical Analysis of Information Linkages and Capability in ASEAN Economies: Case of Indonesia, the Philippines, Thailand and Vietnam

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Masatsugu Tsuji and Shoichi Miyahara

Abstract

This paper refers to the channel by which a donor transfers technology to a recipient as “Linkage,” which connects MNCs or large firms with local firms. This paper attempts to identify (i) effective information linkages and (ii) the capability or potentiality of respondents for innovation, which is termed “Innovation Capability.” The linkages themselves are not necessary conditions for achieving innovation and upgrading, since information convoyed through them is useless if the recipients do not possess the capability or potentiality to convert it to applications or innovations. We conducted comprehensive surveys in four ASEAN economies (Indonesia, the Philippines, Thailand and Vietnam), and received approximately 700 responses. The surveys contained questions on information linkages required for innovation and on the sources of information such as university, public agencies, industry/trade organizations, and public R&D institutions as well as MNCs. As a result, MNCs were identified as important sources which transmit information through not only production but also human linkages. With regard to necessary capability for connecting linkages, we identified ODM, OBM and patent rights for the MNCs linkages, and patent right for the public institutions. Lastly, this paper calculates probability of particular capability for firms to connect with MNCs and public institutions, and these are patent rights, top management who have experience working in MNCs, engineers with the level of college graduates, and granted licensing technology for the MNC linkage.

1. INTRODUCTION

Recent economic development in the East Asian economies, termed the “Growth Center of the Global Economy,” was achieved by the fact that the area became the “Factory of the World.” The explosion of economic growth was initiated by MNCs (Multinational Corporations), which since the middle of 1980s have established branch headquarters and factories in the area to exploit the relatively cheap natural resources

such as labor, land and raw materials. The MNCs combined these resources with in-house technologies, including business management as well as engineering. Ongoing agglomeration of MNCs has seen them invite affiliated firms to also establish themselves in neighboring areas. In addition, local firms have emerged as a result of technology transfer from MNCs, and these are promoting further agglomeration. The results of this process have transformed the areas into industrial clusters. The formation of clusters in turn leads to the greater flow of information, which initiated further transformation of the areas, namely the upgrading of the areas from production bases to innovative areas.[1]

Transformation to innovative economies requires qualitative changes, which local firms have to cope with by upgrading themselves. One of the factors which has made this possible is the transfer of technology from MNCs and other large firms. Technology transfer is achieved by a number of different forms or transmission mechanisms. This paper refers to the channel by which a donor transfers technology to a recipient as "Linkage," which connects MNCs or large firms with local firms. In Tsuji and Miyahara [2010], linkages were described as consisting of the following: (i) production linkages; (ii) research linkages; and (iii) human linkages. Production linkages indicate that information related to innovation is convoyed through market transactions. This consists of the "Forward" and "Backward Linkages": the former represents technology which is transferred from customers to firms, and the latter from suppliers to firms.[2] A typical example of the former is the hierarchical production

[1] An epoch-making event symbolizing this was Toyota Motor Corporation's announcement that it would establish an R&D center in a suburb of Bangkok.

[2] Theoretical as well as empirical research has been conducted to establish fundamental theories or to identify such linkages. For more analysis of linkages, see, for instance, Amara and Landry (1999), Vega-Jurado, Gutiérrez-Gracia, Fernández-de-Lucio, and Manjarrés-Henríquez (2008), and Frenz and Ietto-Gillies (2009). Among them, Javorcik (2004), and Blalock and Gertler (2008) found that backward linkage impacts productivity upgrading for upstream suppliers that occur from customers of MNCs. Most recently, Machikita and Ueki (2010a), (2010b) provided new evidence that the impact of knowledge flows through forward linkages as well as backward linkages. In the context of this paper, the main issue is to verify that firms with a greater variety of linkages achieve more innovations.

structure of the Japanese automotive industry. The automotive assemblers provide cutting-edge technology to their suppliers through blueprints, or by sending their engineers to teach and train the engineers of the suppliers. They often have joint projects to apply new technologies. Suppliers also spontaneously develop new technology by themselves in the process of parts production. An example of backward linkage is found in the case of a firm which purchases new machines and equipment, and then develops new products by making full use of them.[3] Firms can obtain new technologies through universities or other public R&D institutions, which are examples of research linkage. Human linkages are the transfer of new technologies via top management and senior engineers.

The linkages themselves, however, are not necessary conditions for achieving innovation and upgrading, since information convoyed through them is useless if the recipients do not possess the capability or potentiality to convert it to applications or innovations. In this paper, we term this "Capability" or "Innovation Capability," indicating the ability to absorb new information, including that related to technology, management, marketing, or the market, and integrate them to achieve innovation. Innovation capability is thus related to both the current or potential level of technology and that of engineers or employees, which can be measured by their current situation. If firms have already applied for patents, then it is reasonable to consider they have higher technological ability. If their engineers have earned higher engineering degrees such as MS or higher, they have high potentiality of new technologies. In this paper, we construct several measures to indicate the innovation capability of firms, on the basis that innovation is actually the joint result of information linkage and capability. Without both, innovation is hard to be achieved.

In Tsuji and Miyahara (2010), linkages in four ASEAN economies were widely

[3] Machikita and Ueki (2010) showed forward linkages are important of innovation, while backward are not.

analyzed based on survey data, which was also used to examine innovation capability. The aim of the present paper is to identify the level of innovation capability of these four ASEAN economies. The paper consists of six sections. Section 2 provides the results of a survey conducted in the four economies and shows current status of innovation and the sources of information which allow the realization of innovation. In Section 3, the analytical methodology and estimation models used to identify the linkages which contribute to achieving innovation are presented; and in section 4, similarly models are examined with regard to capability. Section 5 incorporates the analyses in the previous two sections, since it is the linkages and capability together which matter to innovation. In this section we extract those factors which jointly affect innovation, and calculate how they actually contribute to performing innovation. Brief concluding remarks are provided in the final section.

2. SURVEYS AND DATA

Firstly, we present here the result of a survey conducted in November and December 2009 in the four ASEAN economies of Indonesia, the Philippines, Thailand and Vietnam, which is the basis of the analysis in this study.

2.1. Product Innovation

This survey aimed to obtain fundamental data on the innovation activities as well as innovation performances of respondents. Innovation is categorized into two types, product and process innovation, but in accordance with the questionnaire, this paper examines only product innovation. Product innovation was classified into the following four types in the questionnaire.

1. *What has your establishment achieved among the following?*

(a) Significant change in packaging or appearance design

(b) Significant improvement of an existing product/service

(c) Development of a totally new product/service based on existing technologies

(d) Development of a totally new product/service based on new technologies

Schumpeter defined the supply of new products or services as examples of product innovation, but this paper adopts more detailed categories. From (1.a) to (1.d), the categories represent an increasingly higher level of innovation; that is, the survey started from the simple improvement of existing products/services and extended to the creation of entirely new products based on new technology. The distribution of product innovation in different economies is summarized in Table 1 and Figure 1. Unlike the findings of two previous surveys, which found little innovation, the present survey indicated that firms in each economy have improved their achievement of innovation.

Table 1 Product Innovation

	Indonesia		Philippines		Thailand		Vietnam		Total	
	freq.	%	freq.	%	freq.	%	freq.	%	freq.	%
Significant change in packaging or appearance design	95	68.35	102	50.25	41	42.71	237	79.00	475	64.36
Significant improvement of an existing product/service	114	82.01	152	74.88	74	77.08	278	92.67	618	83.74
Development of a new product/service based on the existing technologies	102	73.38	113	55.67	60	62.50	234	78.00	509	68.97
Development of a new product/service based on new technologies	94	67.63	103	50.74	53	55.21	162	54.00	412	55.83

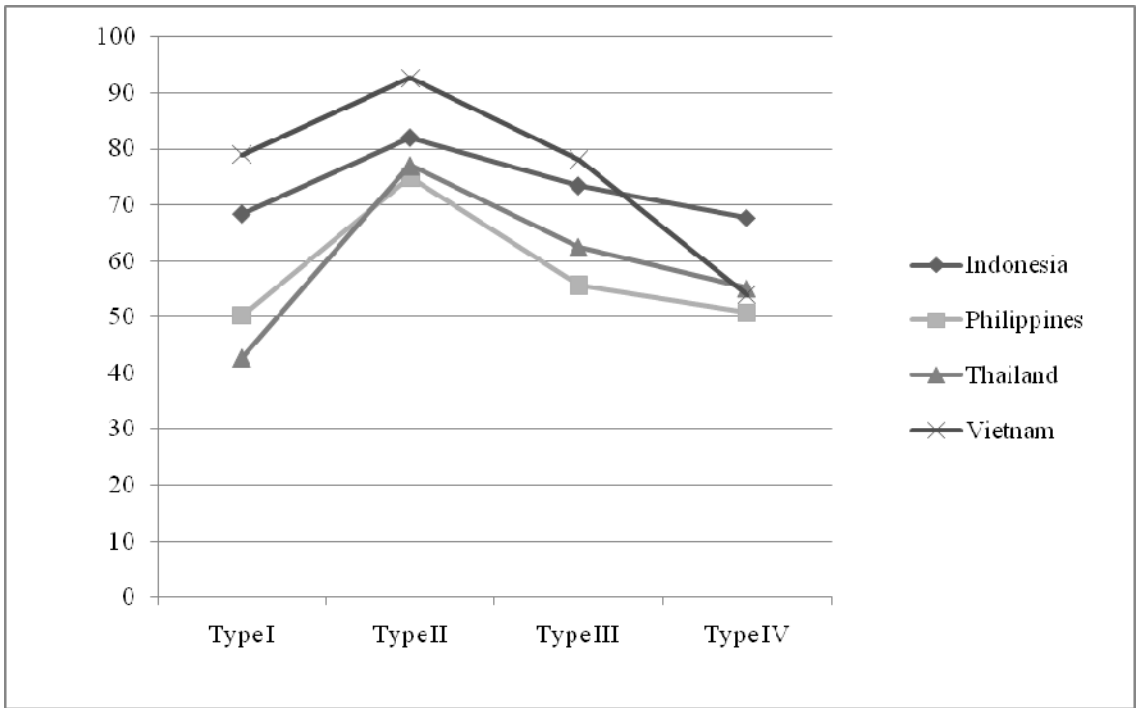

Figure 1 Product Innovation

Notes: Type I Significant change in packaging or appearance design)
Type II Significant improvement of an existing product/service
Type III Development of a new product/service based on the existing technologies
Type IV Development of a new product/service based on new technologies

2.2. Characteristics of Respondent Firms

Table 2 indicates the distribution of firms by the year of establishment, showing that the largest number of firms is aged 11-20 years old, except for Vietnam, which has younger firms. Table 3 shows the type of establishment, indicating that factories/plants account for more than 50% in each economy, followed by headquarters/main office, and that these two categories account for more than 90% of the total. The capital structure of firms is shown in Table 4, indicating that most are locally owned. Tables 5 and Table 6 show the size of SMEs in terms of employment and capital, respectively. The former shows that more than 50% of firms have fewer than 199 employees, while the latter shows a different distribution, namely firms with more than US$100,000 are dominant. Thus the respondents consisted primarily of larger firms. Table 7 shows the distribution

of categories of industry to which the SMEs belonged. Each economy had a different distribution: in Indonesia and the Philippines, light industries such as food, beverages, and tobacco or apparel were major, while Thailand and Vietnam had assembly and processing industries such as automobiles and machinery as the largest categories.

Table 2 Years since Establishment

	Indonesia		Philippines		Thailand		Vietnam		Total	
	freq.	%	freq.	%	freq.	%	freq.	%	freq.	%
0 - 10	39	29.77	48	23.65	18	21.18	157	52.51	262	36.49
11 - 20	39	29.77	101	49.75	31	36.47	100	33.44	271	37.74
21 - 30	33	25.19	30	14.78	17	20.00	19	6.35	99	13.79
31 - 40	16	12.21	15	7.39	12	14.12	16	5.35	59	8.22
41 - 50	3	2.29	7	3.45	3	3.53	6	2.01	19	2.65
over 50	1	0.76	2	0.99	3	3.53	1	0.33	7	0.97
Total	131		203		85		299		718	

Table 3 Type of Establishment

	Indonesia		Philippines		Thailand		Vietnam		Total	
	freq.	%	freq.	%	freq.	%	freq.	%	freq.	%
Headquarters/Main office	50	35.97	20	9.85	38	40.00	97	32.33	205	27.82
Regional Headquarters	3	2.16	1	0.49	3	3.16	4	1.33	11	1.49
Factory/Plant	78	56.12	182	89.66	46	48.42	197	65.67	503	68.25
Branch Office/Sales Office	8	5.76	0	0.00	8	8.42	2	0.67	18	2.44
Total	139		203		95		300		737	

Table 4 Capital Structure

	Indonesia		Philippines		Thailand		Vietnam		Total	
	freq.	%	freq.	%	freq.	%	freq.	%	freq.	%
100% Local-owned	109	79.56	101	49.75	60	63.16	231	77.00	501	68.16
100% Foreign-owned	12	8.76	54	26.60	13	13.68	54	18.00	133	18.10
Joint Venture	16	11.68	48	23.65	22	23.16	15	5.00	101	13.74
Total	137		203		95		300		735	

Table 5 Number of Full-time Employees

.	Indonesia		Philippines		Thailand		Vietnam		Total	
	freq.	%	freq.	%	freq.	%	freq.	%	freq.	%
1 - 19 persons	1	0.72	13	6.40	12	12.77	43	14.33	69	9.39
20 - 49	64	46.38	31	15.27	21	22.34	60	20.00	176	23.95
50 - 99	21	15.22	42	20.69	9	9.57	42	14.00	114	15.51
100 - 199	16	11.59	38	18.72	12	12.77	56	18.67	122	16.60
200 - 299	1	0.72	22	10.84	8	8.51	26	8.67	57	7.76
300 - 399	0	0.00	9	4.43	5	5.32	18	6.00	32	4.35
400 - 499	5	3.62	5	2.46	6	6.38	15	5.00	31	4.22
500 - 999	11	7.97	23	11.33	10	10.64	21	7.00	65	8.84
1,000 - 1,499	2	1.45	6	2.96	4	4.26	11	3.67	23	3.13
1,500 - 1,999	5	3.62	6	2.96	0	0.00	3	1.00	14	1.90
2,000 and above	12	8.70	8	3.94	7	7.45	5	1.67	32	4.35
Total	138		203		94		300		735	

Table 6 Size of Firms (Capital)

Unit: US$

	Indonesia		Philippines		Thailand		Vietnam		Total	
	freq.	%	freq.	%	freq.	%	freq.	%	freq.	%
Less than 10,000	4	4.65	3	1.48	1	1.28	29	9.67	37	5.55
10,000 - 24,999	9	10.47	6	2.96	1	1.28	26	8.67	42	6.30
25,000 - 49,999	6	6.98	11	5.42	3	3.85	22	7.33	42	6.30
50,000 - 74,999	10	11.63	9	4.43	2	2.56	19	6.33	40	6.00
75,000 - 99,999	4	4.65	6	2.96	3	3.85	15	5.00	28	4.20
100,000 - 499,999	13	15.12	28	13.79	15	19.23	33	11.00	89	13.34
500,000 - 999,999	11	12.79	32	15.76	11	14.10	38	12.67	92	13.79
1 million - 4.9 mil.	11	12.79	42	20.69	15	19.23	56	18.67	124	18.59
5 mil. - 9.9 mil.	3	3.49	26	12.81	8	10.26	25	8.33	62	9.30
10 million and above	15	17.44	40	19.70	19	24.36	37	12.33	111	16.64
Total	86		203.00		78		300.00		667	

Table 7 Category of Industry

	Indonesia		Philippines		Thailand		Vietnam		Total	
	freq.	%	freq.	%	freq.	%	freq.	%	freq.	%
Food, beverages, tobacco	29	21.17	34	17.09	5	5.88	19	6.33	87	12.07
Textiles	11	8.03	2	1.01	6	7.06	20	6.67	39	5.41
Apparel, leather	11	8.03	22	11.06	0	0.00	3	1.00	36	4.99
Wood, wood products	11	8.03	11	5.53	3	3.53	9	3.00	34	4.72
Paper, paper products, printing	15	10.95	5	2.51	5	5.88	9	3.00	34	4.72
Coal, petroleum products	1	0.73	0	0.00	1	1.18	2	0.67	4	0.55
Chemicals, chemical products	9	6.57	11	5.53	6	7.06	12	4.00	38	5.27
Plastic, rubber products	4	2.92	15	7.54	5	5.88	39	13.00	63	8.74
Other non-metallic mineral products	0	0.00	8	4.02	2	2.35	3	1.00	13	1.80
Iron, steel	5	3.65	13	6.53	5	5.88	18	6.00	41	5.69
Non-ferrous metals	1	0.73	1	0.50	0	0.00	0	0.00	2	0.28
Metal products	2	1.46	15	7.54	4	4.71	29	9.67	50	6.93
Machinery, equipment, tools	3	2.19	5	2.51	2	2.35	40	13.33	50	6.93
Computers & computer parts	0	0.00	7	3.52	5	5.88	3	1.00	15	2.08
Other electronics & components	5	3.65	22	11.06	2	2.35	45	15.00	74	10.26
Precision instruments	0	0.00	2	1.01	0	0.00	14	4.67	16	2.22
Automobile, auto parts	5	3.65	14	7.04	9	10.59	6	2.00	34	4.72
Other transportation equipments and parts	1	0.73	2	1.01	1	1.18	4	1.33	8	1.11
Others	24	17.52	10	5.03	24	28.24	25	8.33	83	11.51
Total	137		199		85		300		721	

2.3. Linkages: Sources of Information

This paper focuses on information linkages in an area, which consist of various networks within the area, including production, research, and human linkages. Production linkages are related to sources through market transactions such as purchasing and sales, and these linkages are divided into forward and backward linkages. The former implies that firms receive information from their upstream customers, and the latter from their downstream suppliers. Research linkages indicate the flow of information from universities, public research institutions and so on.

To identify the sources of information, we prepared the following questions regarding production linkages:

2. *Sources of knowledge and new technologies: production linkages*

(a) Internal sources of information and own R&D efforts

(b) Cooperation with (technology transfer from) local firms (100% local capital)

(c) Cooperation with (technology transfer from) MNCs (100% non-local capital)

(d) Cooperation with (technology transfer from) from Joint Ventures (JVs)

These four questions were aimed at identifying sources. To examine their relationships in more details, we asked the following questions:

3. *Relationships with partners*

(a) Whether partners were customers or suppliers

(b) Duration of the relationship

(c) Size of partners in terms of employment

(d) Geographical distance

(e) Frequency of communications.

In addition to information through production linkages, firms receive cutting-edge information as well as practical information from various sources. The former is supplied by research institutions such as universities, whereas the latter is transferred through human resources who own skills and know-how. This paper selected the following other sources:

4. *Sources of knowledge and new technologies: other linkages*

Research linkages: new technologies and information

(a) Technical assistance by government/public agencies

(b) Technical assistance by industrial/trade organizations

(c) Technical assistance by community organizations (NGOs or NPOs)

(d) Technical assistance by government-owned financial institutions

(e) Cooperation with (assistance from) universities/higher educational institutions

(f) Cooperation with (assistance from) government or public research institutes

Human linkages: provided by support organizations such as seminars, lectures, training, or consultants/experts dispatched or hired by them

(g) University professors or researchers personally closed contracts with your firm

(h) Dispatch of engineers to universities/higher educational institutions

(i) Dispatch of engineers to government or public research institutes

(j) Recruitment of middle-ranking personnel or mid-carrier engineers

(k) Recruitment of senior engineers retired from MNCs, JVs, or large local firms

(l) Headhunting of top management from MNCs, JVs, or large local firms

Other sources

(m) Technical information obtainable from academic publications

(n) Technical information obtainable from patents

(o) Introduction of “foreign-made” equipment and software

(p) Reverse engineering

(q) Participation in conferences, trade fairs, exhibitions

These definitions of linkages are comprehensive and contain not only organizations as partners but also functions. In accordance with the results of Tsuji and Miyahara [2010], this paper focuses on partners only, and summarizes the following three important partners:

5. *Type of linkage*

(a) MNCs (2.c)

(b) Public Institutes (4.a, 4.d, 4.f, 4.i)

(c) Universities (4.e, 4.g, 4.h)

2.4. Innovation Capability

In addition to linkages, another important subject in this paper is innovation capability or the potentiality of firms in the area. This capability is derived from two

concepts: the firm and regional level. The former implies how much firms possess the ability to absorb new information, including that related to technology, management, marketing, or the market, and integrate them to achieve innovation. In contrast, the latter is related to the ability of the particular region as a whole. This concept can be referred to as "local innovation system."[4] This paper concentrates on the former.

(a) Technological capability

The innovation capability of firms is not observable and it is accordingly difficult to identify whether firms actually possess or not. We therefore selected the following as proxies for capability: (i) technology; and (ii) human resources. These are proxies of the firms' unknown or true ability to absorb new technologies. The level of technology which a firm currently owns, for example, indicates its ability to absorb new ones. More concretely, if a firm has already registered an intellectual property right, or if it is engaged in its own R&D activities by establishing departments or by sending personnel to university laboratories, these reveal they already have strong potential to deal with new technologies. Further, the production methods they currently use might be a proxy for technological potentiality.

Based on the above, the questionnaire asked firms about their capability and strategy for technological upgrading and innovation.

6. *Does your establishment hold any intellectual property rights?*

7. *Does your establishment carry out R&D activities?*

8. *Technical and management systems*

(a) OEM (Original Equipment Manufacturer)

(b) ODM (Original Design Manufacturer)

(c) OBM (Original Brand Manufacturer)

[4] The local innovation system is an important issue in this area. For the establishment of such a system, see the discussions in the conclusion of this paper.

(d) Adoption of ISO 9000, 14000 series or other international standards

(e) Operation of QM (Quality Management) or QC (Quality Control) activities

(f) Granted licensing technologies or know-how from other firms

Whether they are OEM, ODM or OBM depends on their technological capability. Among the capabilities shown in 4, 5 and 6, the latter indicates higher technological potentiality in general.

(b) Human capability

Human resources, categorized into top, middle and lower management, are also proxies for true potentiality or ability. Capability can be measured by education and experiences. Thus, we asked the following questions to measure human capability:

9. *Academic qualifications of top management and employees*

(a) Top management possesses a bachelor (BA), master or Ph.D. degree

(b) Top management has the experience of working for an MNC/JV

(c) Top management was spun-off or headhunted from an MNC/JV or local large firm

(d) Percentage of engineers are technical college graduates or higher

According to the theory of information, the following characteristic is also a proxy for true ability, namely acceptance (dispatch) of personnel to their customers (suppliers), and indicates a firm's total capabilities. We therefore asked the following questions:

10. *Dispatching or accepting engineers from/to customers/suppliers*

(a) Does your establishment dispatch engineers to customers/suppliers?

(b) Do customers/suppliers dispatch engineers to your establishment?

(c) Does your establishment dispatch trainers to customers/suppliers?

(d) Does your establishment dispatch trainees to customers/suppliers?

(e) Do customers/suppliers dispatch trainers to your establishment?

(f) Do customers/suppliers dispatch trainees to your establishment?

11. *Characteristics of recruiting and basis of management*

(a) Recruit personnel who worked for the customer/supplier

(b) Customer/supplier recruits personnel who worked for your establishment

(c) Is your establishment a spin-off from the customer/supplier?

(d) Is the customer/supplier a spin-off from your establishment?

3. ESTIMATION OF EFFECTIVE LINKAGES

Here we use rigorous econometric analysis to identify linkages which contribute to respondents' innovation.

3.1. Estimation Models

(a) Dependent variables

This paper, which focuses only on product innovation, takes the number of performed innovations as a dependent variable, as shown in Table 1, and it takes from zero to four. The ordered logit model is used for estimation.

(b) Independent variables

As mentioned in the previous section, we selected three important sources, which included production, research and human linkages, namely (i) MNCs, (ii) public institutes and (iii) university, and treated them as independent variables. To extract the characteristics of the relationships, the following variables were selected: (3. b) duration of the relationship; (3.c) size of partner in terms of employment; (3.d) distance to the customer/supplier; and (3.e) frequency of communications. I addition to these, the independent variable includes relationships via human networks such as sending and accepting (i) engineers (10.a and 10.b), (ii) trainers (10.c, and 10.d), and (iii) trainees

(10.e and 10.f). Moreover, we added variables related to recruiting attitudes: (i) recruit personnel (11.a. and 11.b) and (ii) type of management (11.c and 11.d). Lastly, we added (8.f) granted licensing technologies or know-how from other firms. We also added characteristics of respondents such as years of establishment, and size of firm by employment, and category of industry. County dummies are also included. The summary statistics are shown in Table 8.

(c) Estimation method

As mentioned above, since the dependent variable takes discrete values, ordered logit estimation is adopted. Here we examined two models depending on the selection of customer or supplier: in the customer (supplier) model, the characteristics of the relationships are those related to customers (suppliers); in the basic model, all samples are taken for estimation; while in the importance model, customers (suppliers) are selected according their share of sales (purchases) which are more than 50%. Moreover, the full model implies that all variables are utilized for estimation, while in the selected model, the particular variable is used with those related to firm characteristics as well as county dummies. The results of estimation are indicated in Table 9.

Table 8 Summary Statistics

	Variable	Obs	Mean	Std. Dev.	Min	Max
Innovation						
1	Number of innovation	738	2.729	1.313	0	4
Characteristics of firms						
	Age (establishment)	717	16.197	13.136	0	181
	Number of full-time employees	735	325.306	499.268	10	2000
	Textiles, Apparel, leather	738	0.102	0.302	0	1
	Wood, Paper products	738	0.092	0.289	0	1
	Coal, Chemical products	738	0.057	0.232	0	1
	Iron, Metal products	738	0.126	0.332	0	1
	Computers, Other electronics	738	0.121	0.326	0	1
	Automobile, Other transportation	738	0.057	0.232	0	1
Linkages						
5.a	MNCs (2.c)	738	0.562	0.496	0	1
5.b	Public Institutes (4.a, 4.d, 4.f, 4.i)	738	0.619	0.486	0	1
5.c	Universities (4.e, 4.g, 4.h)	738	0.505	0.500	0	1
Most important customer						
3.b	Duration of the relationship with the customer	738	6.576	3.612	0	10
3.c	Employment size of the customer	738	365.108	355.217	50	1000
3.d	Please indicate distance from your establishment to the customer (kilo meter)	715	454.785	701.802	5	2000
3.e	How often does your establishment have communications for the collaborations?	738	1.916	1.444	0	4
Most important supplier						
3.b	Duration of the relationship with the supplier	738	6.289	3.569	0	10
3.c	Employment size of the supplier	738	325.881	333.774	50	1000
3.d	Please indicate distance from your establishment to the supplier (kilo meter)	709	533.351	749.780	5	2000
3.e	How often does your establishment have communications for the collaborations?	738	1.672	1.371	0	4

Table 9 Basic and Importance Model

		Basic model				Importance model			
		Customer full sample		Supplier full sample		Customer selected sample (Importance > 50%)		Supplier selected sample (Importance > 50%)	
		Full model	Selected model	Full model	Selected model	Full model	Selected model	Full model	Selected model
	Age (establishment)								
	Number of full-time employees (logarithmic)	***	***	***	***	**	**	***	***
	Textiles, Apparel, leather								
	Wood, Paper products								
	Coal, Chemical products				*				
	Iron, Metal products	[***]	[***]	[***]	[***]	[***]	[***]		
	Computers, Other electronics								
	Automobile, Other transportation								
5.a	MNCs (2.c)	**	***	**	***	*	**	**	**
5.b	Public Institutes (4.a, 4.d, 4.f, 4.i)	*	**		**	*	**		
5.c	Universities (4.e, 4.g, 4.h)								
3.b	Duration of the relationship with the customer					*	**		
3.c	Employment size of the customer				*				
3.d	Please indicate distance from your establishment to the customer (kilo meter)								
3.e	How often does your establishment have communications for the collaborations?		*		*	*	**	**	***
8.f	Granted licensing technologies or know-how from other firms	***	***	***	***	***	***	**	***
10.a, 10.b	Does the customer/supplier dispatch an engineer to your establishment?	[**]	[**]			[**]	[**]		
10.c, 10.d	Does your establishment dispatch trainers to the customer/supplier?								
10.e, 10.f	Does your establishment dispatch trainees to the customer/supplier?		*		*				
11.a, 11.b	Recruit personnel who worked for the customer/supplier							[***]	[***]
11.c, 11.d	Is your establishment a spin-off from the customer/supplier?					*	*		
	Dummy (Indonesia)	***	***	***	***	**	**	**	***
	Dummy (Thai)								
	Dummy (Hanoi)	*	**					**	**
	Dummy (Ho Chi Minh)	***	***	***	***	***	***	**	***

Notes: ***, ** and * indicate the significance level at the 1%, 5% and 10%. [ ] indicates that the sign of a estimated coefficient is negative..

3.2. Estimation Results: Linkages

The results showed that, among the three linkages, MMCs were significant for all estimations, implying that all respondents receive information from them. Linkages with public institutes were significant only with regard to customers in the basic model and also in the importance model, albeit that they may not be significant in either of the two models. Since the estimates for "customers" implies that the respondents are suppliers which sell their products to customers, they are concerned with both quality as well as price, both of which are both related to innovation. It is interesting that "frequency of communications" was significant in the importance model, indicating that respondents communicated with important business partners intimately and that this promoted innovation.[5] Neither "Distance to customer/supplier" nor "duration of the relationship" was significant. In addition to these variables, providing or receiving technology licenses or know-how among business partners also contributed to the innovation of the respondents. These results appear realistic. Human linkages, on the other hand, are mostly not significant, but "dispatching/receiving engineers" and "recruit personnel" have negative signs in some models.[6] These variables appear to be obstacles to innovation and require resolution. Lastly, universities were found to be insignificant in all models, and their role in further innovation should be reconsidered.

4. ANALYSIS OF CAPABILITY

Here, we examined the difference in relevance between innovation and capability, and identified from the estimates which elements of respondents' capability were

[5] Tsuji and Miyahara (2010), on the other hand, obtained different results, namely that distance to partners is significant, while frequency is not.

[6] Or respondents might be satisfied with their personnel and do not need these variables.

significant determinants of innovation.

4.1. Estimation Models

Since capability consists of technological and human factors, we examined the technological and human capacity models. The dependent variable is again the number of product innovations achieved.

(a) Technological capability model

This model contains elements of technological capability shown in section 2.4 as dependent variables. We also add (8.f) “granted licensing technology and know-how from other firms,” since this enhances the technological ability of the recipients.

(b) Human capability model

We selected variables from questions 9 and 10 in consideration of correlations among variables.

In addition to the above variables, attributes of respondents and country dummies are also included. Again, the ordered logit model was utilized and two of the full and selected models were estimated. Since the correlations among variables were rather high, the selected model provided better results.

4.2. Results of Estimation

(a) Technological capability model

The results of the technological capability model are shown in Table 10. Among variables, (8.f) “granted licensing technology and know-how” showed the highest significance level, followed by OEM and OBM, which were also significant. Although owning patents and QM (QC) were significant in the selected model only, they might

provide some effect in achieving innovation.

Table 10 Technological Capability Model

	Technological capability	Full model	Selected model
	Age (establishment)		[*]
	Number of full-time employees (logarithmic)	***	***
	Textiles, Apparel, leather		
	Wood, Paper products		
	Coal, Chemical products		*
	Iron, Metal products	[***]	[***]
	Computers, Other electronics		
	Automobile, Other transportation		
6	Does your establishment hold an intellectual property right?		**
7	Does your establish carry out R&D activities?		
8.a	OEM (Original Equipment Manufacturer)	**	***
8.b	ODM (Original Design Manufacturer)		***
8.c	OBM (Original Brand Manufacturer)	**	***
8.d	Adopting ISO 9000, 14000 series or other international standards		
8.e	Operating QM (Quality Management) or QC (Quality Control) activities		***
8.f	Granted licensing technologies or know-how from other firms	***	***
	Dummy (Indonesia)	***	***
	Dummy (Thai)		
	Dummy (Hanoi)		**
	Dummy (Ho Chi Minh)	***	***

Note 1: ***, ** and * indicate the significance level at the 1%, 5% and 10%
Note 2: [ ] indicates that the sign of a estimated coefficient is negative.

(b) Human capability model

In this model, the experience of top management working for MNCs/JV was significant in both models. Other human capabilities, such as education or experience, were not significant. Dispatching/receiving engineers or trainees was significant only in the selected model. The summary of estimation results is shown in Table 11.

Table 11 Human Capability Model

	Human capability	Full model	Selected model
	Age (establishment)		[*]
	Number of full-time employees (logarithmic)	***	***
	Textiles, Apparel, leather		
	Wood, Paper products		
	Coal, Chemical products		*
	Iron, Metal products	[***]	[***]
	Computers, Other electronics		
	Automobile, Other transportation		
9.a	Top management owns a bachelor (BA), master or Ph.D. degree		
9.b	Top management owns an experience of working for a MNC/JV	***	***
9.c	Spin-off or headhunted from a MNC/JV or local large firm		
9.d	Percentage of engineers are technical college graduates or higher		
10.a, 10.b	Does the customer/supplier dispatch an engineer to your establishment?		**
10.c, 10.d, 10.e, 10.f	Does your establishment (customer/supplier) dispatch trainees to the customer/supplier (your establishment)?		**
	Dummy (Indonesia)	***	***
	Dummy (Thai)		
	Dummy (Hanoi)		*
	Dummy (Ho Chi Minh)	***	***

Note 1: ***, ** and * indicate the significance level at the 1%, 5% and 10%
Note 2: [ ] indicates that the sign of a estimated coefficient is negative.

5. INTEGRATED EFFECT OF LINKAGES AND CAPABILITY

As already mentioned, either linkages or capability alone do not contribute to the achievement of innovation. Once integrated into one, however, they do become effective. Here we examine which linkages and capability are incorporated. For this purpose, we combine together the two models discussed in the previous sections.

5.1. Estimation Model: Linkage-Capability Model

Here the same variable shown Table 1 is taken as a dependent variable. With regard to constructing independent variables, we used linkages such as MNCs, public institutes

and universities as well as all elements of capability listed in 9, 10 and 11 in section 2.[7] To analyze the hypothesis that such linkages and capabilities together promote innovation, we constructed new variables by multiplying each linkage and each element of capability. Since the linkages were assumed to take 1 if they were reported as important by respondents, and otherwise 0, each element of capability is thought to be effective in absorbing information convoyed through the particular linkage. Details of the elements of capability are also shown in Table 12.

The estimation equation is expressed in the following way:

$$y_i = a_0 + a_1 x_i + a_2 x_i z_i + \sum a_3 w_i + \varepsilon_i \qquad (1)$$

where y_i, x_i and z_i stand for the number of innovations, x_i the particular linkage (dummy variable), z_i the element of capability, and w_i the attributes of the i-th firm, respectively. $x_i z_i$ is a cross-term of linkage and capability, and e is residual. There are thus three models according to linkages, and for each model, we attempted 14 estimates for each element of capability.

5.2. Result of Estimation

The estimation results of the linkage-capability model are shown in Table 12. This table presents the three linkage models, namely MNCs, public institutes and universities, and all elements of capability are also listed. The “Linkage” column shows correspondence to a particular linkage (dummy variable), and “Cross term” column shows correspondence to linkage times capability.

[7] Universities do not affect innovation, but this is added as a reference.

Table 12 Linkage-capability Model

		MNC		Public institute		University	
		Linkage	Cross term	Linkage	Cross term	Linkage	Cross term
	Technological capability						
6	Does your establishment hold an intellectual property right?	***	**	*	***		**
7	Does your establish carry out R&D activities?	***		**		**	
8.a	OEM (Original Equipment Manufacturer)	***			*		**
8.b	ODM (Original Design Manufacturer)	***	*		*		
8.c	OBM (Original Brand Manufacturer)	**	*		***		*
8.d	Adopting ISO 9000, 14000 series or other international standards	***		*		***	[*]
8.e	Operating QM (Quality Management) or QC (Quality Control) activities	**			*		
8.f	Granted licensing technologies or know-how from other firms	***			**		
	Human capability						
9.a	Top management owns a bachelor (BA), master or Ph.D. degree	***		**			
9.b	Top management owns an experience of working for a MNC/JV	***			***		
9.c	Spin-off or headhunted from a MNC/JV or local large firm	***		***		**	
9.d	Percentage of engineers are technical college graduates or higher	***	[***]	***	[**]	**	
10.a, 10.b	Does the customer/supplier dispatch an engineer to your establishment?	***					
10.c, 10.d, 10.e, 10.f	Does your establishment (customer/supplier) dispatch trainees to the customer/supplier (your establishment)?	***					

Note 1: ***, ** and * indicate the significance level at the 1%, 5% and 10%

Note 2: [ ] indicates that the sign of a estimated coefficient is negative.

With regard to linkage through MNCs, the cross term “patent rights” shows the highest significance level, followed by ODM and OBM. “Percentage of college graduates” reveals a negative sign, indicating it is an obstacle. Public institutes have no significant terms common to both of linkages and capability except “patent rights” and “percentage of college graduates,” and the latter has a negative sign. University does not have any significant term in common.

Estimation results from the element of capability show that ODM, OEM, “patent rights” and “percentage of college graduates” are important for both linkages and capability.

In sum, firms which own patents or are operating ODM and OBM are able to absorb information from MNCs and exploit them to achieve innovation. For firms which own patents and are operating QM, OEM, granted technical licenses, and top management has experience of working at MNCs, information obtained through public institutes can be realized as innovation. In order for collaborating universities to enhance innovation, the conditions such that they are operating either OEM or OBM, or they already have patents are necessary.

5.3. Estimation Model II: Capability to Obtain Linkages

In the previous section, the capability for firms to perform innovation by absorbing information on new technology was clarified. Here, we derive what kind of capability is required for collaboration with the linkages, particularly focusing on MNCs and public institutions.

For MNCs and public institutes, the dependant variable takes 1 if firms replied that the particular linkage was important to them, otherwise 0. With regard to independent variables, we selected factors among technological and human capabilities according to

previous analyses, and are listed in Table 13. Again, we estimated full and selected models. By utilizing the logit model, we calculate the marginal probability of independent variables regarding the linkages. The estimation equation can be expressed in the following way:

$$\Pr(MNC_i = 1) = a_0 + \sum a_1 Capability_i + \sum a_2 w_i + \varepsilon_i \qquad (2)$$

or

$$\Pr(Public_i = 1) = a_0 + \sum a_1 Capability_i + \sum a_2 w_i + \varepsilon_i \qquad (3)$$

The marginal probability tells us how much the probability of having collaboration with MNCs or public institutions would increase, if firms satisfied an element of capability. Let us consider the example of “patent rights” and linkage with MNCs. The coefficient of “patent rights” shows that if firms registered a patent, then the probability of starting tie-ups with MNCs would increase at the same percentage as the coefficient.

5.4. Estimation Result II

Tables 13 and 14 show the results of estimations for MNC linkage and the public institutes, respectively. The former table tells that in both the full and selected models, according to values of marginal effect, significant variables were (i) top management’s working experience in MNCs; (ii) granted technical licenses and know-how; (iii) patent rights; and (iv) percentage of engineers who were college graduates. Since the marginal effect of (i) is 16.3% in the full model, if firms can recruit top management from MNCs, then the probability for this firm to start collaborating with MNCs increases by 16.3%. In the selected model, in addition to these elements, (v) operating an OBM was also identified.

Similarly, in the latter public institutions model, the common significant variables were (i) granted technical licenses and know-how; (ii) top management's working experience in MNCs; and (iii) percentage of engineers who were college graduates. In the selected model, in addition to these elements, (iv) operating QM and (v) practicing R&D activities were also identified.

In sum, we thus obtained important information on the capability of firms to connect to linkages such as MNCs or public institutions from the different method. In order to have collaborations with MNCs, human networks, such as top management work experience with MNCs, as well as technological capability to obtain patents, technical licenses, and engineers' educational qualification are required. For linkage with public institutes, a lower level of qualifications such as QM and R&D activities are particularly necessary, but holding patents is not required. These conclusions can be applied to policy making.

Table 13 Capability Required for MNCs

	Full model	Selected model
	Marginal Effect	Marginal Effect
6 Does your establishment hold an intellectual property right?	0.098 **	0.144 ***
8.b ODM (Original Design Manufacturer)	-0.005	0.055
8.c OBM (Original Brand Manufacturer)	0.016	0.081 *
8.e Operating QM (Quality Management) or QC (Quality Control) activities	-0.021	0.067
8.f Granted licensing technologies or know-how from other firms	0.143 ***	0.177 ***
9.b Top management owns an experience of working for a MNC/JV	0.163 ***	0.203 ***
9.d Percentage of engineers are technical college graduates or higher	0.090 *	0.130 ***

Note: ***, ** and * indicate the significance level at the 1%, 5% and 10%

Table 14 Capability Required for Public Institutions

	Full model	Selected model
	Marginal Effect	Marginal Effect
6 Does your establishment hold an intellectual property right?	-0.037	0.006
7 Does your establish carry out R&D activities?	0.077	0.094 **
8.a OEM (Original Equipment Manufacturer)	-0.022	0.026
8.b ODM (Original Design Manufacturer)	0.004	0.053
8.c OBM (Original Brand Manufacturer)	0.025	0.067
8.e Operating QM (Quality Management) or QC (Quality Control) activities	0.037	0.098 *
8.f Granted licensing technologies or know-how from other firms	0.125 ***	0.141 ***
9.b Top management owns an experience of working for a MNC/JV	0.087 **	0.119 ***
9.d Percentage of engineers are technical college graduates or higher	0.082 *	0.124 ***

Note: ***, ** and * indicate the significance level at the 1%, 5% and 10%

6. CONCLUSIONS

(a) Summary of results

The objectives of this paper were to identify effective information linkages and the capability or potentiality of respondents for innovation. Based on the same data, Tsuji and Miyahara [2010] focused on the former and attempted to extract linkages which enhanced innovation in the four ASEAN economies. In the results, MNCs were identified as important sources which transmit information through not only production relationships but also human networks; namely, MNCs are sources of supply of high-ranked management to firms in the area, thanks to their advanced managerial systems, and the high ability it confers on managers who have experience of having worked there. Among the research linkages, government-owned financial institutions were significant sources which provide not only financial but also technical assistance, while government/public agencies or government/public research intuitions were significant, since firms need funds for innovation and upgrading, in addition to information for R&D activities, making these sources indispensable. In contrast to these

linkages, university and other higher educational institutions were not significant in any model. Based these results, this paper focuses only on MNCs and public institutions.

With regard to capability, this paper attempted to identify which factors were more effective for the achievement of innovation. Result showed that, among technological capabilities, OEM, OBM and “granted licensing technology and know-how” were significant. Among human capabilities, top management’s experience of having worked at MNCs was significant.

Since innovation is achieved by the incorporation of linkages and capability, this paper developed a model to analyze this process by considering the cross terms of multiplication of these two factors. The rigorous estimation model identified ODM, OBM and patent rights for the MNCs linkages, and patent right for the public institutions.

Lastly, this paper derives the necessary capability for firms to connect with MNCs and public institutions, and without these kinds of capabilities, firms cannot make full use of information from the linkages. These are patent rights, top management who have experience working in MNCs, engineers with the level of college graduates, and granted licensing technology for the MNC linkage; and top management who have experience working in MNCs, engineers with the level of college graduates, and granted licensing technology for the public institutions linkage. These are necessary conditions for connecting with the information linkages.

(b) Policy implications

These last points are important for further upgrading of local firms. Since MNCs play important roles in transferring not only technology but also managerial skills, further policies should be implemented to invite MNCs to these areas. Doing so requires

the establishment of legal as well as physical infrastructure, subsidies and tax exemption for MNCs, and deregulation for effective functioning market mechanisms.[8] Further development of public institutions which provide funds and technical assistance to local firms is required. This is related to establishing the local innovation system, which consists of all entities, public, private, or NPO and NGO.

Another important policy is to empower local firms to enhance technology and human resources, in particular to establish practical training for engineers and workers. Although universities tend to provide higher-level education to engineers, their roles also lie in this function.

According to the results of this analysis, we conclude that innovation in this area heavily depends on MNCs, and that the areas require an endogenous innovation process to further upgrade their economies.

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[8] The flowchart approach can provides more practical examples of these policies. See Kuchiki and Tsuji (2005), (2008), (2009)

REFERENCES

Amara, N. and R. Landry (2005) "Sources of Information as Determinants of Novelty of Innovation in Manufacturing Firms: Evidence from the 1999 Statistics Canada Innovation Survey," *Technovation*, vol. 25, issue 3, pp. 245-59.

Blalock, G.. and P. J. Gertler (2008) "Welfare Gains from Foreign Direct Investment through Technology Transfer to Local Suppliers," *Journal of International Economics*, Vol. 74, pp. 402-21.

Frenz, M. and G. Ietto-Gillies (2009) "The Impact on Innovation Performance of Different Sources of Knowledge: Evidence from the UK Community Innovation Survey," *Research Policy*, vol. 38, issue 7, pp. 1125-35.

Javorcik, B. (2004) "Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillovers through Backward Linkages," *American Economic Review*, Vol. 94, No. 3, pp. 605-27.

Kuchiki, A. and M. Tsuji (2005) *Industrial Clusters in Asia: Analyses of their competition and cooperation*, Basingstroke, UK, Palgrave and Macmillan.

Kuchiki, A. and M. Tsuji (2008) *The Flowchart Approach to Industrial Cluster policy*, Basingstroke, UK, Palgrave and Macmillan.

Kuchiki, A. and M. Tsuji (2009) *From Agglomeration to Innovation*, Basingstroke, UK, Palgrave and Macmillan.

Machikita, T. and Y. Ueki (2010a) "Linked Versus Non-linked Firms in Innovation: The Effects of Economies of Network in Agglomeration in East Asia," mimeo, Institute of Developing Economies.

Machikita, T. and Y. Ueki (2010b) "Learning and Innovation in Upstream-Downstream Relations: Mutual Knowledge Exchanges and Types of Transferred Technologies," mimeo, IDE.

Tsuji, M. and S. Miyahara (2010) "Empirical Analysis of Innovation and the Proximity of Information Linkages in ASEAN Economies: Case of Indonesia, the Philippines,

Thailand and Vietnam," mimeo IDE

APPENDIX

A1. Questionnaire

Innovation

1. What has your establishment achieved among the following?
   (a) Significant change in packaging or appearance design
   (b) Significant improvement of an existing product/service
   (c) Development of a totally new product/service based on existing technologies
   (d) Development of a totally new product/service based on new technologies

Sources

2. Sources of knowledge and new technologies: production linkages
   (a) Internal sources of information and own R&D efforts
   (b) Technology transfer from local firms (100% local capital)
   (c) Technology transfer from MNCs (100% non-local capital)
   (d) technology transfer from Joint Ventures (JVs)

3. Relationships with partners
   (a) Whether partners were customers or suppliers
   (b) Duration of the relationship
   (c) Size of partners in terms of employment
   (d) Geographical distance
   (e) Frequency of communications.

4. Sources of knowledge and new technologies: other linkages
   (a) Technical assistance by government/public agencies
   (b) Technical assistance by industrial/trade organizations
   (c) Technical assistance by community organizations (NGOs or NPOs)
   (d) Technical assistance by government-owned financial institutions
   (e) Cooperation with (assistance from) universities/higher educational institutions
   (f) Cooperation with (assistance from) government or public research institutes
   (g) University professors or researchers personally closed contracts with your firm
   (h) Dispatch of engineers to universities/higher educational institutions
   (i) Dispatch of engineers to government or public research institutes
   (j) Recruitment of middle-ranking personnel or mid-carrier engineers
   (k) Recruitment of senior engineers retired from MNCs, JVs, or large local firms
   (l) Headhunting of top management from MNCs, JVs, or large local firms
   (m) Technical information obtainable from academic publications
   (n) Technical information obtainable from patents
   (o) Introduction of “foreign-made” equipment and software
   (p) Reverse engineering
   (q) Participation in conferences, trade fairs, exhibitions

5. Type of linkage
   (a) MNCs (2.c)
   (b) Public Institutes (4.a, 4.d, 4.f, 4.i)
   (c) Universities (4.e, 4.g, 4.h)

Capabilities

6. Does your establishment hold any intellectual property rights?

7. Does your establishment carry out R&D activities?

8. Technical and management systems

(a) OEM (Original Equipment Manufacturer)
(b) ODM (Original Design Manufacturer)
(c) OBM (Original Brand Manufacturer)
(d) Adoption of ISO 9000, 14000 series or other international standards
(e) Operation of QM (Quality Management) or QC (Quality Control) activities
(f) Granted licensing technologies or know-how from other firms

9. Academic qualifications of top management and employees

(a) Top management possesses a bachelor (BA), master or Ph.D. degree
(b) Top management has the experience of working for an MNC/JV
(c) Top management was spun-off or headhunted from an MNC/JV or local large firm
(d) Percentage of engineers are technical college graduates or higher

10. Dispatching or accepting engineers from/to customers/suppliers

(a) Does your establishment dispatch engineers to customers/suppliers?
(b) Do customers/suppliers dispatch engineers to your establishment?
(c) Does your establishment dispatch trainers to customers/suppliers?
(d) Does your establishment dispatch trainees to customers/suppliers?
(e) Do customers/suppliers dispatch trainers to your establishment?
(f) Do customers/suppliers dispatch trainees to your establishment?

11. Characteristics of recruiting and basis of management

(a) Recruit personnel who worked for the customer/supplier
(b) Customer/supplier recruits personnel who worked for your establishment
(c) Is your establishment a spin-off from the customer/supplier?
(d) Is the customer/supplier a spin-off from your establishment?

Table A2 Estimation Result of Basic Model (Customer full sample) (Table 9)

		Full model	Selected model 1	Selected model 2	Selected model 3	Selected model 4	Selected model 5	Selected model 6	Selected model 7	Selected model 8	Selected model 9
		Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
	Age (establishment)	-0.008	-0.008	-0.008	-0.009	-0.008	-0.010	-0.009	-0.009	-0.010 *	-0.009
		(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
	Number of full-time employees (logarithmic)	0.199 ***	0.197 ***	0.202 ***	0.200 ***	0.192 ***	0.196 ***	0.194 ***	0.189 ***	0.197 ***	0.195 ***
		(0.058)	(0.058)	(0.058)	(0.058)	(0.057)	(0.057)	(0.057)	(0.057)	(0.057)	(0.057)
	Textiles, Apparel, leather	-0.177	-0.188	-0.160	-0.173	-0.137	-0.216	-0.184	-0.221	-0.210	-0.228
		(0.257)	(0.257)	(0.257)	(0.257)	(0.255)	(0.252)	(0.252)	(0.252)	(0.251)	(0.252)
	Wood, Paper products	-0.190	-0.168	-0.215	-0.195	-0.176	-0.217	-0.207	-0.236	-0.219	-0.239
		(0.257)	(0.256)	(0.257)	(0.257)	(0.256)	(0.258)	(0.258)	(0.257)	(0.258)	(0.258)
	Coal, Chemical products	0.364	0.350	0.377	0.363	0.358	0.417	0.355	0.347	0.427	0.415
		(0.316)	(0.315)	(0.313)	(0.312)	(0.312)	(0.312)	(0.313)	(0.313)	(0.310)	(0.310)
	Iron, Metal products	-0.706 ***	-0.718 ***	-0.720 ***	-0.734 ***	-0.726 ***	-0.670 ***	-0.686 ***	-0.696 ***	-0.673 ***	-0.673 ***
		(0.221)	(0.220)	(0.220)	(0.219)	(0.219)	(0.219)	(0.218)	(0.218)	(0.218)	(0.218)
	Computers, Other electronics	-0.006	-0.001	0.053	0.059	0.008	0.070	0.047	0.019	0.047	0.055
		(0.253)	(0.253)	(0.253)	(0.253)	(0.251)	(0.249)	(0.249)	(0.251)	(0.249)	(0.249)
	Automobile, Other transportation	-0.182	-0.188	-0.176	-0.179	-0.159	-0.110	-0.158	-0.171	-0.133	-0.130
		(0.330)	(0.329)	(0.328)	(0.328)	(0.325)	(0.324)	(0.326)	(0.326)	(0.323)	(0.324)
5.a	MNCs (2.c)	0.410 **	0.422 **			0.397 **	0.484 ***	0.462 ***	0.445 ***	0.458 ***	0.488 ***
		(0.172)	(0.165)			(0.170)	(0.170)	(0.169)	(0.170)	(0.170)	(0.169)
5.b	Public Institutes (4.a, 4.d, 4.f, 4.i)	0.295 *		0.317 *		0.292 *	0.327 *	0.314 *	0.314 *	0.336 **	0.342 **
		(0.173)		(0.162)		(0.172)	(0.170)	(0.171)	(0.171)	(0.171)	(0.171)
5.c	Universities (4.e, 4.g, 4.h)	-0.114			0.095	-0.115	-0.022	-0.048	-0.035	-0.037	-0.038
		(0.172)			(0.156)	(0.171)	(0.169)	(0.170)	(0.169)	(0.169)	(0.169)
3.b	Duration of the relationship with the customer	0.035	0.034	0.034	0.033	0.034	0.022	0.022	0.023	0.024	0.024
		(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
3.c	Employment size of the customer	-0.025	-0.021	-0.014	-0.011	-0.050	-0.026	-0.042	-0.044	-0.028	-0.033
		(0.076)	(0.075)	(0.075)	(0.075)	(0.073)	(0.075)	(0.073)	(0.073)	(0.072)	(0.073)
3.d	Please indicate distance from your establishment to the customer (kilo	0.020	0.025	0.019	0.024	0.020	0.032	0.032	0.034	0.033	0.035
		(0.047)	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)
3.e	How often does your establishment have communications for the collaborations?	0.056	0.056	0.063	0.064	0.065	0.098 *	0.085	0.079	0.085	0.081
		(0.055)	(0.055)	(0.055)	(0.055)	(0.054)	(0.054)	(0.054)	(0.054)	(0.054)	(0.054)
8.f	Granted licensing technologies or know-how from other firms	0.465 ***	0.471 ***	0.480 ***	0.489 ***	0.450 ***					
		(0.104)	(0.103)	(0.103)	(0.104)	(0.097)					
10.a, 10.b	Does the customer/supplier dispatch an engineer to your establishment?	-0.241 **	-0.242 **	-0.228 *	-0.227 *		-0.009				
		(0.122)	(0.122)	(0.121)	(0.122)		(0.103)				

10.c, 10.d	Does your establishment dispatch trainers to the customer/supplier?	0.099		0.108		0.096		0.107				0.157									
		(0.142)		(0.141)		(0.141)		(0.142)				(0.114)									
10.e, 10.f	Does your establishment dispatch trainees to the customer/supplier?	0.095		0.102		0.114		0.122						0.178	*						
		(0.128)		(0.127)		(0.127)		(0.127)						(0.103)							
11.a, 11.b	Recruit personnel who worked for the customer/supplier	-0.001		-0.014		0.024		0.013								0.139					
		(0.126)		(0.126)		(0.125)		(0.125)								(0.114)					
11.c, 11.d	Is your establishment a spin-off from the customer/supplier?	0.134		0.118		0.102		0.082										0.279			
		(0.181)		(0.181)		(0.179)		(0.179)										(0.171)			
	Dummy (Indonesia)	0.783	***	0.849	***	0.848	***	0.933	***	0.820	***	0.827	***	0.846	***	0.861	***	0.818	***	0.839	***
		(0.253)		(0.244)		(0.248)		(0.248)		(0.250)		(0.251)		(0.250)		(0.250)		(0.249)		(0.249)	
	Dummy (Thai)	-0.175		-0.124		-0.105		-0.039		-0.098		-0.141		-0.212		-0.185		-0.153		-0.154	
		(0.269)		(0.264)		(0.264)		(0.263)		(0.262)		(0.262)		(0.266)		(0.262)		(0.261)		(0.261)	
	Dummy (Hanoi)	0.419	*	0.491	**	0.389		0.471	*	0.365		0.274		0.207		0.258		0.244		0.267	
		(0.252)		(0.244)		(0.250)		(0.248)		(0.243)		(0.244)		(0.244)		(0.240)		(0.241)		(0.240)	
	Dummy (Ho Chi Minh)	1.856	***	1.823	***	2.038	***	2.006	***	1.709	***	1.382	***	1.313	***	1.374	***	1.364	***	1.393	***
		(0.270)		(0.268)		(0.260)		(0.259)		(0.248)		(0.247)		(0.240)		(0.236)		(0.236)		(0.237)	
	/cut1	-0.534		-0.591		-0.516		-0.587		-0.620		-0.669		-0.732		-0.780		-0.666		-0.665	
		(0.501)		(0.499)		(0.500)		(0.499)		(0.492)		(0.497)		(0.493)		(0.495)		(0.491)		(0.491)	
	/cut2	0.488		0.428		0.503		0.427		0.395		0.332		0.272		0.223		0.335		0.339	
		(0.500)		(0.498)		(0.499)		(0.498)		(0.491)		(0.495)		(0.492)		(0.493)		(0.489)		(0.490)	
	/cut3	1.578		1.515		1.581		1.503		1.479		1.402		1.345		1.298		1.406		1.409	
		(0.503)		(0.501)		(0.502)		(0.501)		(0.494)		(0.498)		(0.494)		(0.495)		(0.492)		(0.493)	
	/cut4	2.783		2.717		2.779		2.698		2.679		2.572		2.517		2.472		2.579		2.583	
		(0.508)		(0.506)		(0.507)		(0.506)		(0.499)		(0.502)		(0.498)		(0.499)		(0.497)		(0.497)	
	Number of observation	696		696		696		696		696		696		696		696		696		696	
	Log likelihood	-939.16		-940.63		-942.00		-943.73		-941.64		-952.56		-951.61		-951.08		-951.81		-951.21	
	Pseudo R2	0.081		0.080		0.078		0.077		0.079		0.068		0.069		0.069		0.069		0.069	

Table A3 Estimation Result of Basic Model (Supplier full sample) (Table 9)

		Full model	Selected model 1	Selected model 2	Selected model 3	Selected model 4	Selected model 5	Selected model 6	Selected model 7	Selected model 8	Selected model 9
		Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
	Age (establishment)	0.003	0.001	0.003	0.001	0.002	0.000	0.001	0.001	0.001	0.002
		(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
	Number of full-time employees (logarithmic)	0.198 **	0.206 **	0.212 **	0.218 **	0.178 **	0.203 **	0.191 **	0.193 **	0.193 **	0.190 **
		(0.091)	(0.091)	(0.090)	(0.091)	(0.090)	(0.090)	(0.089)	(0.089)	(0.089)	(0.090)
	Textiles, Apparel, leather	-0.233	-0.304	-0.197	-0.274	-0.159	-0.255	-0.193	-0.211	-0.211	-0.254
		(0.405)	(0.402)	(0.406)	(0.403)	(0.393)	(0.390)	(0.391)	(0.388)	(0.388)	(0.391)
	Wood, Paper products	-0.127	-0.064	-0.245	-0.180	-0.109	-0.160	-0.122	-0.131	-0.132	-0.135
		(0.417)	(0.413)	(0.412)	(0.409)	(0.411)	(0.414)	(0.415)	(0.414)	(0.413)	(0.414)
	Coal, Chemical products	0.231	0.169	0.291	0.227	0.163	0.340	0.241	0.279	0.279	0.278
		(0.494)	(0.490)	(0.490)	(0.486)	(0.491)	(0.482)	(0.490)	(0.483)	(0.479)	(0.478)
	Iron, Metal products	-1.179 ***	-1.214 ***	-1.212 ***	-1.263 ***	-1.304 ***	-1.195 ***	-1.221 ***	-1.228 ***	-1.226 ***	-1.152 ***
		(0.415)	(0.410)	(0.406)	(0.405)	(0.405)	(0.410)	(0.407)	(0.408)	(0.408)	(0.408)
	Computers, Other electronics	0.182	0.118	0.337	0.286	0.051	0.041	0.016	0.024	0.023	0.065
		(0.448)	(0.441)	(0.443)	(0.440)	(0.446)	(0.439)	(0.439)	(0.439)	(0.439)	(0.442)
	Automobile, Other transportation	0.161	0.097	0.189	0.124	-0.054	0.041	-0.022	-0.011	-0.013	0.040
		(0.496)	(0.499)	(0.491)	(0.494)	(0.492)	(0.486)	(0.488)	(0.486)	(0.486)	(0.490)
5.a	MNCs (2.c)	0.560 *	0.618 **			0.494 *	0.596 **	0.560 **	0.569 **	0.566 **	0.553 *
		(0.289)	(0.262)			(0.285)	(0.286)	(0.285)	(0.285)	(0.285)	(0.285)
5.b	Public Institutes (4.a, 4.d, 4.f, 4.i)	0.526 *		0.596 **		0.489 *	0.572 **	0.548 *	0.553 *	0.555 *	0.604 **
		(0.296)		(0.268)		(0.291)	(0.286)	(0.287)	(0.286)	(0.288)	(0.290)
5.c	Universities (4.e, 4.g, 4.h)	-0.156			0.295	-0.195	-0.190	-0.213	-0.199	-0.199	-0.207
		(0.312)			(0.263)	(0.307)	(0.304)	(0.307)	(0.308)	(0.305)	(0.307)
3.b	Duration of the relationship with the customer	0.071 *	0.078 **	0.071 *	0.080 **	0.076 *	0.058	0.063	0.062	0.063	0.064
		(0.040)	(0.040)	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)
3.c	Employment size of the customer	-0.056	-0.061	-0.071	-0.078	-0.132	-0.025	-0.073	-0.063	-0.064	-0.080
		(0.118)	(0.117)	(0.117)	(0.117)	(0.110)	(0.114)	(0.110)	(0.110)	(0.107)	(0.108)
3.d	Please indicate distance from your establishment to the customer (kilo	-0.029	-0.037	-0.022	-0.031	-0.021	0.007	0.004	0.005	0.006	0.012
		(0.064)	(0.064)	(0.064)	(0.064)	(0.063)	(0.062)	(0.062)	(0.062)	(0.062)	(0.062)
3.e	How often does your establishment have communications for the collaborations?	0.147 *	0.150 *	0.155 *	0.158 *	0.127	0.181 **	0.168 **	0.170 **	0.169 **	0.149 *
		(0.086)	(0.085)	(0.085)	(0.085)	(0.083)	(0.083)	(0.082)	(0.083)	(0.083)	(0.083)
8.f	Granted licensing technologies or know-how from other firms	0.616 ***	0.638 ***	0.624 ***	0.649 ***	0.466 ***					
		(0.174)	(0.172)	(0.174)	(0.172)	(0.153)					
10.a, 10.b	Does the customer/supplier dispatch an engineer to your establishment?	-0.436 **	-0.412 **	-0.421 **	-0.391 **		-0.155				
		(0.199)	(0.198)	(0.199)	(0.198)		(0.161)				
10.c, 10.d	Does your establishment dispatch trainers to the customer/supplier?	0.190	0.217	0.199	0.220			0.064			
		(0.228)	(0.227)	(0.227)	(0.226)			(0.170)			
10.e, 10.f	Does your establishment dispatch trainees to the customer/supplier?	-0.145	-0.172	-0.143	-0.176				-0.003		
		(0.228)	(0.227)	(0.227)	(0.227)				(0.165)		

11.a, 11.b	Recruit personnel who worked for the customer/supplier	-0.241	-0.261	-0.210	-0.226					0.013	
		(0.208)	(0.207)	(0.207)	(0.206)					(0.172)	
11.c, 11.d	Is your establishment a spin-off from the customer/supplier?	0.490 *	0.454 *	0.472 *	0.428						0.401 *
		(0.268)	(0.268)	(0.267)	(0.267)						(0.233)
	Dummy (Indonesia)	0.683 **	0.762 **	0.759 **	0.821 **	0.671 **	0.689 **	0.720 **	0.711 **	0.710 **	0.771 **
		(0.345)	(0.332)	(0.334)	(0.339)	(0.335)	(0.333)	(0.333)	(0.334)	(0.333)	(0.336)
	Dummy (Thai)	-0.008	0.064	0.073	0.141	0.001	0.002	-0.032	-0.004	-0.006	-0.001
		(0.368)	(0.362)	(0.359)	(0.360)	(0.356)	(0.355)	(0.363)	(0.357)	(0.356)	(0.354)
	Dummy (Hanoi)	0.451	0.511	0.437	0.502	0.328	0.359	0.233	0.281	0.278	0.228
		(0.482)	(0.479)	(0.482)	(0.479)	(0.462)	(0.461)	(0.471)	(0.459)	(0.455)	(0.457)
	Dummy (Ho Chi Minh)	2.228 ***	2.122 ***	2.513 ***	2.431 ***	1.678 ***	1.416 **	1.300 **	1.341 **	1.337 **	1.457 **
		(0.675)	(0.655)	(0.663)	(0.654)	(0.615)	(0.607)	(0.609)	(0.611)	(0.602)	(0.606)
	/cut1	0.170	-0.005	0.164	-0.037	-0.211	0.217	0.045	0.078	0.076	0.102
		(0.750)	(0.744)	(0.747)	(0.742)	(0.735)	(0.739)	(0.731)	(0.738)	(0.726)	(0.723)
	/cut2	1.096	0.909	1.085	0.871	0.692	1.095	0.922	0.955	0.953	0.989
		(0.757)	(0.749)	(0.754)	(0.747)	(0.739)	(0.745)	(0.736)	(0.744)	(0.731)	(0.729)
	/cut3	1.961	1.768	1.942	1.721	1.536	1.926	1.751	1.783	1.781	1.822
		(0.764)	(0.756)	(0.761)	(0.753)	(0.745)	(0.752)	(0.742)	(0.750)	(0.738)	(0.736)
	/cut4	2.967	2.768	2.937	2.710	2.520	2.890	2.711	2.743	2.741	2.787
		(0.771)	(0.763)	(0.768)	(0.759)	(0.750)	(0.759)	(0.749)	(0.757)	(0.744)	(0.742)
	Number of observation	261	261	261	261	261	261	261	261	261	261
	Log likelihood	-355.59	-357.19	-357.50	-359.36	-360.33	-364.59	-364.99	-365.06	-365.05	-363.54
	Pseudo R2	0.091	0.087	0.086	0.081	0.079	0.068	0.067	0.067	0.067	0.071

Table A4 Estimation Result of Importance Model (Customer selected sample) (Table 9)

		Full model	Selected model 1	Selected model 2	Selected model 3	Selected model 4	Selected model 5	Selected model 6	Selected model 7	Selected model 8	Selected model 9
		Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
	Age (establishment)	-0.007	-0.007	-0.007	-0.007	-0.007	-0.008	-0.009	-0.008	-0.009	-0.009
		(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
	Number of full-time employees (logarithmic)	0.176 ***	0.176 ***	0.180 ***	0.181 ***	0.175 ***	0.178 ***	0.183 ***	0.183 ***	0.184 ***	0.185 ***
		(0.059)	(0.059)	(0.059)	(0.059)	(0.058)	(0.059)	(0.058)	(0.058)	(0.058)	(0.058)
	Textiles, Apparel, leather	-0.102	-0.106	-0.092	-0.098	-0.122	-0.131	-0.158	-0.135	-0.180	-0.179
		(0.254)	(0.254)	(0.254)	(0.254)	(0.251)	(0.253)	(0.250)	(0.251)	(0.249)	(0.250)
	Wood, Paper products	-0.037	-0.017	-0.059	-0.040	-0.079	-0.079	-0.091	-0.070	-0.100	-0.104
		(0.264)	(0.263)	(0.264)	(0.263)	(0.261)	(0.263)	(0.263)	(0.263)	(0.264)	(0.262)
	Coal, Chemical products	0.490	0.483	0.512 *	0.508	0.499	0.482	0.494	0.452	0.490	0.486
		(0.313)	(0.312)	(0.311)	(0.310)	(0.311)	(0.310)	(0.310)	(0.311)	(0.310)	(0.310)
	Iron, Metal products	-0.624 ***	-0.633 ***	-0.634 ***	-0.645 ***	-0.632 ***	-0.598 ***	-0.607 ***	-0.597 ***	-0.595 ***	-0.593 ***
		(0.220)	(0.220)	(0.219)	(0.219)	(0.219)	(0.218)	(0.219)	(0.218)	(0.219)	(0.218)
	Computers, Other electronics	0.053	0.063	0.121	0.134	0.063	0.046	0.028	0.024	0.047	0.045
		(0.248)	(0.248)	(0.247)	(0.246)	(0.247)	(0.247)	(0.247)	(0.248)	(0.247)	(0.247)
	Automobile, Other transportation	-0.102	-0.102	-0.101	-0.097	-0.104	-0.131	-0.132	-0.136	-0.104	-0.109
		(0.325)	(0.325)	(0.324)	(0.323)	(0.324)	(0.323)	(0.322)	(0.323)	(0.323)	(0.322)
5.a	MNCs (2.c)	0.399 **	0.407 **			0.410 **	0.441 ***	0.437 **	0.432 **	0.463 ***	0.463 ***
		(0.171)	(0.163)			(0.170)	(0.170)	(0.170)	(0.170)	(0.169)	(0.169)
5.b	Public Institutes ((4.a, 4.d, 4.f, 4.i)	0.277		0.300 *		0.288 *	0.320 *	0.332 *	0.316 *	0.339 **	0.340 **
		(0.174)		(0.163)		(0.174)	(0.173)	(0.172)	(0.173)	(0.172)	(0.172)
5.c	Universities (4.e, 4.g, 4.h)	-0.105			0.100	-0.102	-0.052	-0.064	-0.055	-0.041	-0.045
		(0.173)			(0.157)	(0.172)	(0.171)	(0.172)	(0.171)	(0.171)	(0.171)
3.b	Duration of the relationship with the customer	0.008	0.007	0.008	0.007	0.010	0.007	0.010	0.005	0.007	0.007
		(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
3.c	Employment size of the customer	0.131	0.129	0.134	0.132	0.139 *	0.130	0.136 *	0.130	0.149 *	0.148 *
		(0.082)	(0.082)	(0.082)	(0.082)	(0.081)	(0.082)	(0.081)	(0.081)	(0.081)	(0.081)
3.d	Please indicate distance from your establishment to the customer (kilo	-0.016	-0.021	-0.021	-0.027	-0.015	-0.006	-0.006	-0.009	-0.006	-0.006
		(0.048)	(0.048)	(0.048)	(0.048)	(0.048)	(0.048)	(0.048)	(0.048)	(0.048)	(0.048)
3.e	How often does your establishment have communications for the collaborations?	0.076	0.076	0.080	0.080	0.075	0.100 *	0.091	0.091	0.107 *	0.101 *
		(0.057)	(0.057)	(0.057)	(0.057)	(0.056)	(0.055)	(0.056)	(0.056)	(0.056)	(0.057)
8.f	Granted licensing technologies or know-how from other firms	0.328 ***	0.337 ***	0.340 ***	0.351 ***	0.337 ***					
		(0.104)	(0.103)	(0.103)	(0.103)	(0.096)					
10.a, 10.b	Does the customer/supplier dispatch an engineer to your establishment?	0.009	0.018	0.018	0.028		0.128				
		(0.115)	(0.115)	(0.115)	(0.114)		(0.099)				
10.c, 10.d	Does your establishment dispatch trainers to the customer/supplier?	0.049	0.044	0.060	0.056			0.144			
		(0.118)	(0.117)	(0.117)	(0.117)			(0.097)			
10.e, 10.f	Does your establishment dispatch trainees to the customer/supplier?	0.075	0.083	0.089	0.099				0.188 *		
		(0.131)	(0.131)	(0.131)	(0.131)				(0.108)		

11.a, 11.b	Recruit personnel who worked for the customer/supplier	-0.121 (0.128)	-0.124 (0.128)	-0.113 (0.128)	-0.115 (0.128)					-0.005 (0.120)	
11.c, 11.d	Is your establishment a spin-off from the customer/supplier?	-0.042 (0.182)	-0.050 (0.182)	-0.062 (0.180)	-0.071 (0.180)						0.071 (0.173)
	Dummy (Indonesia)	0.851 *** (0.260)	0.902 *** (0.251)	0.924 *** (0.253)	0.988 *** (0.256)	0.794 *** (0.253)	0.883 *** (0.257)	0.858 *** (0.254)	0.854 *** (0.254)	0.829 *** (0.255)	0.828 *** (0.253)
	Dummy (Thai)	-0.199 (0.274)	-0.142 (0.267)	-0.134 (0.268)	-0.065 (0.267)	-0.185 (0.269)	-0.187 (0.268)	-0.247 (0.269)	-0.259 (0.269)	-0.206 (0.269)	-0.208 (0.268)
	Dummy (Hanoi)	0.246 (0.249)	0.300 (0.241)	0.217 (0.247)	0.279 (0.247)	0.253 (0.240)	0.138 (0.242)	0.190 (0.238)	0.127 (0.241)	0.193 (0.239)	0.195 (0.238)
	Dummy (Ho Chi Minh)	1.423 *** (0.273)	1.394 *** (0.272)	1.589 *** (0.263)	1.562 *** (0.263)	1.443 *** (0.258)	1.174 *** (0.255)	1.181 *** (0.253)	1.180 *** (0.252)	1.236 *** (0.253)	1.244 *** (0.252)
	/cut1	-0.199 (0.482)	-0.310 (0.476)	-0.229 (0.482)	-0.358 (0.477)	-0.166 (0.480)	-0.214 (0.480)	-0.199 (0.479)	-0.259 (0.481)	-0.168 (0.480)	-0.172 (0.479)
	/cut2	0.841 (0.482)	0.726 (0.475)	0.806 (0.482)	0.673 (0.476)	0.871 (0.480)	0.817 (0.480)	0.832 (0.479)	0.771 (0.481)	0.860 (0.479)	0.856 (0.479)
	/cut3	1.930 (0.488)	1.812 (0.480)	1.885 (0.486)	1.749 (0.480)	1.956 (0.485)	1.893 (0.485)	1.909 (0.484)	1.847 (0.486)	1.933 (0.484)	1.929 (0.484)
	/cut4	3.148 (0.494)	3.028 (0.487)	3.096 (0.493)	2.957 (0.486)	3.172 (0.492)	3.094 (0.491)	3.111 (0.490)	3.050 (0.492)	3.132 (0.491)	3.129 (0.491)
	Number of observation	690	690	690	690	690	690	690	690	690	690
	Log likelihood	-934.55	-935.82	-937.26	-938.74	-935.38	-940.83	-940.55	-940.14	-941.65	-941.57
	Pseudo R2	0.077	0.076	0.074	0.073	0.076	0.071	0.071	0.072	0.070	0.070

Table A5 Estimation Result of Importance Model (Suppiers selected sample) (Table 9)

		Full model	Selected model 1	Selected model 2	Selected model 3	Selected model 4	Selected model 5	Selected model 6	Selected model 7	Selected model 8	Selected model 9
		Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
	Age (establishment)	-0.014	-0.014	-0.015	-0.015	-0.010	-0.010	-0.010	-0.011	-0.012	-0.011
		(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
	Number of full-time employees (logarithmic)	0.385 ***	0.385 ***	0.410 ***	0.409 ***	0.337 ***	0.339 ***	0.337 ***	0.336 ***	0.361 ***	0.342 ***
		(0.114)	(0.114)	(0.113)	(0.113)	(0.111)	(0.112)	(0.111)	(0.111)	(0.112)	(0.112)
	Textiles, Apparel, leather	0.159	0.167	0.191	0.188	0.161	0.095	0.072	0.070	0.069	0.077
		(0.445)	(0.443)	(0.444)	(0.444)	(0.435)	(0.435)	(0.434)	(0.434)	(0.436)	(0.434)
	Wood, Paper products	0.675	0.688	0.565	0.601	0.590	0.583	0.563	0.558	0.632	0.568
		(0.475)	(0.471)	(0.472)	(0.470)	(0.470)	(0.473)	(0.472)	(0.471)	(0.471)	(0.470)
	Coal, Chemical products	0.320	0.331	0.371	0.405	0.403	0.360	0.343	0.373	0.352	0.311
		(0.522)	(0.518)	(0.513)	(0.511)	(0.510)	(0.507)	(0.509)	(0.508)	(0.511)	(0.510)
	Iron, Metal products	-0.535	-0.547	-0.550	-0.561	-0.532	-0.484	-0.480	-0.471	-0.482	-0.492
		(0.411)	(0.410)	(0.403)	(0.403)	(0.404)	(0.403)	(0.404)	(0.406)	(0.406)	(0.404)
	Computers, Other electronics	-0.185	-0.159	-0.075	-0.049	-0.219	-0.272	-0.254	-0.238	-0.269	-0.265
		(0.497)	(0.494)	(0.498)	(0.501)	(0.490)	(0.489)	(0.483)	(0.483)	(0.483)	(0.486)
	Automobile, Other transportation	-0.027	-0.034	-0.035	-0.043	-0.141	-0.144	-0.095	-0.097	-0.117	-0.117
		(0.514)	(0.515)	(0.508)	(0.509)	(0.501)	(0.504)	(0.503)	(0.504)	(0.499)	(0.500)
5.a	MNCs (2.c)	0.728 **	0.683 **			0.642 **	0.698 **	0.730 **	0.742 **	0.730 **	0.732 **
		(0.316)	(0.289)			(0.303)	(0.307)	(0.304)	(0.307)	(0.302)	(0.302)
5.b	Public Institutes ((4.a, 4.d, 4.f, 4.i)	0.060		0.159		0.167	0.253	0.260	0.261	0.227	0.262
		(0.321)		(0.288)		(0.315)	(0.310)	(0.309)	(0.309)	(0.311)	(0.310)
5.c	Universities (4.e, 4.g, 4.h)	-0.140			0.163	-0.206	-0.228	-0.213	-0.226	-0.183	-0.230
		(0.326)			(0.276)	(0.320)	(0.319)	(0.320)	(0.319)	(0.321)	(0.319)
3.b	Duration of the relationship with the customer	0.018	0.018	0.020	0.022	0.020	0.012	0.011	0.010	0.004	0.010
		(0.042)	(0.042)	(0.042)	(0.042)	(0.041)	(0.041)	(0.040)	(0.040)	(0.041)	(0.040)
3.c	Employment size of the customer	0.182	0.185	0.168	0.170	0.143	0.158	0.181	0.179	0.195	0.157
		(0.139)	(0.139)	(0.137)	(0.138)	(0.132)	(0.137)	(0.136)	(0.134)	(0.133)	(0.133)
3.d	Please indicate distance from your establishment to the customer (kilo	-0.060	-0.065	-0.076	-0.082	-0.045	-0.027	-0.024	-0.021	-0.033	-0.029
		(0.073)	(0.072)	(0.072)	(0.073)	(0.072)	(0.070)	(0.070)	(0.071)	(0.070)	(0.070)
3.e	How often does your establishment have communications for the collaborations?	0.188 **	0.183 **	0.179 **	0.173 *	0.159 *	0.194 **	0.207 **	0.210 **	0.228 ***	0.180 **
		(0.092)	(0.091)	(0.091)	(0.091)	(0.088)	(0.087)	(0.088)	(0.089)	(0.088)	(0.087)
8.f	Granted licensing technologies or know-how from other firms	0.426 **	0.432 **	0.453 **	0.467 ***	0.260					
		(0.183)	(0.180)	(0.183)	(0.180)	(0.159)					
10.a, 10.b	Does the customer/supplier dispatch an engineer to your establishment?	0.109	0.105	0.163	0.160		0.032				
		(0.222)	(0.222)	(0.217)	(0.218)		(0.174)				
10.c, 10.d	Does your establishment dispatch trainers to the customer/supplier?	-0.082	-0.088	-0.077	-0.084			-0.095			
		(0.253)	(0.252)	(0.250)	(0.250)			(0.185)			
10.e, 10.f	Does your establishment dispatch trainees to the customer/supplier?	-0.242	-0.236	-0.187	-0.186				-0.107		
		(0.250)	(0.249)	(0.248)	(0.248)				(0.187)		
11.a, 11.b	Recruit personnel who worked for the customer/supplier	-0.602 ***	-0.609 ***	-0.597 ***	-0.612 ***					-0.376 *	
		(0.228)	(0.227)	(0.227)	(0.227)					(0.199)	

11.c, 11.d	Is your establishment a spin-off from the customer/supplier?	0.377 (0.271)	0.377 (0.271)	0.277 (0.265)	0.281 (0.265)						0.220 (0.250)
	Dummy (Indonesia)	0.911 ** (0.374)	0.878 ** (0.356)	1.046 *** (0.355)	1.019 *** (0.368)	0.811 ** (0.358)	0.858 ** (0.360)	0.835 ** (0.357)	0.848 ** (0.356)	0.904 ** (0.360)	0.853 ** (0.358)
	Dummy (Thai)	0.000 (0.411)	-0.005 (0.402)	0.157 (0.399)	0.163 (0.395)	-0.264 (0.386)	-0.323 (0.385)	-0.297 (0.388)	-0.295 (0.389)	-0.281 (0.385)	-0.328 (0.383)
	Dummy (Hanoi)	1.442 ** (0.593)	1.428 ** (0.583)	1.274 ** (0.594)	1.294 ** (0.589)	1.015 * (0.559)	0.862 (0.552)	0.938 * (0.558)	0.937 * (0.555)	1.024 * (0.554)	0.858 (0.549)
	Dummy (Ho Chi Minh)	1.386 ** (0.607)	1.395 ** (0.606)	1.581 *** (0.596)	1.582 *** (0.595)	0.901 (0.561)	0.687 (0.552)	0.741 (0.556)	0.751 (0.557)	0.798 (0.555)	0.728 (0.550)
	/cut1	1.457 (0.790)	1.435 (0.778)	1.356 (0.784)	1.298 (0.771)	1.171 (0.765)	1.244 (0.762)	1.338 (0.779)	1.329 (0.772)	1.377 (0.763)	1.217 (0.761)
	/cut2	2.304 (0.804)	2.282 (0.791)	2.193 (0.797)	2.134 (0.784)	1.995 (0.777)	2.065 (0.774)	2.159 (0.791)	2.151 (0.785)	2.206 (0.776)	2.040 (0.773)
	/cut3	3.129 (0.819)	3.107 (0.806)	3.005 (0.810)	2.947 (0.798)	2.803 (0.791)	2.871 (0.787)	2.964 (0.805)	2.956 (0.798)	3.020 (0.791)	2.845 (0.787)
	/cut4	4.128 (0.832)	4.105 (0.820)	3.986 (0.822)	3.930 (0.810)	3.775 (0.801)	3.834 (0.798)	3.928 (0.816)	3.919 (0.809)	3.994 (0.803)	3.808 (0.798)
	Number of observation	236	236	236	236	236	236	236	236	236	236
	Log likelihood	-320.53	-320.62	-323.29	-323.27	-325.36	-326.69	-326.57	-326.54	-324.93	-326.31
	Pseudo R2	0.092	0.092	0.084	0.084	0.079	0.075	0.075	0.075	0.080	0.076

Table A6 Estimation Result of Technological Capability Model (Table 10)

		Full model	Selected model 1	Selected model 2	Selected model 3	Selected model 4	Selected model 5	Selected model 6	Selected model 7	Selected model 8
		Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
	Age (establishment)	-0.006	-0.010 *	-0.010 *	-0.010 *	-0.010 *	-0.010 *	-0.010 *	-0.011 *	-0.006
		(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
	Number of full-time employees (logarithmic)	0.159 ***	0.198 ***	0.200 ***	0.199 ***	0.210 ***	0.203 ***	0.222 ***	0.207 ***	0.200 ***
		(0.057)	(0.054)	(0.056)	(0.054)	(0.053)	(0.054)	(0.054)	(0.054)	(0.053)
	Textiles, Apparel, leather	-0.118	-0.165	-0.116	-0.225	-0.149	-0.098	-0.157	-0.160	-0.105
		(0.250)	(0.243)	(0.246)	(0.245)	(0.245)	(0.246)	(0.244)	(0.244)	(0.245)
	Wood, Paper products	-0.045	-0.121	-0.158	-0.151	-0.186	-0.094	-0.171	-0.119	-0.136
		(0.258)	(0.253)	(0.252)	(0.254)	(0.253)	(0.254)	(0.253)	(0.252)	(0.252)
	Coal, Chemical products	0.327	0.414	0.464	0.488	0.465	0.396	0.502 *	0.455	0.479
		(0.309)	(0.305)	(0.305)	(0.304)	(0.305)	(0.304)	(0.303)	(0.304)	(0.305)
	Iron, Metal products	-0.708 ***	-0.669 ***	-0.660 ***	-0.661 ***	-0.628 ***	-0.596 ***	-0.637 ***	-0.660 ***	-0.701 ***
		(0.216)	(0.213)	(0.213)	(0.213)	(0.213)	(0.213)	(0.213)	(0.214)	(0.213)
	Computers, Other electronics	0.111	0.207	0.176	0.200	0.155	0.180	0.206	0.228	0.129
		(0.248)	(0.240)	(0.240)	(0.240)	(0.241)	(0.241)	(0.240)	(0.240)	(0.242)
	Automobile, Other transportation	-0.191	0.013	0.019	0.003	0.040	0.009	0.053	-0.057	-0.035
		(0.324)	(0.315)	(0.316)	(0.313)	(0.316)	(0.317)	(0.314)	(0.317)	(0.319)
6	Does your establishment hold an intellectual property right?	0.252	0.513 ***							
		(0.181)	(0.183)							
7	Does your establish carry out R&D activities?	-0.115		0.201						
		(0.186)		(0.159)						
8.a	OEM (Original Equipment Manufacturer)	0.383 **			0.633 ***					
		(0.177)			(0.163)					
8.b	ODM (Original Design Manufacturer)	0.144				0.439 ***				
		(0.169)				(0.146)				
8.c	OBM (Original Brand Manufacturer)	0.410 **					0.632 ***			
		(0.177)					(0.156)			
8.d	Adoption of ISO 9000, 14000 series or other international standards	0.013						-0.014		
		(0.167)						(0.179)		
8.e	Operating QM (Quality Management) or QC (Quality Control) activities	0.272							0.439 **	
		(0.192)							(0.176)	
8.f	Granted licensing technologies or know-how from other firms	0.595 ***								0.684 ***
		(0.155)								(0.153)
	Dummy (Indonesia)	0.869 ***	1.033 ***	1.004 ***	0.899 ***	0.948 ***	1.009 ***	0.983 ***	0.820 ***	0.983 ***
		(0.240)	(0.224)	(0.224)	(0.225)	(0.224)	(0.225)	(0.224)	(0.233)	(0.223)
	Dummy (Thai)	0.116	0.158	0.120	0.093	0.138	0.219	0.147	0.118	0.115
		(0.246)	(0.241)	(0.242)	(0.242)	(0.241)	(0.242)	(0.241)	(0.241)	(0.241)

Dummy (Hanoi)	0.127	0.407 **	0.328	0.186	0.200	0.146	0.334	0.361 *	0.334
	(0.219)	(0.206)	(0.205)	(0.208)	(0.210)	(0.210)	(0.205)	(0.205)	(0.205)
Dummy (Ho Chi Minh)	1.155 ***	1.411 ***	1.424 ***	1.037 ***	1.338 ***	1.220 ***	1.469 ***	1.471 ***	1.697 ***
	(0.257)	(0.211)	(0.213)	(0.238)	(0.215)	(0.220)	(0.211)	(0.210)	(0.218)
/cut1	-0.653	-0.844	-1.134	-1.102	-1.074	-0.965	-1.137	-1.149	-0.935
	(0.338)	(0.332)	(0.316)	(0.316)	(0.317)	(0.320)	(0.316)	(0.316)	(0.319)
/cut2	0.363	0.136	-0.162	-0.124	-0.100	0.020	-0.168	-0.174	0.055
	(0.334)	(0.326)	(0.308)	(0.309)	(0.309)	(0.313)	(0.308)	(0.308)	(0.312)
/cut3	1.416	1.151	0.844	0.895	0.909	1.037	0.836	0.835	1.080
	(0.338)	(0.329)	(0.309)	(0.310)	(0.310)	(0.315)	(0.309)	(0.309)	(0.314)
/cut4	2.604	2.293	1.979	2.049	2.052	2.184	1.969	1.976	2.236
	(0.346)	(0.335)	(0.315)	(0.316)	(0.316)	(0.321)	(0.315)	(0.315)	(0.321)
Number of observation	715	715	715	715	715	715	715	715	715
Log likelihood	-968.16	-988.37	-991.50	-984.72	-987.77	-984.06	-992.29	-989.15	-982.03
Pseudo R2	0.078	0.059	0.056	0.062	0.059	0.063	0.055	0.058	0.065

Table A7 Estimation Result of Human Capability Model (Table 11)

		Full model	Selected model 1	Selected model 2	Selected model 3	Selected model 4	Selected model 5	Selected model 6
		Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
	Age (establishment)	-0.009	-0.010 *	-0.010 *	-0.010 *	-0.010 *	-0.009	-0.009
		(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
	Number of full-time employees (logarithmic)	0.185 ***	0.209 ***	0.202 ***	0.220 ***	0.222 ***	0.203 ***	0.203 ***
		(0.055)	(0.054)	(0.054)	(0.053)	(0.053)	(0.054)	(0.054)
	Textiles, Apparel, leather	-0.035	-0.123	-0.100	-0.155	-0.162	-0.089	-0.085
		(0.250)	(0.245)	(0.245)	(0.244)	(0.245)	(0.247)	(0.246)
	Wood, Paper products	-0.113	-0.168	-0.124	-0.168	-0.173	-0.141	-0.144
		(0.252)	(0.251)	(0.252)	(0.252)	(0.252)	(0.253)	(0.252)
	Coal, Chemical products	0.392	0.475	0.411	0.496	0.511 *	0.484	0.408
		(0.310)	(0.304)	(0.304)	(0.304)	(0.305)	(0.304)	(0.307)
	Iron, Metal products	-0.708 ***	-0.630 ***	-0.695 ***	-0.636 ***	-0.635 ***	-0.669 ***	-0.659 ***
		(0.213)	(0.212)	(0.213)	(0.212)	(0.213)	(0.213)	(0.213)
	Computers, Other electronics	0.115	0.208	0.130	0.208	0.214	0.162	0.163
		(0.244)	(0.239)	(0.242)	(0.239)	(0.240)	(0.241)	(0.241)
	Automobile, Other transportation	-0.115	0.030	-0.089	0.047	0.058	0.027	-0.025
		(0.318)	(0.314)	(0.318)	(0.315)	(0.314)	(0.313)	(0.316)
9.a	Top management owns a bachelor (BA), master or Ph.D. degree	0.161	0.260					
		(0.174)	(0.170)					
9.b	Top management owns an experience of working for a MNC/JV	0.452 ***		0.508 ***				
		(0.156)		(0.146)				
9.c	Spin-off or headhunted from a MNC/JV or local large firm	-0.130			0.084			
		(0.287)			(0.279)			
9.d	Percentage of engineers are technical college graduates or higher	-0.143				-0.046		
		(0.172)				(0.169)		
10.a, 10.b	Does the customer/supplier dispatch an engineer to your establishment?	0.237					0.384 **	
		(0.190)					(0.164)	
10.c, 10.d,	Does your establishment (customer/supplier) dispatch trainees to the customer/supplier (your establishment)?	0.151						0.395 **
		(0.196)						(0.168)
	Dummy (Indonesia)	1.002 ***	0.988 ***	0.959 ***	0.986 ***	0.977 ***	1.067 ***	1.014 ***
		(0.229)	(0.223)	(0.224)	(0.223)	(0.225)	(0.227)	(0.224)
	Dummy (Thai)	0.023	0.093	0.082	0.150	0.152	0.125	0.071
		(0.244)	(0.243)	(0.241)	(0.241)	(0.241)	(0.240)	(0.242)
	Dummy (Hanoi)	0.290	0.355 *	0.333	0.331	0.353	0.226	0.205
		(0.226)	(0.205)	(0.204)	(0.205)	(0.216)	(0.210)	(0.212)
	Dummy (Ho Chi Minh)	1.402 ***	1.474 ***	1.442 ***	1.457 ***	1.493 ***	1.345 ***	1.315 ***
		(0.243)	(0.210)	(0.212)	(0.215)	(0.226)	(0.217)	(0.220)

/cut1	-0.999	-1.134	-1.062	-1.141	-1.151	-1.027	-1.041
	(0.324)	(0.316)	(0.317)	(0.317)	(0.320)	(0.320)	(0.319)
/cut2	-0.010	-0.162	-0.082	-0.172	-0.181	-0.049	-0.061
	(0.318)	(0.308)	(0.309)	(0.309)	(0.312)	(0.312)	(0.311)
/cut3	1.017	0.845	0.934	0.832	0.823	0.963	0.953
	(0.320)	(0.309)	(0.310)	(0.309)	(0.313)	(0.314)	(0.313)
/cut4	2.170	1.981	2.082	1.965	1.956	2.101	2.090
	(0.326)	(0.315)	(0.317)	(0.315)	(0.319)	(0.320)	(0.319)
Number of observation	715	715	715	715	715	715	715
Log likelihood	-983.35	-991.12	-986.18	-992.25	-992.25	-989.55	-989.54
Pseudo R2	0.063	0.056	0.061	0.055	0.055	0.058	0.058

Table A8 Estimation Result of Linkage-capability Model I (Table 12)

	6. Does your establishment hold an intellectual property right?			7. Does your establish carry out R&D activities?			8.a. OEM (Original Equipment Manufacturer)			8.b. ODM (Original Design Manufacturer)		
	Case (I)	Case (II)	Case (III)	Case (I)	Case (II)	Case (III)	Case (I)	Case (II)	Case (III)	Case (I)	Case (II)	Case (III)
Source	0.492 ***	0.271 *	0.165	0.646 ***	0.409 **	0.335 **	0.580 ***	0.250	0.046	0.512 ***	0.271	0.136
	(0.161)	(0.162)	(0.155)	(0.157)	(0.162)	(0.154)	(0.182)	(0.180)	(0.179)	(0.170)	(0.175)	(0.174)
Cross term	0.528 **	0.646 ***	0.497 **	0.022	0.084	-0.195	0.143	0.346 *	0.458 **	0.310 *	0.336 *	0.310
	(0.207)	(0.209)	(0.224)	(0.222)	(0.211)	(0.230)	(0.212)	(0.178)	(0.196)	(0.186)	(0.176)	(0.193)
Dummy (Indonesia)	0.640 ***	0.573 **	0.671 ***	0.711 ***	0.725 ***	0.752 ***	0.699 ***	0.702 ***	0.769 ***	0.702 ***	0.716 ***	0.762 ***
	(0.216)	(0.224)	(0.222)	(0.214)	(0.220)	(0.219)	(0.215)	(0.219)	(0.219)	(0.215)	(0.219)	(0.219)
Dummy (Thai)	-0.189	-0.152	-0.076	-0.189	-0.127	-0.072	-0.182	-0.107	-0.016	-0.173	-0.103	-0.039
	(0.234)	(0.236)	(0.234)	(0.234)	(0.236)	(0.234)	(0.234)	(0.236)	(0.235)	(0.234)	(0.236)	(0.235)
Dummy (Ho Chi Minh)	1.273 ***	1.572 ***	1.545 ***	1.214 ***	1.558 ***	1.513 ***	1.141 ***	1.459 ***	1.439 ***	1.140 ***	1.509 ***	1.491 ***
	(0.220)	(0.207)	(0.206)	(0.218)	(0.207)	(0.206)	(0.242)	(0.212)	(0.209)	(0.222)	(0.208)	(0.207)
Dummy (Hanoi)	0.179	0.101	0.125	0.140	0.026	0.063	0.126	-0.021	0.060	0.108	-0.036	0.046
	(0.193)	(0.202)	(0.200)	(0.193)	(0.202)	(0.199)	(0.193)	(0.201)	(0.198)	(0.193)	(0.202)	(0.199)
/cut1	-1.709	-1.745	-1.824	-1.708	-1.729	-1.830	-1.719	-1.773	-1.850	-1.726	-1.758	-1.836
	(0.173)	(0.178)	(0.172)	(0.173)	(0.178)	(0.173)	(0.173)	(0.180)	(0.173)	(0.173)	(0.179)	(0.173)
/cut2	-0.769	-0.811	-0.896	-0.771	-0.800	-0.905	-0.781	-0.844	-0.923	-0.788	-0.827	-0.909
	(0.154)	(0.160)	(0.152)	(0.154)	(0.160)	(0.153)	(0.154)	(0.161)	(0.153)	(0.154)	(0.160)	(0.153)
/cut3	0.211	0.156	0.062	0.206	0.160	0.053	0.196	0.118	0.037	0.191	0.136	0.048
	(0.151)	(0.156)	(0.148)	(0.151)	(0.156)	(0.148)	(0.151)	(0.157)	(0.148)	(0.151)	(0.156)	(0.148)
/cut4	1.327	1.261	1.160	1.315	1.254	1.146	1.305	1.217	1.135	1.303	1.233	1.141
	(0.157)	(0.161)	(0.152)	(0.157)	(0.161)	(0.152)	(0.157)	(0.162)	(0.152)	(0.157)	(0.161)	(0.152)
Number of observation	738	738	738	738	738	738	738	738	738	738	738	738
Log likelihood	-1033.71	-1037.88	-1042.07	-1037.03	-1042.64	-1044.22	-1036.81	-1040.83	-1041.84	-1035.65	-1040.88	-1043.28
Pseudo R2	0.048	0.044	0.040	0.045	0.039	0.038	0.045	0.041	0.040	0.046	0.041	0.039

Note: Case (I): MNCs
Case (II): Public Institutes
Case (III): University

	8.c. OBM (Original Brand Manufacturer)			8.d. Adopting ISO 9000, 14000 series or other international standards			8.e. Operating QM (Quality Management) or QC (Quality Control) activities			8.f. Granted licensing technologies or know-how from other firms		
	Case (I)	Case (II)	Case (III)	Case (I)	Case (II)	Case (III)	Case (I)	Case (II)	Case (III)	Case (I)	Case (II)	Case (III)
Source	0.439 **	0.111	0.060	0.743 ***	0.338 *	0.510 ***	0.494 **	0.085	0.078	0.552 ***	0.272	0.185
	(0.185)	(0.187)	(0.190)	(0.199)	(0.189)	(0.196)	(0.247)	(0.236)	(0.239)	(0.178)	(0.170)	(0.170)
Cross term	0.384 *	0.538 ***	0.373 *	-0.143	0.145	-0.330 *	0.198	0.412 *	0.263	0.194	0.373 **	0.227
	(0.201)	(0.181)	(0.200)	(0.202)	(0.177)	(0.200)	(0.252)	(0.214)	(0.234)	(0.192)	(0.174)	(0.190)
Dummy (Indonesia)	0.725 ***	0.761 ***	0.797 ***	0.695 ***	0.740 ***	0.716 ***	0.713 ***	0.743 ***	0.776 ***	0.718 ***	0.734 ***	0.769 ***
	(0.215)	(0.220)	(0.220)	(0.215)	(0.221)	(0.220)	(0.214)	(0.219)	(0.219)	(0.214)	(0.219)	(0.219)
Dummy (Thai)	-0.140	-0.046	-0.005	-0.180	-0.137	-0.064	-0.202	-0.121	-0.071	-0.188	-0.140	-0.079
	(0.235)	(0.237)	(0.237)	(0.235)	(0.236)	(0.234)	(0.235)	(0.235)	(0.234)	(0.234)	(0.236)	(0.234)
Dummy (Ho Chi Minh)	1.085 ***	1.468 ***	1.480 ***	1.236 ***	1.539 ***	1.546 ***	1.181 ***	1.535 ***	1.512 ***	1.275 ***	1.611 ***	1.543 ***
	(0.228)	(0.209)	(0.207)	(0.220)	(0.207)	(0.206)	(0.221)	(0.207)	(0.206)	(0.227)	(0.209)	(0.207)
Dummy (Hanoi)	0.106	-0.071	0.046	0.134	0.028	0.070	0.150	0.061	0.103	0.141	0.022	0.070
	(0.193)	(0.203)	(0.199)	(0.192)	(0.201)	(0.199)	(0.193)	(0.202)	(0.200)	(0.192)	(0.200)	(0.198)
/cut1	-1.724	-1.778	-1.833	-1.711	-1.736	-1.823	-1.709	-1.737	-1.822	-1.705	-1.722	-1.821
	(0.173)	(0.180)	(0.173)	(0.173)	(0.178)	(0.172)	(0.173)	(0.178)	(0.172)	(0.173)	(0.178)	(0.172)
/cut2	-0.785	-0.841	-0.905	-0.773	-0.806	-0.896	-0.771	-0.804	-0.895	-0.766	-0.789	-0.894
	(0.154)	(0.161)	(0.153)	(0.154)	(0.160)	(0.152)	(0.154)	(0.160)	(0.152)	(0.154)	(0.160)	(0.152)
/cut3	0.193	0.126	0.052	0.204	0.155	0.060	0.207	0.158	0.063	0.212	0.177	0.064
	(0.151)	(0.157)	(0.148)	(0.151)	(0.156)	(0.147)	(0.151)	(0.156)	(0.148)	(0.151)	(0.156)	(0.148)
/cut4	1.306	1.226	1.145	1.313	1.249	1.153	1.316	1.255	1.155	1.321	1.276	1.157
	(0.157)	(0.161)	(0.152)	(0.157)	(0.161)	(0.152)	(0.157)	(0.161)	(0.152)	(0.157)	(0.161)	(0.152)
Number of observation	738	738	738	738	738	738	738	738	738	738	738	738
Log likelihood	-1035.22	-1038.30	-1042.83	-1036.79	-1042.38	-1043.20	-1036.73	-1040.87	-1043.95	-1036.52	-1040.40	-1043.86
Pseudo R2	0.046	0.043	0.039	0.045	0.040	0.039	0.045	0.041	0.038	0.045	0.041	0.038

Note: Case (I): MNCs
Case (II): Public Institutes
Case (III): University

Table A9 Estimation Result of Linkage-capability Model II (Table 12)

	9.a. Top management owns a bachelor (BA), master or Ph.D. degree			9.b. Top management owns an experience of working for a MNC/JV			9.c. Spin-off or headhunted from a MNC/JV or local large firm		
	Case (I)	Case (II)	Case (III)	Case (I)	Case (II)	Case (III)	Case (I)	Case (II)	Case (III)
Source	0.590 ***	0.353 **	0.229	0.514 ***	0.165	0.136	0.637 ***	0.438 ***	0.298 **
	(0.159)	(0.163)	(0.157)	(0.178)	(0.177)	(0.173)	(0.151)	(0.159)	(0.149)
Cross term	0.227	0.293	0.217	0.250	0.523 ***	0.310	0.156	-0.077	-0.058
	(0.205)	(0.201)	(0.216)	(0.182)	(0.174)	(0.190)	(0.290)	(0.316)	(0.347)
Dummy (Indonesia)	0.718 ***	0.727 ***	0.775 ***	0.718 ***	0.730 ***	0.765 ***	0.716 ***	0.713 ***	0.758 ***
	(0.214)	(0.219)	(0.219)	(0.215)	(0.219)	(0.219)	(0.215)	(0.220)	(0.219)
Dummy (Thai)	-0.228	-0.185	-0.106	-0.190	-0.150	-0.073	-0.188	-0.129	-0.073
	(0.237)	(0.239)	(0.236)	(0.234)	(0.235)	(0.234)	(0.234)	(0.236)	(0.234)
Dummy (Ho Chi Minh)	1.219 ***	1.553 ***	1.532 ***	1.219 ***	1.523 ***	1.526 ***	1.192 ***	1.560 ***	1.524 ***
	(0.218)	(0.207)	(0.206)	(0.218)	(0.207)	(0.206)	(0.221)	(0.209)	(0.207)
Dummy (Hanoi)	0.158	0.042	0.098	0.155	0.062	0.097	0.138	0.014	0.075
	(0.193)	(0.201)	(0.200)	(0.193)	(0.201)	(0.199)	(0.192)	(0.200)	(0.198)
/cut1	-1.707	-1.737	-1.820	-1.706	-1.754	-1.823	-1.709	-1.732	-1.822
	(0.173)	(0.178)	(0.172)	(0.173)	(0.179)	(0.172)	(0.173)	(0.178)	(0.172)
/cut2	-0.768	-0.806	-0.893	-0.766	-0.820	-0.896	-0.772	-0.802	-0.897
	(0.154)	(0.160)	(0.152)	(0.154)	(0.160)	(0.152)	(0.154)	(0.160)	(0.152)
/cut3	0.210	0.157	0.064	0.213	0.149	0.064	0.205	0.158	0.059
	(0.151)	(0.156)	(0.148)	(0.151)	(0.156)	(0.148)	(0.151)	(0.156)	(0.147)
/cut4	1.320	1.253	1.156	1.323	1.255	1.158	1.314	1.252	1.151
	(0.157)	(0.161)	(0.152)	(0.157)	(0.161)	(0.152)	(0.157)	(0.161)	(0.152)
Number of observation	738	738	738	738	738	738	738	738	738
Log likelihood	-1036.42	-1041.65	-1044.07	-1036.08	-1038.15	-1043.24	-1036.89	-1042.69	-1044.56
Pseudo R2	0.045	0.040	0.038	0.045	0.044	0.039	0.045	0.039	0.038

Note: Case (I): MNCs
Case (II): Public Institutes
Case (III): University

	9.d. Percentage of engineers are technical college graduates or higher			10.a, 10.b. Does the customer/supplier dispatch an engineer to your establishment?			10.c, 10.d, 10.e, 10.f. Does your establishment (customer/supplier) dispatch trainees to the customer/supplier (your establishment)?		
	Case (I)	Case (II)	Case (III)	Case (I)	Case (II)	Case (III)	Case (I)	Case (II)	Case (III)
Source	1.054 ***	0.716 ***	0.476 **	0.772 ***	0.293	0.242	0.686 ***	0.228	0.100
	(0.198)	(0.197)	(0.194)	(0.209)	(0.198)	(0.205)	(0.226)	(0.208)	(0.216)
Cross term	-0.677 ***	-0.452 **	-0.296	-0.178	0.206	0.072	-0.048	0.279	0.260
	(0.214)	(0.192)	(0.208)	(0.215)	(0.190)	(0.211)	(0.229)	(0.194)	(0.218)
Dummy (Indonesia)	0.623 ***	0.620 ***	0.701 ***	0.674 ***	0.773 ***	0.777 ***	0.703 ***	0.774 ***	0.806 ***
	(0.216)	(0.223)	(0.222)	(0.219)	(0.225)	(0.224)	(0.216)	(0.223)	(0.222)
Dummy (Thai)	-0.185	-0.144	-0.080	-0.194	-0.126	-0.071	-0.188	-0.137	-0.071
	(0.235)	(0.236)	(0.234)	(0.235)	(0.235)	(0.234)	(0.234)	(0.235)	(0.234)
Dummy (Ho Chi Minh)	1.462 ***	1.641 ***	1.570 ***	1.250 ***	1.536 ***	1.514 ***	1.222 ***	1.528 ***	1.497 ***
	(0.232)	(0.210)	(0.209)	(0.223)	(0.207)	(0.207)	(0.223)	(0.208)	(0.207)
Dummy (Hanoi)	0.210	0.118	0.123	0.154	-0.016	0.068	0.142	-0.014	0.051
	(0.194)	(0.205)	(0.201)	(0.193)	(0.202)	(0.200)	(0.193)	(0.201)	(0.200)
/cut1	-1.697	-1.710	-1.811	-1.707	-1.742	-1.824	-1.708	-1.747	-1.833
	(0.173)	(0.178)	(0.172)	(0.173)	(0.178)	(0.172)	(0.173)	(0.179)	(0.173)
/cut2	-0.753	-0.778	-0.884	-0.770	-0.811	-0.899	-0.771	-0.814	-0.905
	(0.154)	(0.160)	(0.153)	(0.154)	(0.160)	(0.152)	(0.154)	(0.160)	(0.153)
/cut3	0.232	0.187	0.073	0.206	0.152	0.057	0.206	0.149	0.053
	(0.151)	(0.156)	(0.148)	(0.151)	(0.156)	(0.148)	(0.151)	(0.156)	(0.148)
/cut4	1.351	1.288	1.167	1.317	1.247	1.149	1.315	1.245	1.145
	(0.158)	(0.162)	(0.153)	(0.157)	(0.161)	(0.152)	(0.157)	(0.161)	(0.152)
Number of observation	738	738	738	738	738	738	738	738	738
Log likelihood	-1031.96	-1039.92	-1043.55	-1036.69	-1042.13	-1044.51	-1037.01	-1041.68	-1043.86
Pseudo R2	0.049	0.042	0.039	0.045	0.040	0.038	0.045	0.040	0.038

Note: Case (I): MNCs
Case (II): Public Institutes
Case (III): University

Table A10 Estimation Result of Capability Required for MNCs (Table 13)

		Full model	Selected model 1	Selected model 2	Selected model 3	Selected model 4	Selected model 5	Selected model 6	Selected model 7
		Marginal Effect	Marginal Effect	Marginal Effect	Marginal Effect	Marginal Effect	Marginal Effect	Marginal Effect	Marginal Effect
6	Does your establishment hold an intellectual property right?	0.098 **	0.067						
		(0.049)	(0.050)						
8.b	ODM (Original Design Manufacturer)	-0.005		0.055					
		(0.049)		(0.041)					
8.c	OBM (Original Brand Manufacturer)	0.016			0.081 *				
		(0.051)			(0.043)				
8.e	Operation of QM (Quality Management) or QC (Quality	-0.021				0.144 ***			
		(0.052)				(0.044)			
8.f	Granted licensing technologies or know-how from other firms	0.143 ***					0.203 ***		
		(0.041)					(0.038)		
9.b	Top management owns an experience of working for a	0.163 ***						0.130 ***	
		(0.041)						(0.045)	
9.d	Percentage of engineers are technical college graduates or	0.090 *							0.177 ***
		(0.047)							(0.039)
	Dummy (Indonesia)	0.233 ***	0.238 ***	0.229 ***	0.234 ***	0.193 ***	0.239 ***	0.249 ***	0.239 ***
		(0.049)	(0.044)	(0.045)	(0.044)	(0.049)	(0.045)	(0.044)	(0.045)
	Dummy (Thai)	0.274 ***	0.284 ***	0.283 ***	0.287 ***	0.278 ***	0.273 ***	0.280 ***	0.281 ***
		(0.045)	(0.043)	(0.043)	(0.043)	(0.044)	(0.044)	(0.044)	(0.044)
	Dummy (Ho Chi Minh)	0.447 ***	0.450 ***	0.445 ***	0.436 ***	0.457 ***	0.449 ***	0.421 ***	0.478 ***
		(0.037)	(0.033)	(0.034)	(0.035)	(0.032)	(0.033)	(0.037)	(0.031)
	Dummy (Hanoi)	0.057	0.094 *	0.069	0.061	0.099 *	0.087 *	0.038	0.079
		(0.059)	(0.051)	(0.053)	(0.054)	(0.051)	(0.052)	(0.055)	(0.052)

Table A11 Capability Required for Public Institutions (Table 14)

		Full model	Selected model 1	Selected model 2	Selected model 3	Selected model 4	Selected model 5	Selected model 6	Selected model 7	Selected model 8	Selected model 9
		Marginal Effect	Marginal Effect	Marginal Effect	Marginal Effect	Marginal Effect	Marginal Effect	Marginal Effect	Marginal Effect	Marginal Effect	Marginal Effect
6	Does your establishment hold an intellectual property right?	-0.037	0.098 *								
		(0.050)	(0.053)								
7	Does your establish carry out R&D activities?	0.077		0.026							
		(0.047)		(0.046)							
8.a	OEM (Original Equipment Manufacturer)	-0.022			0.053						
		(0.052)			(0.040)						
8.b	ODM (Original Design Manufacturer)	0.004				0.067					
		(0.049)				(0.043)					
8.c	OBM (Original Brand Manufacturer)	0.025					0.094 **				
		(0.051)					(0.045)				
8.e	Operation of QM (Quality Management) or QC (Quality	0.037						0.006			
		(0.037)						(0.046)			
8.f	Granted licensing technologies or know-how from other firms	0.125 ***							0.119 ***		
		(0.040)							(0.038)		
9.b	Top management owns an experience of working for a	0.087 **								0.124 ***	
		(0.040)								(0.046)	
9.d	Percentage of engineers are technical college graduates or	0.082 *									0.141 ***
		(0.048)									(0.038)
	Dummy (Indonesia)	0.329 ***	0.305 ***	0.295 ***	0.296 ***	0.299 ***	0.303 ***	0.295 ***	0.299 ***	0.309 ***	0.301 ***
		(0.035)	(0.035)	(0.036)	(0.036)	(0.036)	(0.036)	(0.037)	(0.036)	(0.035)	(0.036)
	Dummy (Thai)	0.308 ***	0.312 ***	0.308 ***	0.310 ***	0.313 ***	0.311 ***	0.309 ***	0.304 ***	0.308 ***	0.307 ***
		(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.036)	(0.035)	(0.035)
	Dummy (Ho Chi Minh)	-0.050	-0.043	-0.049	-0.051	-0.063	-0.020	-0.030	-0.048	-0.099 *	0.004
		(0.071)	(0.052)	(0.062)	(0.054)	(0.056)	(0.051)	(0.051)	(0.053)	(0.059)	(0.051)
	Dummy (Hanoi)	0.284 ***	0.306 ***	0.292 ***	0.286 ***	0.283 ***	0.303 ***	0.296 ***	0.298 ***	0.267 ***	0.295 ***
		(0.042)	(0.036)	(0.037)	(0.037)	(0.038)	(0.036)	(0.036)	(0.036)	(0.040)	(0.036)