Chapter **8**

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

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8

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Abstract

The success factors of remarkable economic growth East Asian economies lie in the agglomeration of firms in this region, being initiated by MNCs. The agglomeration created another agglomeration in such a way that MNCs' affiliated firms, such as parts suppliers and supporting firms, were founded in locations near the MNCs and local firms were developed due to technology transfer from MNCs. This leads to the transformation of the regional economies into innovative economies: transformation from agglomeration to innovation. A key factor is information flow among all entities of the area; information is related to technology, know-how, management, marketing and market, and on the sources of information such as university, public agencies, industry/trade organizations, and public R&D institutions as well as MNCs. The transmission channel of information to firms is referred to as "linkages." This paper classifies this into four categories; (i) production; (ii) research; (iii) human; and (iv) other linkages. Based on comprehensive surveys conducted in four ASEAN economies (Indonesia, the Philippines, Thailand and Vietnam), and received approximately 700 responses. Based on the surveys, this paper attempts to identify rigorously which linkages are statistically significant for innovation. This paper is particularly concerned with the proximity between firms and partners, and attempts to examine whether neighboring or remote partners are more related to their innovation. By rigorous econometric analysis, among the production linkages, MNCs are identified. Government owned financial institutions government/public research intuitions are found to be significant among research linkages. As for human linkages, recruiting managers as well as engineers from various sources such as MNCs, JVs or other large firms are found significant. Related to the proximity, government-owned financial institutions located in the neighboring areas and remote government/public agencies or government/public research institutions are found to be significant. This paper also identified required linkages for firms to upgrade from low to high level of innovation.

1. INTRODUCTION

East Asian economies have been achieving remarkable economic growth. One of

their success factors lies in the agglomeration of firms in this region, giving it the moniker, "Factory of the World." Multi-national corporations (MNCs) have been establishing their factories or branch headquarters in this region since the middle of 1980s in order to exploit relatively cheap natural resources such as labor, land and raw materials. MNCs combined these resources with their technologies, including business management and engineering. This initiated a "big bang" of economic growth in the region, and since then more firms have been agglomerating in this region. The agglomeration created the following two transformations of the regional economies: (i) MNCs' affiliated firms, such as parts suppliers and supporting firms, were founded in locations near the MNCs; and (ii) local firms were established by local business people, due to technology transfer from MNCs.[1] Technology transfer consists of various forms such as formal and informal; the former includes local firms learning technology and know-how from MNCs, whereas in the latter, they learned technology from backward engineering or copying new products. By repeating these processes of agglomeration and upgrading, the areas then became industrial clusters, and sustainable economic growth is being achieving exactly as described by the endogenous growth theory. Industrial clusters in these areas originated as production bases. But further agglomeration itself created the power to transform the clusters. The more firms or factories agglomerated, the more the flow of information grew and became enriched. This resulted in the second explosion in the areas. In other words, agglomeration created the transformation from quantity to quality in these areas. This is the second developing process which can be viewed from the point of innovation and upgrading. The aftermath of these processes is qualitative transformation in these areas, that is, more innovation and upgrading are being achieved. Previous studies have clearly identified these

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[1] The agglomeration is hypothesized by Kuchiki and Tsuji (2005), (2008) and (2009) as the Flowchart approach, which represents the requirements of industrial clustering. This approach vividly describes the clustering process in East Asia as follows: first MNCs, referred to as anchor firms, establish their factories in industrial estates or parks, and then parts suppliers and supporting firms are established near them. This is origin of industrial clusters in an area.

activities as increasing.[2]

The main issues in this context are how information on technology and management has been transmitted among local entities in the region, and how information has contributed to innovation performances in the region. This mechanism consists of following two elements: (i) sources of information from the view point of the recipients; and (ii) contents of information conveyed in the mechanism. The former can be termed information linkages. Examples include MNCs, customers, suppliers, and competitors in the regions or government/public agencies such as universities, or regional research institutions. The latter is related to technology, management, skills of engineers and workers, etc. It is difficult, however, to distinguish these two elements clearly, and accordingly this paper attempts to identify which transmission channels or linkages contributes more significantly to innovation performances of firms in their areas.

Other issues are related to the relevancy between agglomeration and innovation. In this context, Fujita, Krugman, and Venables (1999), Krugman (1991), Porter (1980), Markusen (1996) and Saxenian (1994) present representative theories. The essence of these theories lies in the flow of information generated by agglomeration; that is, in areas where firms, research institutions and other organizations agglomerate, collaboration and competition among those entities and organizations create positive motions for spontaneous upgrading or innovation. In our previous papers, we verified the relationship between agglomeration and innovation by applying the Flowchart approach initiated by Kuchiki and Tsuji (2005), (2008), (2009). This paper, on the other hand, takes a different approach: we focus instead on the geographic proximity of linkages, that is, if neighboring or remote linkages have larger effects on innovation. Firms attempt to find and connect to partners for transactions in the market or for

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[2] Tsuji, Miyahara and Ueki (2008), Tsuji and Miyahara (2009).

information related to innovation, and since partners are scattered all over an area, firms can choose them according to partners' locations as well as their specific advantages. This paper thus examines their proximity.

To do so, 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 such as technology, know-how, management, marketing and market, and on the sources of information such as university, public agencies, industry/trade organizations, and public R&D institutions as well as global partners such as MNCs. Based on the surveys, this paper attempts to identify rigorously which linkages are statistically significant for innovation.

This paper consists of the five sections. Section 2 provides the results of survey conducted on four economies and shows the current situation of innovation and the sources of information that create innovation. In Section 3, we present the analytical methodology and estimation models. Their results are also extensively discussed in this section. The analysis here is based on the cross-section static data, but Section 4 utilizes a more dynamic methodology and analyzes factors that move these economies to innovative stages. A brief concluding discussion is provided in the final section. The conclusion is that technology transfer to firms seems to occur through human resources rather than production or research networks. This is an important conclusion obtained by this paper.

2. SURVEYS AND DATA

First, we present here the result of the survey conducted in November and December 2009 in four ASEAN economies (Indonesia, the Philippines, Thailand and Vietnam) that form the basis of the analysis in this study.

2.1. Innovation

(a) Product innovation

This mail survey sought to obtain fundamental data on the innovative activities as well as innovation performances of respondents. Following Schumpeter (1934), this paper defines two types of innovation as product and process innovation. First, the following four types of product innovation were asked 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 the existing technologies

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

Schumpeter defined supplying new products or services as examples of product innovation, but this paper adopts the more detailed categories. From (1.a) to (1.d) the categories increase in the level of innovation. That is, we asked establishments about activities from simple improvement of existing products/services to creating entire new products/services based on new technologies. The distribution of product innovation in different economies is summarized in Table 1 and Figure 1. Firms in each economy have been accomplishing quite more innovative achievements, which is quite different from those of previous two surveys.

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
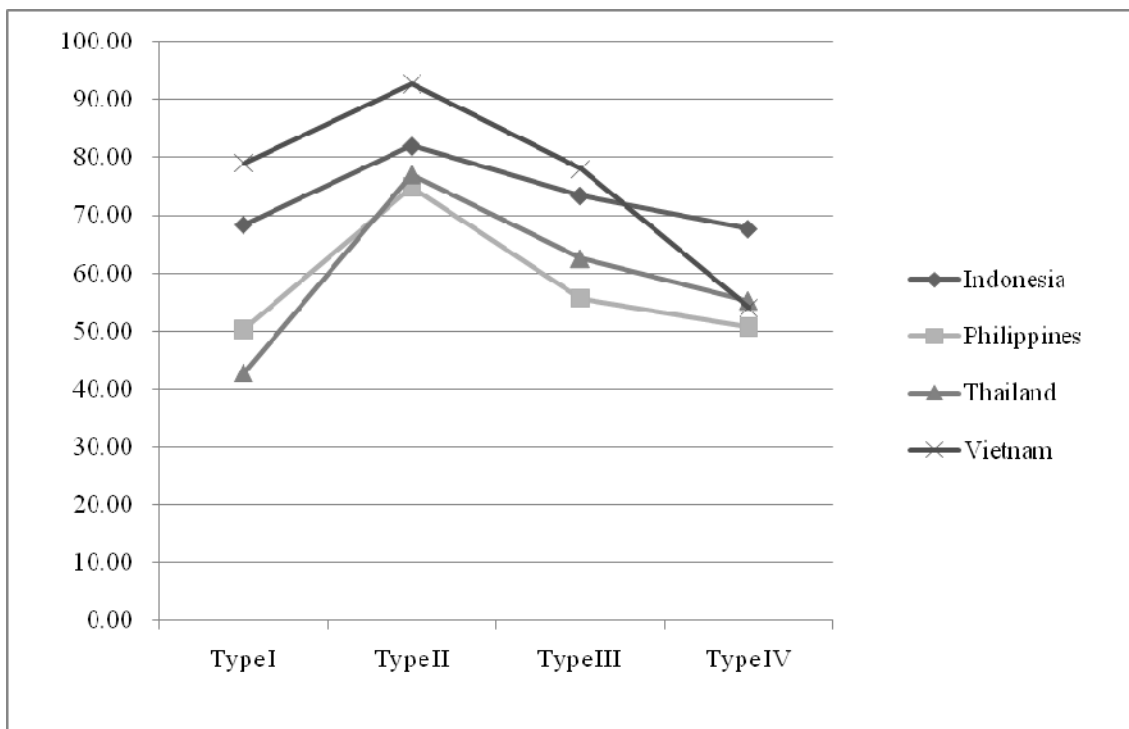
Figure 1 Product Innovation

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

(b) Process innovation

Schumpeterian definition of process innovation consists of (i) introducing new production or supply methods; (ii) obtaining new customers; (iii) finding new suppliers;

and (iv) establishing new managerial organization. In the questionnaire, the following question was related to process innovation:

2. *Has your establishment achieved substantial organizational changes in the following managerial systems?*

 (a) Sales and marketing

 (b) Quality control

 (c) Production control and management

 (d) Inventory control and management

In general, process innovation is not necessarily limited to these categories, but this paper focuses on the above four. Responses related to process innovation are presented in Table 2 and Figure 2. Again most economies show better performances than the previous surveys.

Table 2 Process Innovation

	Indonesia		Philippines		Thailand		Vietnam		Total	
	freq.	%	freq.	%	freq.	%	freq.	%	freq.	%
Sales and marketing	118	84.89	111	54.68	73	76.04	275	91.67	577	78.18
Quality control	131	94.24	147	72.41	82	85.42	259	86.33	619	83.88
Production control and management	122	87.77	152	74.88	75	78.13	249	83.00	598	81.03
Inventory control and management	110	79.14	132	65.02	75	78.13	235	78.33	552	74.80
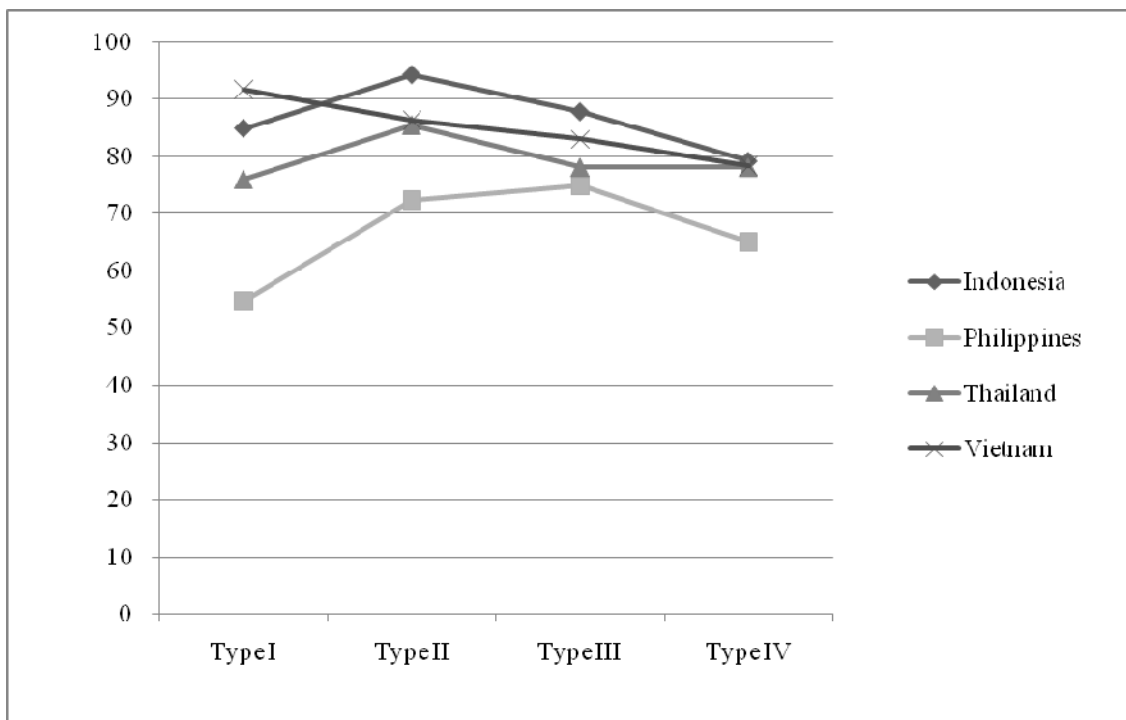
Figure 2 Process Innovation

Notes: Type I   Sales and marketing
                   Type II   Quality control
                   Type III   Production control and management
                   Type IV   Inventory control and management

2.2. Characteristics of Respondent Firms

Table 3 indicates the distribution of the year of establishment. Most firms are 11-20 years old, except in Vietnam, which has younger firms. Table 4 shows the type of establishment. In each economy, factory/plant accounts for more than 50 percent, followed by headquarters/main office. These two categories make up more than 90 percent of all establishments. The capital structure of establishments is shown in Table 5, which are mostly local owned. Tables 6 and Table 7 show the size of small and medium-sized enterprises (SMEs) in terms of employees and capital, respectively. The former shows the firms with less than 199 employees account for more than 50% of all firms, whereas the latter shows a different distribution. That is, larger firms with more than US$100,000 dominated. Thus the respondents belong to larger firms. Table 8

shows the distribution of the categories of industry to which the SMEs belong; each economy has a different distribution. In Indonesia and the Philippines, light industries such as food, beverages, and tobacco or apparel are dominant, whereas in Thailand and Vietnam, assembling and processing industries such as automobile and machinery are the largest categories.

Table 3 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 4 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 5 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 6 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 7 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 8 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 in an area, including production, research, and human linkages. The production linkages are related to sources through market transactions such as purchasing and sales, and these linkages are divided into the following two categories: (i) forward and (ii) backward.[3] The former indicates that firms receive information from their upstream customers, whereas the latter indicates that firms receive information from their downstream suppliers. Research linkages indicate the information flow from universities or public research institutions and so on.

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[3] Theoretical as well as empirical research has been conducted to establish fundamental theories or to identify such linkages. 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.

In order to identify the sources of information, we used the following questions for production linkages:

3. *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)

Research linkages: new technologies and information

    (e) Technical assistance by government/public agency

    (f) Technical assistance by industrial/trade organizations

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

    (h) Technical assistance by government owned financial institutions

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

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

Human linkages: provided by support organizations such as seminar, lecture, training, or consultant/expert dispatched or hired by them

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

    (l) Dispatch your engineers to universities/higher educational institutions

    (m) Dispatch your engineers to government or public research institutes

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

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

    (p) Headhunt of top management from MNCs, JVs, or large local firms

Other sources

    (q) Technical information obtainable from academic publication

    (r) Technical information obtainable from patents

(s) Introduction of "foreign-made" equipments and software

(t) Reverse engineering

(u) Participation in conferences, trade fairs, exhibitions

(v) Licensing technologies from other firms

In our analysis below, we focus on which linkages are statistically significant to innovation performances.[4] In addition, this paper is also interested in the relevancy between the number of linkages and innovation, that is, we analyze if firms with a greater variety of linkages achieve more innovations.

2.4. Proximity to Information Linkages

This paper attempts to analyze whether and how information linkages contribute to innovation performances of respondents. In this context we are interested in how firms are connected with partners. In order to analyze this question, we asked about the frequency of communications and the distance between them. It is impossible to identify the contents of communications, but we take these two factors as proxy of intimate relationships. Here we are particularly concerned with the distance between firms and partners since it represents an intimate relationship.

In relation to question 3, we prepare with sub-questions asking the locations of sources attached to the sources, namely,

4. *In which are the sources located?*

   (a) in the area

   (b) in the country

   (c) in other ASEAN

   (d) in East Asia

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[4] 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).For example, see Tsuji, Miyahara and Ueki (2008), Tsuji and Miyahara (2009), (2010).

(e) in other country

If firms reply "In the area," this implies that sources are located closer to firms. These questions are fully utilized in the analysis below.

3. ESTIMATION OF PROXIMITY OF INFORMATION LINKAGES

Here we use rigorous econometric analysis to investigate the hypothesis that industrial clustering promotes innovation in the areas. In so doing, based on the framework explained in the previous sections, we identify the linkages that contribute to respondents' innovation.

3.1. Methodology of Analysis

We chose research sites in cluster areas in four ASEAN economies, and the firms to which we sent questionnaire are considered to be located in the clusters. The usual methodology of this kind analysis is to choose two groups of firms inside and outside the clusters and then to compare their innovation achievements.[5] Since all firms surveyed are inside clusters, we cannot use this method, and thus we take the proximity of linkages, that is, geographical proximity between firms and sources, into consideration. The underlying hypothesis in this context is that if the linkages or the partners of innovation activities are closed to each other, then the information flow inside an area is "dense," and this makes the area more innovative.

In order to accommodate the proximity into the estimation equations, we construct the variables related to sources as follows: Question 4 asks the exact location of sources, and each source takes values from one to five depending upon location of sources. If it is located "in the area," the source takes five, and if it is "in the country," it takes four, and so on. Because of the construction, if estimated coefficients take a positive sign,

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[5] See Tsuji and Miyahara (2010a), for example.

then the sources are located close to respondents.

3.2. Estimation Models

(a) Dependent variables

The first estimation models are aimed to verify the relevance between proximity of the linkages and innovation. In so doing, we estimate three models based on the categories of innovations, namely, product and process innovation and total of these two. We take the number of innovation they achieved, that is, the number of "yes" in question 1 for product innovation and question 2 for process innovation. The sum of these two innovations is taken as a dependent variable in total innovation.

(b) Independent variables

As independent variables, we use following variables; (i) attributes of respondent such as year of establishment, size of firms in term of employment, and categories of industry; (ii) sources of information such as production linkages, research linkages, and human linkages; (iii) number of sources; and (iv) country dummies. "(iii) Number of sources" refer to linkages that a particular firm replies to have in question 3 ("Sources of knowledge and new technologies") in the previous section.

In actual estimation, we examine two kinds of models, that is, full and selected models; the former contains all sources as well as characteristics of firms, whereas the latter includes only a specific source in addition to firm characteristics. The reason for this is to focus on the particular source and to examine the robustness of estimates. Summary statistics are shown in Table 9.

Table 9 Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Dependent variables					
Number of product innovation	738	2.729	1.313	0	4
Number of process innovation	738	3.179	1.244	0	4
Total number of innovation	738	5.908	2.166	0	8
Significant change in packaging or appearance design	738	0.644	0.479	0	1
Significant improvement of an existing product/service	738	0.837	0.369	0	1
Development of a totally new product/service based on the existing technologies for your establishment	738	0.690	0.463	0	1
Development of a totally new product/service based on new technologies for your establishment	738	0.558	0.497	0	1
Characteristics					
Year of 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
Proximity of sources (In the Area 6, In the country 5, In the ASEAN 4, In East Asia 3, In Europe or US 2, In other countries 1)					
(a) Internal sources of information and own R&D efforts	738	2.967	2.624	0	6
(b) Cooperation with local firms (100% local capital)	738	3.141	2.804	0	6
(c) Cooperation with MNCs (100% non-local capital)	738	1.699	2.109	0	6
(d) Cooperation with Joint Ventures	738	2.047	2.474	0	6
(e) Technical assistance financed/provided by government/public agency	738	1.911	2.644	0	6
(f) Technical assistance financed/provided by industrial/trade organizations	738	1.928	2.654	0	6
(g) Technical assistance financed/provided by community organizations (NGOs or NPOs)	738	1.744	2.631	0	6
(h) Technical assistance financed/provided by government owned financial institutions	738	1.453	2.497	0	6
(i) Cooperation with universities/higher educational institutions	738	1.520	2.512	0	6
(j) Cooperation with government or public research institutes	738	1.397	2.422	0	6
(k) University professors or researchers personally closed contracts with your firm	738	1.291	2.340	0	6
(l) Dispatch your engineers to universities/higher educational institutions	738	1.153	2.225	0	6
(m) Dispatch your engineers to government or public research institutes	738	0.970	2.093	0	6
(n) Recruitment of middle-ranking personnel or mid-carrier engineers	738	3.953	2.656	0	6
(o) Recruitment of senior engineers retired from MNCs, JVs, or large local firms	738	1.511	2.399	0	6
(p) Headhunt of top management from MNCs, JVs, or large local firms	738	1.220	2.112	0	6
(q) Technical information obtainable from academic publication	738	2.477	2.605	0	6
(r) Technical information obtainable from patents	738	2.175	2.563	0	6
(s) Introduction of "foreign-made" equipments and software	738	1.995	2.182	0	6
(t) Reverse engineering	738	1.172	2.107	0	6
(u) Participation in conferences, trade fairs, exhibitions	738	2.980	2.502	0	6
(v) Licensing technologies from other firms	738	1.725	2.421	0	6
Country dummy variables					
Dummy (Indonesia)	738	0.188	0.391	0	1
Dummy (Thai)	738	0.130	0.337	0	1
Dummy (Vietnam)	738	0.407	0.492	0	1

3.3. Result of Estimation I: Basic Models

Let us discuss the results of estimation. Table 10 provides the results of estimation of total innovation, product innovation and process innovation. As for total innovation, only two linkages, (g) "technical assistance by community organizations (NGOs or NPOs)" and (h) "technical assistance by government owned financial institutions," were found to be significant in both of full and selected models. Since the signs of these two sources are positive, firms utilize the neighboring linkages with these sources, such as community organizations (NGOs or NPOs) and government-owned financial institutions.

As for the estimation of product innovation, the same linkages are also significant, which implies they use linkages closer to them. In the estimation of process innovation, on the other hand, the production linkages of (b) "cooperation with (technology transfer from) local firms" and the human linkages such as of (o) "recruitment of senior engineers retired from MNCs, JVs, or large local firms" are significant. As for the proximity, since the former (latter) has a positive (negative) sign, firms connect to neighboring local firms for technology transfer, while they hire senior engineers from remote MNCs or other large local firms. These are consistent with realty, since MNCs or larger firms may locate themselves in remote industrial parks or estates.

In addition, in all three models, the number of linkages is significant, and the more linkages, the more innovation firms achieve. This is also consistent with reality.[6]

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[6] In the estimation of the basic models, the variables with proximity are already explained, that is, they take values from one to five. We also constructed the variables in such a way that they take a value of one if they replied "yes" to "in the Area," whereas they take 0 otherwise. We differentiate depending upon locating in an area or not. The results are almost similar except (h) technical assistance by government owned financial institutions being not significant for product innovation, while (q) headhunt of top management from MNCs, JVs, or large local firms being significant for total and product innovation. There is no change in process innovation.

Table 10 Estimation Results of Basic Models

	Total innovation		Product innovation		Process innovation	
	Full	Selected	Full	Selected	Full	Selected
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						
Production Linkage						
(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)						
Research linkage						
(e) Technical assistance financed/provided by government/public agency						
(f) Technical assistance financed/provided by industrial/trade organizations						
(g) Technical assistance financed/provided by community organizations (NGOs or NPOs)	*	**	**	**		
(h) Technical assistance financed/provided by government owned financial institutions	**	**	**	**		
(i) Cooperation with universities/higher educational institutions						
(j) Cooperation with government or public research institutes						
Human linkage						
(k) University professors or researchers personally closed contracts with your firm						
(l) Dispatch your engineers to universities/higher educational institutions						
(m) Dispatch your engineers to government or public research institutes						
(n) Recruitment of middle-ranking personnel or mid-carrier engineers						
(o) Recruitment of senior engineers retired from MNCs, JVs, or large local firms					[**]	[*]
(p) Headhunt of top management from MNCs, JVs, or large local firms						
Number of Sources	***	***	**	***	***	***
Dummy variable (Indonesia)	***	***	**	**	***	***
Dummy variable (Thai)						
Dummy variable (Hanoi)						
Dummy variable (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.

3.4. Result of Estimation II: Research and Human Linkages

In the previous estimation, the production linkages are found to be less significant except cooperation with local firms. In particular, the linkage with MNCs is not identified as significant, which is different from the results obtained in our previous papers, such as Tsuji and Miyahara (2009), (2010). Next, in order to focus more on research and human linkages, we estimate the same models in which the production linkages are removed. The results of these models are shown in Table 11. As for the result of total innovation, the research linkages of remote (a) government/public agencies and (h) neighboring government-owned financial institutions are found to be significant. Among the human linkages, (o) hiring senior engineers from remote MNCs and large firms proved significant. These firms are located rather in the remote areas.

Regarding the linkages of product and process innovation, (h) neighboring government-owned financial institutions again are significant in all the models. Clear differences between two innovations are such that product innovation is related to recruiting middle-ranked engineers from neighboring firms, whereas process innovation showed the significant linkages with (a) government/public agencies and (o) recruiting senior engineers from remote MNCs/large firms, which are located in the remote areas.

These results can be interpreted in the following way: product innovation requires middle-ranked engineers from neighboring firms, whereas process innovation requires senior engineers from remote larger firms such as MNCs.

In all of three models, the number of linkages is again significant, and the variety of the linkages promotes innovation.

Table 11 Estimation Results of Research Linkages

	Total innovation		Product innovation		Process innovation	
	Full	Selected	Full	Selected	Full	Selected
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						
(e) Technical assistance financed/provided by government/public agency	[**]	[***]	[*]		[**]	[**]
(f) Technical assistance financed/provided by industrial/trade organizations						
(g) Technical assistance financed/provided by community organizations (NGOs or NPOs)			*			
(h) Technical assistance financed/provided by government owned financial institutions	***	***	***	***	**	**
(i) Cooperation with universities/higher educational institutions						
(j) Cooperation with government or public research institutes			[*]			
(k) University professors or researchers personally closed contracts with your firm						
(l) Dispatch your engineers to universities/higher educational institutions						
(m) Dispatch your engineers to government or public research institutes						
(n) Recruitment of middle-ranking personnel or mid-carrier engineers			*	*		
(o) Recruitment of senior engineers retired from MNCs, JVs, or large local firms	[*]	[**]			[***]	[***]
(p) Headhunt of top management from MNCs, JVs, or large local firms						
Number of Sources	***	***	***	***	***	***
Dummy variable (Indonesia)	**	***	**	**	***	***
Dummy variable (Thai)						
Dummy variable (Vietnam)	***	***	**	***	***	***

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.

3.5. Results of Estimation III: Innovation in Different Industries

Here we examine whether different linkages are identified in forms of different industries. Again we focus on the research and human linkages, and examine their proximity.　In the industry-wise estimation, the number of samples in each industry is small, which makes the estimation of total innovation difficult. We conducted here only

the selected model; that is, variables such as the firm attributes and a particular linkage are used.

The results of estimation are shown in Table 12 for innovation as a whole, in Table 13 for product innovation and in Table 14 for process innovation. It is rather difficult, however, to identify the some coherent trend concerning proximity in all industries, since even a single linkage has a different direction for a different industry. In Table 12, only government/public agency has all negative trends for significant industries such as (I) food, beverage and tobacco, (VI) iron and steel, and (VII) machinery. The automobile industry has all positive trends for (h) government owned financial institutions and (n) recruiting middle-ranked engineers. The number of the linkages is not significant for all industries, and in particular for industries related to natural resources.

As for product innovation, (I) food, beverage and tobacco and (IX) precision instruments, automobile, auto parts, other transportation equipment have only significant neighboring linkages, while (V) plastic, rubber products, other non-metallic mineral products and (VI) iron, steel, non-ferrous metals, metal products have rather remote linkages for innovation. In particular, food is a typical industry with local features, and natural resource industry has the same tendency as mentioned in total innovation. The number of linkages has the almost same tendency. The results of process innovation are summarized in Table 14, but it is rather difficult to draw conclusions with consistent interpretations.

Table 12 Research Linkages in Different Industry (Total innovation)

		I	II	III	IV	V	VI	VII	VIII	IX	X
	Age (establishment)						*			[**]	
	Number of full-time employees (logarithmic)		*			***	*	**	***	***	
(e)	Technical assistance financed/provided by government/public agency	[**]					[**]	[***]			
(f)	Technical assistance financed/provided by industrial/trade organizations					[***]					
(g)	Technical assistance financed/provided by community organizations (NGOs or NPOs)										*
(h)	Technical assistance financed/provided by government owned financial institutions									**	
(i)	Cooperation with universities/higher educational institutions					[*]					
(j)	Cooperation with government or public research institutes	*						[**]			
(k)	University professors or researchers personally closed contracts with your firm	[**]					*				
(l)	Dispatch your engineers to universities/higher educational institutions			[**]				**			
(m)	Dispatch your engineers to government or public research institutes							[**]			**
(n)	Recruitment of middle-ranking personnel or mid-carrier engineers						[**]			*	
(o)	Recruitment of senior engineers retired from MNCs, JVs, or large local firms				[**]		[*]	**			
(p)	Headhunt of top management from MNCs, JVs, or large local firms										
	Number of Sources	***	***	***		**		**	*		
	Dummy variable (Indonesia)									***	
	Dummy variable (Thai)			[**]				**		***	[*]
	Dummy variable (Vietnam)				*	***	***		***	***	

Note 1: I (Food, beverages, tobacco), II (Textiles, Apparel, leather), III (Wood, wood products, paper, paper products, printing), IV (Coal, petroleum products, chemicals, chemical products), V (Plastic, rubber products, other non-metallic mineral products), VI (Iron, steel, non-ferrous metals, metal products), VII (Machinery, equipment, tools), VIII (Computers & computer parts, other electronics & components), IX (Precision instruments, automobile, auto parts, other transportation equipments and parts), X (Others).

Note 2: ***, ** and * indicate the significance level at the 1%, 5% and 10%.

Note 3: [   ] indicates that the sign of an estimated coefficient is negative.

Table 13 Research Linkages in Different Industry (Product innovation)

		I	II	III	IV	V	VI	VII	VIII	IX	X
	Age (establishment)				[*]					[**]	
	Number of full-time employees (logarithmic)				**	***			***	**	**
(e)	Technical assistance financed/provided by government/public agency										
(f)	Technical assistance financed/provided by industrial/trade organizations	**			[*]	[***]					
(g)	Technical assistance financed/provided by community organizations (NGOs or NPOs)			*			**				**
(h)	Technical assistance financed/provided by government owned financial institutions							*		*	
(i)	Cooperation with universities/higher educational institutions					[**]					
(j)	Cooperation with government or public research institutes	**					[**]	[*]			
(k)	University professors or researchers personally closed contracts with your firm										
(l)	Dispatch your engineers to universities/higher educational institutions							*			
(m)	Dispatch your engineers to government or public research institutes				**		[***]				
(n)	Recruitment of middle-ranking personnel or mid-carrier engineers	**					[**]			**	
(o)	Recruitment of senior engineers retired from MNCs, JVs, or large local firms						[*]				
(p)	Headhunt of top management from MNCs, JVs, or large local firms										
	Number of Sources	***	***	**		*		**			
	Dummy variable (Indonesia)								[**]	*	
	Dummy variable (Thai)			[*]		[**]		**		*	
	Dummy variable (Vietnam)					***	***	*	**		

Note 1: I (Food, beverages, tobacco), II (Textiles, Apparel, leather), III (Wood, wood products, paper, paper products, printing), IV (Coal, petroleum products, chemicals, chemical products), V (Plastic, rubber products, other non-metallic mineral products), VI (Iron, steel, non-ferrous metals, metal products), VII (Machinery, equipment, tools), VIII (Computers & computer parts, other electronics & components), IX (Precision instruments, automobile, auto parts, other transportation equipments and parts), X (Others).

Note 2: ***, ** and * indicate the significance level at the 1%, 5% and 10%.

Note 3: [ ] indicates that the sign of an estimated coefficient is negative.

Table 14 Research Linkages in Different Industry (Process innovation)

	I	II	III	IV	V	VI	VII	VIII	IX	X
Age (establishment)			*	*			**	*		
Number of full-time employees (logarithmic)			**		***	**	**	***	***	
(e) Technical assistance financed/provided by government/public agency	[*]					[**]	[***]			
(f) Technical assistance financed/provided by industrial/trade organizations					[**]					
(g) Technical assistance financed/provided by community organizations (NGOs or NPOs)										
(h) Technical assistance financed/provided by government owned financial institutions									**	*
(i) Cooperation with universities/higher educational institutions										
(j) Cooperation with government or public research institutes							[***]			
(k) University professors or researchers personally closed contracts with your firm	[***]					**				
(l) Dispatch your engineers to universities/higher educational institutions			[**]				*			
(m) Dispatch your engineers to government or public research institutes										**
(n) Recruitment of middle-ranking personnel or mid-carrier engineers						[**]				
(o) Recruitment of senior engineers retired from MNCs, JVs, or large local firms				[**]			**	[*]		
(p) Headhunt of top management from MNCs, JVs, or large local firms					*					
Number of Sources		**	**		**		**	**	[**]	
Dummy variable (Indonesia)									**	
Dummy variable (Thai)			[*]		*				***	[**]
Dummy variable (Vietnam)	**			*	*			***	***	

Note 1: I (Food, beverages, tobacco), II (Textiles, Apparel, leather), III (Wood, wood products, paper, paper products, printing), IV (Coal, petroleum products, chemicals, chemical products), V (Plastic, rubber products, other non-metallic mineral products), VI (Iron, steel, non-ferrous metals, metal products), VII (Machinery, equipment, tools), VIII (Computers & computer parts, other electronics & components), IX (Precision instruments, automobile, auto parts, other transportation equipments and parts), X (Others).

Note 2: ***, ** and * indicate the significance level at the 1%, 5% and 10%.

Note 3: [   ] indicates that the sign of an estimated coefficient is negative.

4. CHARACTERIZATION OF INNOVATION PROCESS

The analysis of this paper is based on the cross-section data, but here some dynamic flavor will be introduced in this section.

4.1. Linkages Charactering the Level of Innovation

The categories of innovation related to product innovation are defined as (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 the existing technologies, and (d) development of a totally new product/service based on new technologies. These categories can be viewed as the development from low to high level of innovation. In order to upgrade the level of innovation, we examine what kinds of linkages are required, and characterize these categories of innovation by utilizing probit analysis. The methodology is as follows: product innovations in each category are taken as dependent variables and information linkages as well as attributes of respondents as independent variables. Their relevancy is estimated.[7] The analysis is limited only to product innovation.[8] The results of the probit analysis are shown in Table 15.

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[7] In general, by normalizing, some category is taken as standard. In the actual estimation, the normalizing method did not provide good results, and thus here we present estimations without normalization. Care should be taken for the interpretation of estimates, namely, the comparison of numerical values of estimates do not have any meaning, and we only compare signs and significance levels of estimates.

[8] As for process innovation listed in section 2.1., it is rather difficult to arrange them according to quality of innovation.

Table 15 Estimation Results of Characterization of Innovation

	Case (I)		Case (II)		Case (III)		Case (IV)	
	Full	Selected	Full	Selected	Full	Selected	Full	Selected
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								
Production Linkage								
(a) Internal sources of information and own R&D efforts	[**]	[**]		*	[*]			
(b) Cooperation with local firms (100% local capital)								
(c) Cooperation with MNCs (100% non-local capital)	*	*					**	**
(d) Cooperation with Joint Ventures								
Research linkage								
(e) Technical assistance financed/provided by government/public agency		[**]					[**]	[***]
(f) Technical assistance financed/provided by industrial/trade organizations								
(g) Technical assistance financed/provided by community organizations (NGOs or NPOs)								*
(h) Technical assistance financed/provided by government owned financial institutions	***	***		**				
(i) Cooperation with universities/higher educational institutions	[**]	[**]						
(j) Cooperation with government or public research institutes							[***]	[***]
Human linkage								
(k) University professors or researchers personally closed contracts with your firm								
(l) Dispatch your engineers to universities/higher educational institutions	[*]							
(m) Dispatch your engineers to government or public research institutes	**	**						**
(n) Recruitment of middle-ranking personnel or mid-carrier engineers			*	***				
(o) Recruitment of senior engineers retired from MNCs, JVs, or large local firms								
(p) Headhunt of top management from MNCs, JVs, or large local firms							**	**
Number of Sources		**		***	**	***	*	**
Dummy variable (Indonesia)	*	**					**	**
Dummy variable (Thai)								
Dummy variable (Vietnam)	***	***	***	***	**	***		

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

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

Note 3: Case (I): Significant change in packaging or appearance design.
Case (II): Significant improvement of an existing product/service.
Case (III): Development of a new product/service based on the existing technologies.
Case (IV): Development of a new product/service based on new technologies.

The interpretation of this result is as follows: firms with significant linkages tend to be more highly achieving of innovation in this category. In order to understand the aim of this estimation, let us take as an example (e) technical assistance by government/public agency, which is negatively significant for innovation category (a) change in packaging and category (d) development of new product with new technology. This implies that firms which own this linkage are more likely to be classified either as having the lowest or as the highest level of innovations. Again the negative sign implies that government/public agency is located in the remote area. Similarly, (i) the linkage with universities and public agencies is negatively significant, which indicates that firms with this neighboring linkages are more likely to be classified to achieve the level of category (a) innovation.

Thus, firms attempt to perform the lowest level of innovation category (a) require (e) technical assistance by remote government and public agencies, (h) technical assistance by government owned financial institutions, (i) tie with remote university and, (m) dispatch of engineers to neighboring government or public research institutes. As for the second level of category (b) innovation, (h) technical assistance by neighboring government-owned financial institutions, and (n) recruitment of middle-ranking personnel or mid-carrier engineers are identified. There are no sources identified for innovation category (c). Regarding the highest level of category (d) innovation, two remote sources such as (a) government/public agency for technical assistance are required, while neighboring linkages such as (m) government or public research institutes to which to dispatch engineers and (p) MNCs, large local firms for headhunting of top management, are also required.

410

In sum, firms classified as achieving the lowest level of innovation tend to have linkages such as (i) remote universities/higher education institutions, firms achieving as the second lowest own the neighboring linkages such as (n) recruiting mid-ranked engineers, and firms achieving the highest level of innovation tend to have neighboring linkages of MNC or large firms for headhunting of top management.

4.2. Linkages for Upgrading Innovation Level

The previous analysis characterizes the level of innovation by linkages, and in this section we attempt to identify which linkages are required for firms to evolve from the lowest to the highest level of innovation by using ordered logit analysis. The result of estimation is summarized in Table 16. According to this estimation, the following linkages are extracted as key factors:

- Production linkages:

    Neighboring MNCs

- Research linkages:

    Remote government/public agencies for technical assistance

    Remote government or public research institutions for cooperation

- Human linkages:

    Neighboring government or public research institutions for sending engineers

    Neighboring MNCs or large firms for headhunting top management

- Number of linkages

    In order to focus more on the partners of the linkages, the followings are summarized as important:

MNCs or large firms (neighboring)

Government/public agencies (remote)

Government or public research institutions (neighboring and remote)

Table 16 Estimation Result of Upgrading Innovation

	Full	Selected
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		
Production Linkage		
(a) Internal sources of information and own R&D efforts		
(b) Cooperation with local firms (100% local capital)		
(c) Cooperation with MNCs (100% non-local capital)	**	**
(d) Cooperation with Joint Ventures		
Research linkage		
(e) Technical assistance financed/provided by government/public agency	[*]	[**]
(f) Technical assistance financed/provided by industrial/trade organizations		
(g) Technical assistance financed/provided by community organizations (NGOs or NPOs)		
(h) Technical assistance financed/provided by government owned financial institutions		
(i) Cooperation with universities/higher educational institutions		
(j) Cooperation with government or public research institutes	[**]	[**]
Human linkage		
(k) University professors or researchers personally closed contracts with your firm		
(l) Dispatch your engineers to universities/higher educational institutions		
(m) Dispatch your engineers to government or public research institutes	*	**
(n) Recruitment of middle-ranking personnel or mid-carrier engineers		
(o) Recruitment of senior engineers retired from MNCs, JVs, or large local firms		
(p) Headhunt of top management from MNCs, JVs, or large local firms	*	**
Number of Sources	***	***
Dummy variable (Indonesia)	**	***
Dummy variable (Thai)		
Dummy variable (Vietnam)		***

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

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

Thus MNCs or large firms that are located in the area provide technological information through market transactions as well as supplying managerial human resources for executives, while public agencies, whether they are located in neighbor or remote, contribute to innovation by technical assistance, consulting, joint research or training. Most of these are consistent with the realty, and these results can provide practical information for policy for promoting innovation.

5. CONCLUSION

Economic development in the East Asian economies called the "growth centers of the global economy" is achieved by the Factory of the World. If their economic growth is due to the increase in factors of production such as capita and labor, then sooner or later its growth will face the serious limit, as Krugman predicted. In order to maintain its sustainability, the economies have to transform in such a way that their growth is contributed by the total factor productivity which is realized by technological development. Thus innovation and upgrading are required for their further economic development. Using this framework, this paper sought to examine the current stage of innovation and upgrading of firms in four ASEAN economies (Indonesia, the Philippines, Thailand and Vietnam), and identify their causes and reasons. By making use of survey data, this paper attempted to identify linkages that provide necessary information to firms in the area. In contrast with our previous studies, this survey revealed quite active innovation activities in all economies, and that most of firms are achieving some categories of innovation. Since the four economies are different from one another in the stages of economic development and innovation, this variety makes

the coherent results to be yield. The following results can be summarized by considering all estimation results in this paper:

(i) As for sources of information, among the production linkages, MNCs are also identified, which is the same conclusion drawn by other studies. Not only through market transactions but also MNCs are sources of supplying high-ranked management to firms in the area. The latter seems to be consistent with reality, since MNCs have advanced managerial systems and the experiences of working there provide high ability to managers.

Among the research linkages, the various estimation models extract government owned financial institutions as significant sources which provide not only financial but also technical assistance. Innovation and upgrading require funds for R&D activities, and this makes these sources indispensable. In addition, government/public agencies or government/public research intuitions are found to be significant. This seems natural, since in these economies, private or semi-public agencies such as business/trade or community organizations are less popular.

Forms of human linkages are recruiting managers as well as engineers from various sources such as MNCs, JVs or other large firms, which shows that personnel with professional skills are still scarce resources in these economies. Technology transfer to firms seems to be done through human resources rather than production networks.

(ii) The estimation results do not present consistent conclusion concerning proximity, and it is difficult to obtain a general hypothesis. One neighboring source is found significant in one estimation model, while the same source in the remote area becomes feasible in another model. Only government-owned financial institutions,

however, are significant in the neighboring areas, and this is consistent with reality, as already mentioned. Remote government/public agencies or government/public research institutions are found to be significant, and the reason is that its number is not large and they are located in the capitals or other prioritized regions. University and higher educational institutions are not significant; the role of university should be reconsidered for making strategy of the local innovation system.

(iii) Not only the distance but also the frequency of communication between firms and partners of linkages is not significant in any models. Because of this reason this paper fully utilized responses to the proximity in the questionnaire as explained in section 3.3. The distance or frequency does not necessarily indicate the intimate relationships or contents of communications, but it seems to be difficult to definite results in this type of questionnaire.[9]

From these results, the directions of future research are suggested in order to make this approach fruitful.

(iv) This paper does not capture the importance of the production linkages as sources of innovation information. According to in-depth interviews conducted at the same time of the survey, it is reported widely that firms obtain valuable information from not only customers but also suppliers. They receive it not only from the formal but also informal channels and measures. The formal channels imply that MNCs, for example, accept trainees or send their engineers to firms, while informal measures indicate they learn by doing. Technology transfer takes various routes. Care should be taken to construct questionnaire in order to capture these complicated phenomena.

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[9] Tsuji and Miyahara (2010a) also have the same problem about these subjects. Thus this paper concludes in this way.

The relevancy between agglomeration and innovation is an old research issue, but still one of the hot issues in this field. In particular, the transmission mechanism from information to innovation is an open question. This paper found some of linkages that contribute to innovation in the area, but this is only beginning of the research of endogenous innovation process in this area.

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APPENDIX

A1. Questionnaire

Innovations

1. What has your establishment achieved?
- (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 the existing technologies for your establishment
- (d)   Development of a totally new product/service based on new technologies for your establishment

2. Has your establishment achieved substantial organizational changes in the following managerial systems?
- (a)   Sales and marketing
- (b)   Quality control
- (c)   Production control and management
- (d)   Inventory control and management

Sources

3. Please identify sources and their locations that provided new technologies and information for upgrading/innovation
- (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) Joint Ventures(JVs)
- (e)   Technical assistance financed/provided by government/public agency
- (f)   Technical assistance financed/provided by industrial/trade organizations
- (g)   Technical assistance financed/provided by community organizations (NGOs or NPOs)
- (h)   Technical assistance financed/provided by government owned financial institutions
- (i)   Cooperation with (assistance from) universities/higher educational institutions
- (j)   Cooperation with (assistance from) government or public research institutes
- (k)   University professors or researchers/higher educational institutions
- (l)   Dispatch your engineers to universities/higher educational institutions
- (m)   Dispatch your engineers to government or public research institutes
- (n)   Recruitment of middle-ranking personnel or mid-carrier engineers
- (o)   Recruitment of senior engineers retired from MNCs, JVs, or large local firms
- (p)   Headhunt of top management from MNCs, JVs, or large local firms
- (q)   Technical information obtainable from academic publication
- (r)   Technical information obtainable from patents
- (s)   Introduction of "foreign-made" equipments and software
- (t)   Reverse engineering
- (u)   Participation in conferences, trade fairs, exhibitions
- (v)   Licensing technologies from other firms

Table A2 Estimation Results of Basic Models (Table 10)

	Total innovation					Product innovation				
	Full model	Selected model 1	Selected model 2	Selected model 3	Selected model 4	Full model	Selected model 1	Selected model 2	Selected model 3	Selected model 4
Age (establishment)	0.000	0.000	0.000	0.000	0.000	-0.009 *	-0.009	-0.009	-0.008	-0.009
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)
Number of full-time employees (logarithmic)	0.211 ***	0.212 ***	0.207 ***	0.204 ***	0.192 ***	0.207 ***	0.212 ***	0.216 ***	0.207 ***	0.188 ***
	(0.054)	(0.053)	(0.052)	(0.052)	(0.053)	(0.055)	(0.054)	(0.054)	(0.054)	(0.054)
Textiles, Apparel, leather	0.136	0.126	0.083	0.037	0.078	-0.010	-0.052	-0.064	-0.110	-0.052
	(0.250)	(0.246)	(0.244)	(0.246)	(0.246)	(0.252)	(0.247)	(0.246)	(0.247)	(0.247)
Wood, Paper products	-0.106	-0.120	-0.085	-0.079	-0.054	-0.010	-0.084	-0.036	-0.048	0.000
	(0.252)	(0.247)	(0.250)	(0.245)	(0.245)	(0.261)	(0.255)	(0.259)	(0.254)	(0.254)
Coal, Chemical products	0.375	0.322	0.374	0.303	0.305	0.590 *	0.520 *	0.574 *	0.508 *	0.511 *
	(0.309)	(0.302)	(0.304)	(0.301)	(0.302)	(0.320)	(0.311)	(0.309)	(0.308)	(0.310)
Iron, Metal products	-0.392 *	-0.377 *	-0.385 *	-0.390 *	-0.366 *	-0.649 ***	-0.645 ***	-0.627 ***	-0.664 ***	-0.631 ***
	(0.213)	(0.209)	(0.210)	(0.208)	(0.209)	(0.221)	(0.216)	(0.218)	(0.215)	(0.216)
Computers, Other electronics	-0.096	-0.058	-0.078	-0.063	-0.090	0.066	0.119	0.146	0.145	0.072
	(0.236)	(0.232)	(0.231)	(0.232)	(0.231)	(0.247)	(0.242)	(0.242)	(0.243)	(0.242)
Automobile, Other transportation	0.136	0.096	0.151	0.095	0.091	0.063	0.028	0.084	0.002	-0.009
	(0.327)	(0.326)	(0.328)	(0.328)	(0.330)	(0.323)	(0.318)	(0.321)	(0.320)	(0.322)
(a) Internal sources of information and own R&D efforts	-0.035	-0.032				-0.029	-0.018			
	(0.030)	(0.029)				(0.032)	(0.030)			
(b) Cooperation with local firms (100% local capital)	0.032	0.047				0.006	0.035			
	(0.031)	(0.029)				(0.032)	(0.031)			
(c) Cooperation with MNCs (100% non-local capital)	0.052	0.047				0.069	0.068			
	(0.041)	(0.040)				(0.043)	(0.041)			
(d) Cooperation with Joint Ventures	-0.052	-0.039				-0.044	-0.033			
	(0.037)	(0.036)				(0.038)	(0.037)			
(e) Technical assistance financed/provided by government/public agency	-0.019		-0.027			-0.001		-0.009		
	(0.033)		(0.031)			(0.034)		(0.032)		
(f) Technical assistance financed/provided by industrial/trade organizations	0.011		0.007			0.014		0.014		
	(0.031)		(0.030)			(0.032)		(0.031)		
(g) Technical assistance financed/provided by community organizations (NGOs or NPOs)	0.056 *		0.065 **			0.072 **		0.078 **		
	(0.032)		(0.031)			(0.033)		(0.033)		
(h) Technical assistance financed/provided by government owned financial institutions	0.078 **		0.072 **			0.083 **		0.073 **		
	(0.034)		(0.033)			(0.035)		(0.034)		
(i) Cooperation with universities/higher educational institutions	-0.037			-0.041		-0.029			-0.022	
	(0.036)			(0.035)		(0.037)			(0.036)	
(j) Cooperation with government or public research institutes	-0.024			0.003		-0.045			-0.010	
	(0.036)			(0.035)		(0.038)			(0.036)	

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(k) University professors or researchers personally closed contracts with your firm	0.010			0.027		0.010			0.027	
	(0.038)			(0.037)		(0.038)			(0.037)	
(l) Dispatch your engineers to universities/higher educational institutions	-0.025			-0.016		-0.024			-0.012	
	(0.040)			(0.040)		(0.042)			(0.041)	
(m) Dispatch your engineers to government or public research institutes	0.038			0.045		0.032			0.051	
	(0.046)			(0.044)		(0.047)			(0.046)	
(n) Recruitment of middle-ranking personnel or mid-carrier engineers	0.021				0.023	0.042				0.049
	(0.034)				(0.031)	(0.035)				(0.032)
(o) Recruitment of senior engineers retired from MNCs, JVs, or large local firms	-0.034				-0.020	0.008				0.016
	(0.037)				(0.036)	(0.038)				(0.037)
(p) Headhunt of top management from MNCs, JVs, or large local firms	0.059				0.053	0.065				0.053
	(0.042)				(0.040)	(0.044)				(0.042)
Number of Sources	0.053 ***	0.066 ***	0.053 ***	0.069 ***	0.065 ***	0.039 **	0.061 ***	0.045 ***	0.064 ***	0.055 ***
	(0.015)	(0.013)	(0.013)	(0.014)	(0.013)	(0.016)	(0.014)	(0.014)	(0.014)	(0.014)
Dummy variable (Indonesia)	0.752 ***	0.680 ***	0.764 ***	0.688 ***	0.683 ***	0.681 **	0.498 **	0.602 **	0.488 **	0.550 **
	(0.250)	(0.235)	(0.238)	(0.235)	(0.237)	(0.263)	(0.246)	(0.249)	(0.246)	(0.248)
Dummy variable (Thai)	-0.094	-0.109	-0.081	-0.142	-0.158	-0.175	-0.278	-0.199	-0.292	-0.249
	(0.255)	(0.250)	(0.251)	(0.251)	(0.253)	(0.268)	(0.259)	(0.261)	(0.260)	(0.264)
Dummy variable (Hanoi)	-0.077	-0.038	-0.183	-0.031	-0.075	-0.130	-0.016	-0.176	0.011	-0.108
	(0.248)	(0.230)	(0.221)	(0.219)	(0.221)	(0.255)	(0.235)	(0.226)	(0.223)	(0.226)
Dummy variable (Ho Chi Minh)	1.829 ***	1.830 ***	1.850 ***	1.907 ***	1.854 ***	1.324 ***	1.285 ***	1.346 ***	1.379 ***	1.303 ***
	(0.264)	(0.232)	(0.219)	(0.220)	(0.227)	(0.272)	(0.236)	(0.220)	(0.221)	(0.230)
/cut1	-1.684	-1.671	-1.728	-1.714	-1.709	-0.693	-0.718	-0.716	-0.755	-0.721
	(0.361)	(0.357)	(0.356)	(0.355)	(0.358)	(0.330)	(0.326)	(0.325)	(0.324)	(0.327)
/cut2	-0.957	-0.946	-1.003	-0.989	-0.983	0.311	0.278	0.282	0.240	0.276
	(0.330)	(0.326)	(0.324)	(0.323)	(0.327)	(0.326)	(0.321)	(0.319)	(0.318)	(0.322)
/cut3	-0.434	-0.425	-0.480	-0.468	-0.462	1.369	1.316	1.329	1.271	1.312
	(0.318)	(0.314)	(0.312)	(0.311)	(0.315)	(0.330)	(0.324)	(0.323)	(0.321)	(0.326)
/cut4	0.216	0.220	0.168	0.173	0.180	2.576	2.490	2.519	2.442	2.488
	(0.313)	(0.308)	(0.306)	(0.305)	(0.309)	(0.338)	(0.332)	(0.332)	(0.329)	(0.334)
/cut5	0.879	0.873	0.826	0.821	0.827					
	(0.314)	(0.309)	(0.307)	(0.306)	(0.310)					
/cut6	1.469	1.454	1.410	1.401	1.406					
	(0.318)	(0.314)	(0.312)	(0.311)	(0.315)					
/cut7	2.274	2.246	2.206	2.194	2.197					
	(0.327)	(0.322)	(0.320)	(0.319)	(0.323)					
/cut8	3.347	3.299	3.268	3.245	3.248					
	(0.337)	(0.332)	(0.330)	(0.329)	(0.332)					
Number of observation	715	715	715	715	715	715	715	715	715	715
Log likelihood	-1256	-1265	-1261	-1266	-1266	-963	-975	-969	-976	-974
Pseudo R2	0.078	0.071	0.074	0.070	0.070	0.083	0.071	0.077	0.070	0.072

	Process innovation				
	Full model	Selected model 1	Selected model 2	Selected model 3	Selected model 4
Age (establishment)	0.013 *	0.012 *	0.013 *	0.013 *	0.013 *
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Number of full-time employees (logarithmic)	0.200 ***	0.186 ***	0.179 ***	0.183 ***	0.180 ***
	(0.062)	(0.061)	(0.060)	(0.061)	(0.061)
Textiles, Apparel, leather	0.024	0.055	0.016	-0.042	-0.051
	(0.275)	(0.271)	(0.269)	(0.269)	(0.269)
Wood, Paper products	-0.262	-0.241	-0.202	-0.193	-0.205
	(0.284)	(0.277)	(0.280)	(0.277)	(0.277)
Coal, Chemical products	-0.048	-0.018	-0.045	-0.074	-0.094
	(0.351)	(0.344)	(0.343)	(0.345)	(0.343)
Iron, Metal products	0.217	0.233	0.191	0.197	0.202
	(0.253)	(0.249)	(0.248)	(0.247)	(0.246)
Computers, Other electronics	-0.374	-0.374	-0.403	-0.392	-0.382
	(0.291)	(0.285)	(0.283)	(0.285)	(0.285)
Automobile, Other transportation	-0.054	-0.040	-0.033	-0.062	-0.085
	(0.377)	(0.371)	(0.373)	(0.371)	(0.373)
(a) Internal sources of information and own R&D efforts	-0.014	-0.016			
	(0.035)	(0.034)			
(b) Cooperation with local firms (100% local capital)	0.060 *	0.057 *			
	(0.036)	(0.035)			
(c) Cooperation with MNCs (100% non-local capital)	0.047	0.041			
	(0.046)	(0.045)			
(d) Cooperation with Joint Ventures	-0.057	-0.052			
	(0.044)	(0.043)			
(e) Technical assistance financed/provided by government/public agency	-0.023		-0.031		
	(0.037)		(0.034)		
(f) Technical assistance financed/provided by industrial/trade organizations	0.021		0.009		
	(0.037)		(0.035)		
(g) Technical assistance financed/provided by community organizations (NGOs or NPOs)	0.007		0.020		
	(0.040)		(0.039)		
(h) Technical assistance financed/provided by government owned financial institutions	0.047		0.049		
	(0.041)		(0.039)		
(i) Cooperation with universities/higher educational institutions	-0.041			-0.058	
	(0.041)			(0.039)	
(j) Cooperation with government or public research institutes	0.009			0.023	
	(0.042)			(0.040)	

(k) University professors or researchers personally closed contracts with your firm	0.016 (0.044)			0.024 (0.043)	
(l) Dispatch your engineers to universities/higher educational institutions	-0.019 (0.047)			-0.011 (0.046)	
(m) Dispatch your engineers to government or public research institutes	0.037 (0.052)			0.034 (0.051)	
(n) Recruitment of middle-ranking personnel or mid-carrier engineers	-0.023 (0.038)				-0.018 (0.034)
(o) Recruitment of senior engineers retired from MNCs, JVs, or large local firms	-0.093 ** (0.043)				-0.072 * (0.041)
(p) Headhunt of top management from MNCs, JVs, or large local firms	0.056 (0.049)				0.052 (0.046)
Number of Sources	0.048 *** (0.017)	0.046 *** (0.014)	0.042 *** (0.015)	0.049 *** (0.015)	0.057 *** (0.015)
Dummy variable (Indonesia)	0.779 *** (0.275)	0.854 *** (0.261)	0.877 *** (0.262)	0.880 *** (0.262)	0.773 *** (0.262)
Dummy variable (Thai)	0.092 (0.274)	0.162 (0.267)	0.166 (0.268)	0.140 (0.269)	0.045 (0.270)
Dummy variable (Hanoi)	0.099 (0.272)	-0.006 (0.246)	-0.018 (0.240)	0.023 (0.234)	0.083 (0.234)
Dummy variable (Ho Chi Minh)	2.546 *** (0.368)	2.511 *** (0.339)	2.542 *** (0.326)	2.589 *** (0.327)	2.570 *** (0.332)
/cut1	-0.551 (0.360)	-0.537 (0.356)	-0.613 (0.352)	-0.587 (0.351)	-0.645 (0.355)
/cut2	-0.040 (0.355)	-0.030 (0.351)	-0.106 (0.347)	-0.081 (0.346)	-0.139 (0.350)
/cut3	0.877 (0.356)	0.875 (0.352)	0.800 (0.347)	0.822 (0.347)	0.763 (0.350)
/cut4	1.787 (0.362)	1.774 (0.358)	1.696 (0.352)	1.719 (0.352)	1.661 (0.355)
Number of observation	715	715	715	715	715
Log likelihood	-760	-765	-766	-766	-766
Pseudo R2	0.100	0.095	0.094	0.094	0.094

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

Note 2: Standard errors in parenthesis

Table A3 Estimation Results of Research Linkages (Table 11)

		Total innovation				Product innovation			
		Full model	Selected model 1	Selected model 2	Selected model 3	Full model	Selected model 1	Selected model 2	Selected model 3
		Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
	Age (establishment)	0.004	0.004	0.003	0.004	-0.006	-0.005	-0.006	-0.005
		(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
	Number of full-time employees (logarithmic)	0.255 ***	0.270 ***	0.267 ***	0.254 ***	0.251 ***	0.269 ***	0.261 ***	0.244 ***
		(0.053)	(0.052)	(0.052)	(0.053)	(0.055)	(0.054)	(0.053)	(0.054)
	Textiles, Apparel, leather	0.023	0.002	-0.055	-0.022	-0.097	-0.146	-0.183	-0.136
		(0.247)	(0.244)	(0.246)	(0.246)	(0.249)	(0.246)	(0.247)	(0.247)
	Wood, Paper products	-0.069	-0.131	-0.055	-0.048	-0.005	-0.079	-0.032	-0.005
		(0.247)	(0.245)	(0.242)	(0.242)	(0.258)	(0.256)	(0.253)	(0.252)
	Coal, Chemical products	0.457	0.441	0.349	0.334	0.643 **	0.600 *	0.527 *	0.527 *
		(0.305)	(0.302)	(0.300)	(0.299)	(0.314)	(0.307)	(0.308)	(0.309)
	Iron, Metal products	-0.419 **	-0.463 **	-0.408 **	-0.369 *	-0.694 ***	-0.720 ***	-0.711 ***	-0.670 ***
		(0.210)	(0.207)	(0.206)	(0.207)	(0.218)	(0.215)	(0.213)	(0.214)
	Computers, Other electronics	0.170	0.203	0.254	0.265	0.279	0.344	0.359	0.324
		(0.229)	(0.227)	(0.226)	(0.225)	(0.240)	(0.236)	(0.235)	(0.235)
	Automobile, Other transportation	0.179	0.160	0.121	0.148	0.099	0.095	0.019	0.026
		(0.330)	(0.326)	(0.325)	(0.326)	(0.325)	(0.322)	(0.320)	(0.321)
(e)	Technical assistance financed/provided by government/public agency	-0.079 **	-0.078 ***			-0.054 *	-0.050		
		(0.031)	(0.030)			(0.033)	(0.031)		
(f)	Technical assistance financed/provided by industrial/trade organizations	-0.013	-0.031			-0.010	-0.018		
		(0.030)	(0.029)			(0.031)	(0.030)		
(g)	Technical assistance financed/provided by community organizations (NGOs or NPOs)	0.034	0.026			0.055 *	0.051		
		(0.031)	(0.031)			(0.032)	(0.032)		
(h)	Technical assistance financed/provided by government owned financial institutions	0.104 ***	0.095 ***			0.105 ***	0.093 ***		
		(0.033)	(0.032)			(0.035)	(0.033)		
(i)	Cooperation with universities/higher educational institutions	-0.023		-0.043		-0.014		-0.025	
		(0.036)		(0.035)		(0.037)		(0.036)	
(j)	Cooperation with government or public research institutes	-0.056		-0.043		-0.068 *		-0.041	
		(0.036)		(0.035)		(0.037)		(0.036)	
(k)	University professors or researchers personally closed contracts with your firm	-0.033		-0.015		-0.025		-0.004	
		(0.037)		(0.036)		(0.037)		(0.037)	
(l)	Dispatch your engineers to universities/higher educational institutions	-0.034		-0.026		-0.029		-0.016	
		(0.040)		(0.040)		(0.042)		(0.041)	
(m)	Dispatch your engineers to government or public research institutes	0.073		0.069		0.061		0.065	
		(0.045)		(0.044)		(0.047)		(0.046)	

		(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
(n)	Recruitment of middle-ranking personnel or mid-carrier engineers	0.048						0.041		0.060	*					0.060	*
		(0.032)						(0.031)		(0.034)						(0.032)	
(o)	Recruitment of senior engineers retired from MNCs, JVs, or large local firms	-0.071	*					-0.087	**	-0.023						-0.034	
		(0.037)						(0.035)		(0.037)						(0.036)	
(p)	Headhunt of top management from MNCs, JVs, or large local firms	0.049						0.049		0.057						0.052	
		(0.043)						(0.040)		(0.044)						(0.042)	
	Number of Sources	0.056	***	0.046	***	0.059	***	0.053	***	0.044	***	0.042	***	0.059	***	0.048	***
		(0.015)		(0.013)		(0.013)		(0.013)		(0.015)		(0.014)		(0.014)		(0.014)	
	Dummy variable (Indonesia)	0.621	**	0.740	***	0.733	***	0.718	***	0.567	**	0.615	**	0.538	**	0.591	**
		(0.241)		(0.236)		(0.233)		(0.235)		(0.255)		(0.248)		(0.246)		(0.248)	
	Dummy variable (Thai)	-0.124		-0.023		-0.083		-0.104		-0.198		-0.147		-0.252		-0.219	
		(0.253)		(0.248)		(0.248)		(0.249)		(0.265)		(0.259)		(0.259)		(0.261)	
	Dummy variable (Vietnam)	0.819	***	0.889	***	0.986	***	0.889	***	0.536	**	0.646	***	0.736	***	0.609	***
		(0.203)		(0.182)		(0.185)		(0.190)		(0.208)		(0.185)		(0.188)		(0.195)	
	/cut1	-1.429		-1.461		-1.384		-1.335		-0.451		-0.484		-0.473		-0.395	
		(0.359)		(0.357)		(0.355)		(0.357)		(0.328)		(0.325)		(0.322)		(0.324)	
	/cut2	-0.702		-0.737		-0.657		-0.607		0.547		0.508		0.521		0.601	
		(0.328)		(0.325)		(0.323)		(0.326)		(0.323)		(0.320)		(0.316)		(0.319)	
	/cut3	-0.183		-0.219		-0.140		-0.088		1.564		1.516		1.520		1.601	
		(0.316)		(0.313)		(0.311)		(0.314)		(0.328)		(0.324)		(0.320)		(0.324)	
	/cut4	0.455		0.415		0.494		0.549		2.710		2.645		2.635		2.716	
		(0.310)		(0.307)		(0.305)		(0.308)		(0.337)		(0.333)		(0.329)		(0.333)	
	/cut5	1.097		1.052		1.127		1.183									
		(0.312)		(0.309)		(0.307)		(0.310)									
	/cut6	1.657		1.606		1.674		1.728									
		(0.316)		(0.313)		(0.311)		(0.314)									
	/cut7	2.391		2.325		2.388		2.440									
		(0.324)		(0.321)		(0.319)		(0.322)									
	/cut8	3.374		3.292		3.346		3.396									
		(0.334)		(0.330)		(0.328)		(0.332)									
	Number of observation	715		715		715		715		715		715		715		715	
	Log likelihood	-1291		-1299		-1303		-1302		-983		-989		-994		-993	
	Pseudo R2	0.052		0.047		0.044		0.044		0.064		0.058		0.053		0.054	

		Process innovation		
		Full model	Selected	Selected	Selected
		Coef.	Coef.	Coef.	Coef.
	Age (establishment)	0.020 ***	0.020 ***	0.017 **	0.019 **
		(0.008)	(0.008)	(0.007)	(0.007)
	Number of full-time employees (logarithmic)	0.250 ***	0.251 ***	0.257 ***	0.249 ***
		(0.061)	(0.060)	(0.060)	(0.061)
	Textiles, Apparel, leather	-0.147	-0.103	-0.183	-0.202
		(0.268)	(0.264)	(0.265)	(0.265)
	Wood, Paper products	-0.243	-0.271	-0.193	-0.216
		(0.274)	(0.272)	(0.267)	(0.267)
	Coal, Chemical products	-0.001	0.019	-0.027	-0.081
		(0.338)	(0.332)	(0.333)	(0.330)
	Iron, Metal products	0.068	0.029	0.107	0.112
		(0.243)	(0.240)	(0.240)	(0.239)
	Computers, Other electronics	-0.059	-0.050	-0.003	0.022
		(0.271)	(0.265)	(0.265)	(0.265)
	Automobile, Other transportation	-0.009	0.001	-0.024	-0.025
		(0.372)	(0.369)	(0.364)	(0.368)
(e)	Technical assistance financed/provided by government/public agency	-0.080 **	-0.081 **		
		(0.034)	(0.033)		
(f)	Technical assistance financed/provided by industrial/trade organizations	-0.012	-0.036		
		(0.035)	(0.033)		
(g)	Technical assistance financed/provided by community organizations (NGOs or NPOs)	-0.024	-0.023		
		(0.037)	(0.036)		
(h)	Technical assistance financed/provided by government owned financial institutions	0.083 **	0.075 **		
		(0.039)	(0.038)		
(i)	Cooperation with universities/higher educational institutions	-0.030		-0.057	
		(0.040)		(0.039)	
(j)	Cooperation with government or public research institutes	-0.014		-0.018	
		(0.041)		(0.040)	
(k)	University professors or researchers personally closed contracts with your firm	-0.026		-0.020	
		(0.042)		(0.041)	
(l)	Dispatch your engineers to universities/higher educational institutions	-0.035		-0.027	
		(0.046)		(0.045)	
(m)	Dispatch your engineers to government or public research institutes	0.073		0.060	
		(0.052)		(0.051)	
(n)	Recruitment of middle-ranking personnel or mid-carrier engineers	0.011			0.001
		(0.036)			(0.034)
(o)	Recruitment of senior engineers retired from MNCs, JVs, or large local firms	-0.119 ***			-0.127 ***
		(0.041)			(0.040)

(p)	Headhunt of top management from MNCs, JVs, or large local firms	0.051 (0.049)						0.051 (0.046)	
	Number of Sources	0.055 (0.017)	***	0.041 (0.015)	***	0.043 (0.015)	***	0.048 (0.015)	***
	Dummy variable (Indonesia)	0.732 (0.270)	***	0.892 (0.262)	***	0.955 (0.262)	***	0.852 (0.263)	***
	Dummy variable (Thai)	0.090 (0.274)		0.221 (0.268)		0.197 (0.269)		0.110 (0.270)	
	Dummy variable (Vietnam)	1.095 (0.228)	***	1.052 (0.204)	***	1.057 (0.205)	***	1.033 (0.209)	***
	/cut1	-0.264 (0.355)		-0.262 (0.353)		-0.162 (0.351)		-0.195 (0.354)	
	/cut2	0.242 (0.350)		0.240 (0.348)		0.341 (0.346)		0.308 (0.349)	
	/cut3	1.124 (0.350)		1.113 (0.348)		1.209 (0.346)		1.177 (0.349)	
	/cut4	1.969 (0.356)		1.947 (0.354)		2.034 (0.352)		2.006 (0.355)	
	Number of observation	715		715		715		715	
	Log likelihood	-794		-800		-803		-801	
	Pseudo R2	0.061		0.053		0.050		0.053	

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

Note 2: Standard errors in parenthesis

Table A4 Research Linkages in Different Industry (Total Innovation) (Table 12)

	Food, beverages, tobacco			Textiles, Apparel, leather			Wood, wood products, Paper, paper products, printing		
	Selected model 1	Selected model 2	Selected model 3	Selected model 1	Selected model 2	Selected model 3	Selected model 1	Selected model 2	Selected model 3
Age (establishment)	0.007 (0.018)	-0.009 (0.019)	0.001 (0.019)	0.006 (0.029)	0.016 (0.031)	0.001 (0.028)	0.010 (0.016)	0.009 (0.016)	0.014 (0.017)
Number of full-time employees (logarithmic)	0.216 (0.172)	0.219 (0.187)	0.217 (0.175)	0.297 * (0.171)	0.327 * (0.178)	0.282 (0.173)	0.293 (0.193)	0.319 (0.195)	0.271 (0.194)
(e) Technical assistance financed/provided by government/public agency	-0.238 ** (0.102)		0.119 (0.089)	-0.077 (0.095)			0.002 (0.091)		
(f) Technical assistance financed/provided by industrial/trade organizations	0.142 (0.093)		-0.165 (0.126)	-0.077 (0.103)			-0.094 (0.104)		
(g) Technical assistance financed/provided by community organizations (NGOs or NPOs)	-0.090 (0.101)		-0.027 (0.131)	0.005 (0.101)			0.076 (0.126)		
(h) Technical assistance financed/provided by government owned financial institutions	0.118 (0.123)			0.085 (0.159)			0.031 (0.105)		
(i) Cooperation with universities/higher educational institutions		0.020 (0.112)			-0.188 (0.143)			0.009 (0.141)	
(j) Cooperation with government or public research institutes		0.230 * (0.128)			0.090 (0.129)			-0.071 (0.102)	
(k) University professors or researchers personally closed contracts with your firm		-0.278 ** (0.132)			-0.138 (0.133)			-0.056 (0.141)	
(l) Dispatch your engineers to universities/higher educational institutions		-0.157 (0.137)			0.101 (0.204)			-0.316 ** (0.147)	
(m) Dispatch your engineers to government or public research institutes		-0.036 (0.137)			-0.213 (0.238)			0.161 (0.146)	
(n) Recruitment of middle-ranking personnel or mid-carrier engineers						0.017 (0.114)			0.034 (0.102)
(o) Recruitment of senior engineers retired from MNCs, JVs, or large local firms						-0.203 (0.139)			-0.042 (0.129)
(p) Headhunt of top management from MNCs, JVs, or large local firms						0.081 (0.154)			-0.095 (0.165)
Number of Sources	0.124 *** (0.035)	0.122 *** (0.040)	0.118 *** (0.036)	0.119 ** (0.049)	0.143 *** (0.047)	0.131 *** (0.046)	0.072 * (0.038)	0.118 *** (0.041)	0.082 ** (0.037)
Dummy variable (Indonesia)	-0.185 (0.534)	-0.315 (0.544)	-0.032 (0.539)	0.834 (0.789)	0.912 (0.798)	0.819 (0.773)	0.754 (0.691)	0.241 (0.744)	0.743 (0.689)
Dummy variable (Thai)	0.642 (1.126)	0.563 (1.183)	0.846 (1.098)	-0.289 (1.123)	0.624 (1.243)	-0.533 (1.195)	-1.652 (1.050)	-2.313 ** (1.144)	-1.685 (1.038)

Dummy variable (Vietnam)	0.663	0.263	0.084	0.166	0.409	0.122	0.802	0.891	0.852
	(0.567)	(0.583)	(0.577)	(0.665)	(0.655)	(0.732)	(0.748)	(0.771)	(0.809)
/cut1	-2.520	-2.916	-2.233	-0.090	0.374	-0.018	-0.942	-1.153	-0.865
	(1.328)	(1.360)	(1.338)	(0.981)	(1.040)	(0.989)	(1.127)	(1.202)	(1.123)
/cut2	-1.364	-1.717	-1.080	0.265	0.746	0.346	-0.607	-0.812	-0.526
	(1.056)	(1.102)	(1.069)	(0.973)	(1.036)	(0.981)	(1.093)	(1.165)	(1.090)
/cut3	-0.579	-0.929	-0.300	0.544	1.040	0.636	-0.345	-0.548	-0.261
	(0.987)	(1.030)	(1.001)	(0.970)	(1.037)	(0.980)	(1.075)	(1.146)	(1.072)
/cut4	0.289	-0.060	0.546	1.100	1.634	1.205	0.491	0.318	0.587
	(0.958)	(0.995)	(0.974)	(0.977)	(1.050)	(0.989)	(1.046)	(1.115)	(1.044)
/cut5	1.311	0.978	1.536	1.549	2.106	1.650	0.961	0.813	1.063
	(0.970)	(1.000)	(0.984)	(0.986)	(1.061)	(0.997)	(1.043)	(1.111)	(1.042)
/cut6	1.712	1.389	1.922	1.941	2.516	2.039	2.050	1.973	2.148
	(0.984)	(1.009)	(0.994)	(0.994)	(1.072)	(1.006)	(1.061)	(1.125)	(1.061)
/cut7	2.360	2.025	2.538	2.874	3.499	2.962	2.835	2.817	2.918
	(1.009)	(1.026)	(1.015)	(1.027)	(1.118)	(1.043)	(1.094)	(1.153)	(1.093)
/cut8	3.549	3.185	3.666	3.603	4.247	3.689	3.924	3.966	3.984
	(1.042)	(1.055)	(1.048)	(1.052)	(1.147)	(1.068)	(1.143)	(1.198)	(1.139)
Number of observation	84	84	84	72	72	72	65	65	65
Log likelihood	-145.1	-144.6	-147.4	-125.8	-123.7	-125.5	-114.4	-111.3	-114.8
Pseudo R2	0.075	0.077	0.059	0.086	0.101	0.088	0.076	0.101	0.074

	Coal, petroleum products, Chemicals, chemical products			Plastic, rubber products, Other non-metallic mineral products			Iron, steel, Non-ferrous metals, Metal products		
	Selected model 1	Selected model 2	Selected model 3	Selected model 1	Selected model 2	Selected model 3	Selected model 1	Selected model 2	Selected model 3
Age (establishment)	0.009	-0.003	0.027	-0.010	-0.013	-0.010	0.030 *	0.017	0.029
	(0.028)	(0.029)	(0.033)	(0.021)	(0.022)	(0.020)	(0.018)	(0.019)	(0.018)
Number of full-time employees (logarithmic)	0.463	0.393	0.481	0.616 ***	0.748 ***	0.636 ***	0.150	0.142	0.283 *
	(0.316)	(0.335)	(0.353)	(0.207)	(0.211)	(0.207)	(0.146)	(0.159)	(0.147)
(e) Technical assistance financed/provided by government/public agency	-0.001 (0.136)			-0.054 (0.104)			-0.175 ** (0.088)		
(f) Technical assistance financed/provided by industrial/trade organizations	-0.139 (0.140)			-0.276 *** (0.102)			0.076 (0.093)		
(g) Technical assistance financed/provided by community organizations (NGOs or NPOs)	0.157 (0.168)			0.025 (0.103)			0.115 (0.088)		
(h) Technical assistance financed/provided by government owned financial institutions	-0.005 (0.234)			0.120 (0.099)			-0.033 (0.089)		
(i) Cooperation with universities/higher educational institutions		0.103 (0.375)			-0.309 * (0.167)			0.003 (0.099)	
(j) Cooperation with government or public research institutes		-0.161 (0.294)			-0.048 (0.129)			-0.183 (0.112)	
(k) University professors or researchers personally closed contracts with your firm		-0.188 (0.222)			0.075 (0.159)			0.194 * (0.110)	
(l) Dispatch your engineers to universities/higher educational institutions		-0.203 (0.183)			0.080 (0.168)			-0.005 (0.101)	
(m) Dispatch your engineers to government or public research institutes		0.614 (0.394)			0.066 (0.146)			-0.086 (0.113)	
(n) Recruitment of middle-ranking personnel or mid-carrier engineers			-0.143 (0.143)			0.048 (0.098)			-0.206 ** (0.082)
(o) Recruitment of senior engineers retired from MNCs, JVs, or large local firms			-0.377 ** (0.152)			-0.145 (0.120)			-0.176 * (0.100)
(p) Headhunt of top management from MNCs, JVs, or large local firms			0.134 (0.179)			0.153 (0.150)			0.012 (0.110)
Number of Sources	0.039	-0.010	0.080	0.097 **	0.099 *	0.054	0.004	0.013	0.058
	(0.074)	(0.078)	(0.067)	(0.046)	(0.056)	(0.053)	(0.046)	(0.041)	(0.039)
Dummy variable (Indonesia)	-0.476	0.342	-0.393	1.214	0.388	0.290	0.776	0.878	0.428
	(1.381)	(1.275)	(1.312)	(0.953)	(1.010)	(0.952)	(0.906)	(0.816)	(0.809)
Dummy variable (Thai)	-0.668	-0.332	-0.705	-0.607	-1.043	-0.737	0.268	0.112	0.122
	(1.009)	(0.921)	(0.963)	(0.836)	(0.992)	(0.912)	(0.678)	(0.671)	(0.697)

Dummy variable (Vietnam)	0.478	1.376	1.690 *	1.693 ***	1.304 **	1.316 **	1.609 **:	1.531 ***	2.243 ***
	(1.009)	(0.960)	(0.986)	(0.610)	(0.639)	(0.571)	(0.532)	(0.538)	(0.539)
/cut1	-0.618	-1.331	-0.493	0.420	1.154	0.694	-2.930	-3.180	-2.613
	(1.741)	(1.954)	(1.889)	(0.977)	(0.992)	(0.966)	(1.223)	(1.248)	(1.224)
/cut2	0.128	-0.574	0.433	1.459	2.254	1.748	-1.487	-1.756	-1.152
	(1.673)	(1.885)	(1.813)	(0.949)	(0.974)	(0.938)	(0.871)	(0.906)	(0.873)
/cut3	0.925	0.261	1.428	1.972	2.802	2.270	-0.595	-0.855	-0.254
	(1.633)	(1.831)	(1.760)	(0.955)	(0.987)	(0.944)	(0.790)	(0.824)	(0.792)
/cut4	1.723	1.127	2.380	2.401	3.244	2.688	0.109	-0.127	0.457
	(1.636)	(1.815)	(1.768)	(0.969)	(1.008)	(0.958)	(0.765)	(0.794)	(0.765)
/cut5	2.212	1.660	2.926	3.098	3.898	3.305	1.151	0.906	1.521
	(1.660)	(1.832)	(1.800)	(1.006)	(1.047)	(0.989)	(0.781)	(0.798)	(0.779)
/cut6	3.200	2.693	3.898	3.290	4.063	3.463	1.914	1.678	2.291
	(1.700)	(1.873)	(1.856)	(1.017)	(1.056)	(0.998)	(0.816)	(0.828)	(0.816)
/cut7				4.251	4.912	4.314	2.655	2.467	3.048
				(1.067)	(1.098)	(1.040)	(0.847)	(0.860)	(0.852)
/cut8				5.296	5.896	5.302	3.747	3.585	4.188
				(1.113)	(1.144)	(1.085)	(0.873)	(0.887)	(0.888)
Number of observation	41	41	41	75	75	75	93	93	93
Log likelihood	-66.4	-65.1	-64.0	-128.3	-130.6	-132.0	-174.6	-173.7	-172.5
Pseudo R2	0.056	0.075	0.091	0.117	0.101	0.091	0.059	0.063	0.070

	Machinery, equipment, tools			Computers & computer parts, Other electronics & components			Precision instruments, Automobile, auto parts, Other transportation equipments and parts		
	Selected model 1	Selected model 2	Selected model 3	Selected model 1	Selected model 2	Selected model 3	Selected model 1	Selected model 2	Selected model 3
Age (establishment)	0.017 (0.037)	0.036 (0.035)	0.038 (0.034)	0.016 (0.028)	-0.021 (0.031)	0.012 (0.028)	-0.050 ** (0.024)	-0.055 ** (0.025)	-0.038 (0.025)
Number of full-time employees (logarithmic)	0.337 (0.282)	0.468 (0.285)	0.603 ** (0.295)	0.560 *** (0.181)	0.566 *** (0.186)	0.631 *** (0.187)	0.634 **: (0.217)	0.618 *** (0.211)	0.574 *** (0.215)
(e) Technical assistance financed/provided by government/public agency	-0.388 *** (0.142)			0.192 (0.119)			-0.016 (0.114)		
(f) Technical assistance financed/provided by industrial/trade organizations	-0.189 (0.122)			0.018 (0.111)			0.003 (0.116)		
(g) Technical assistance financed/provided by community organizations (NGOs or NPOs)	-0.032 (0.130)			-0.081 (0.088)			0.019 (0.129)		
(h) Technical assistance financed/provided by government owned financial institutions	0.169 (0.131)			0.065 (0.093)			0.320 ** (0.160)		
(i) Cooperation with universities/higher educational institutions		-0.097 (0.156)			-0.092 (0.128)			-0.007 (0.124)	
(j) Cooperation with government or public research institutes		-0.302 ** (0.148)			-0.192 (0.127)			0.058 (0.161)	
(k) University professors or researchers personally closed contracts with your firm		-0.115 (0.125)			-0.072 (0.113)			0.042 (0.130)	
(l) Dispatch your engineers to universities/higher educational institutions		0.339 ** (0.169)			0.043 (0.162)			0.100 (0.142)	
(m) Dispatch your engineers to government or public research institutes		-0.572 ** (0.287)			-0.116 (0.180)			0.272 (0.178)	
(n) Recruitment of middle-ranking personnel or mid-carrier engineers			-0.018 (0.242)			0.115 (0.126)			0.265 * (0.152)
(o) Recruitment of senior engineers retired from MNCs, JVs, or large local firms			0.265 ** (0.133)			-0.160 (0.106)			-0.074 (0.192)
(p) Headhunt of top management from MNCs, JVs, or large local firms			0.128 (0.196)			0.167 (0.140)			0.158 (0.202)
Number of Sources	0.196 ** (0.096)	0.232 ** (0.100)	-0.020 (0.092)	0.010 (0.052)	0.120 * (0.062)	0.022 (0.053)	-0.044 (0.050)	-0.093 (0.058)	-0.056 (0.052)
Dummy variable (Indonesia)	15.259 (1112)	14.639 (1263)	17.256 (814)	0.174 (0.970)	-0.791 (0.987)	-0.087 (0.991)	3.097 ** (1.356)	3.349 ** (1.343)	4.097 *** (1.566)
Dummy variable (Thai)	3.296 ** (1.644)	2.341 (2.137)	2.918 * (1.701)	0.627 (0.882)	-0.516 (1.037)	1.051 (0.911)	2.795 **: (0.946)	2.712 *** (0.907)	2.895 *** (0.933)

Dummy variable (Vietnam)	1.214	0.794	1.652	2.237 ***	1.649 ***	1.768 ***	2.025 **:	1.878 ***	1.190
	(0.967)	(0.925)	(1.221)	(0.615)	(0.581)	(0.643)	(0.698)	(0.667)	(0.752)
/cut1	-1.041	0.230	0.352	-0.123	-0.439	0.409	-0.327	-0.838	0.132
	(1.717)	(1.655)	(1.680)	(1.509)	(1.533)	(1.501)	(1.278)	(1.260)	(1.336)
/cut2	0.243	1.518	1.642	1.745	1.459	2.293	0.514	-0.031	0.951
	(1.536)	(1.494)	(1.508)	(1.208)	(1.236)	(1.200)	(1.203)	(1.183)	(1.266)
/cut3	1.606	2.936	2.978	2.350	2.071	2.914	1.516	0.980	1.913
	(1.518)	(1.519)	(1.526)	(1.192)	(1.221)	(1.187)	(1.185)	(1.157)	(1.251)
/cut4	1.994	3.322	3.324	2.823	2.552	3.408	2.052	1.536	2.455
	(1.530)	(1.541)	(1.543)	(1.202)	(1.228)	(1.201)	(1.204)	(1.172)	(1.269)
/cut5	2.897	4.087	4.022	3.409	3.138	4.018	2.710	2.213	3.109
	(1.568)	(1.583)	(1.581)	(1.226)	(1.246)	(1.233)	(1.233)	(1.196)	(1.290)
/cut6	3.850	5.005	4.826	4.082	3.787	4.690	3.795	3.348	4.162
	(1.604)	(1.638)	(1.620)	(1.260)	(1.275)	(1.276)	(1.268)	(1.228)	(1.309)
/cut7	5.041	6.203	5.895	5.596	5.250	6.157	4.643	4.204	5.011
	(1.643)	(1.694)	(1.667)	(1.327)	(1.329)	(1.342)	(1.300)	(1.259)	(1.344)
Number of observation	50	50	50	87	87	87	57	57	57
Log likelihood	-72.4	-73.6	-76.8	-127.0	-127.1	-127.3	-88.5	-88.2	-88.3
Pseudo R2	0.178	0.164	0.128	0.101	0.101	0.099	0.122	0.124	0.123

	Others		
	Selected model 1	Selected model 2	Selected model 3
Age (establishment)	0.000 (0.009)	0.009 (0.009)	0.004 (0.009)
Number of full-time employees (logarithmic)	0.191 (0.141)	0.016 (0.149)	0.101 (0.142)
(e) Technical assistance financed/provided by government/public agency	-0.101		
(f) Technical assistance financed/provided by industrial/trade organizations	0.049		
(g) Technical assistance financed/provided by community organizations (NGOs or NPOs)	0.180 *		
(h) Technical assistance financed/provided by government owned financial institutions	0.132		
(i) Cooperation with universities/higher educational institutions		-0.110 (0.103)	
(j) Cooperation with government or public research institutes		0.000 (0.110)	
(k) University professors or researchers personally closed contracts with your firm		0.058 (0.099)	
(l) Dispatch your engineers to universities/higher educational institutions		0.031 (0.118)	
(m) Dispatch your engineers to government or public research institutes		0.261 ** (0.123)	
(n) Recruitment of middle-ranking personnel or mid-carrier engineers			0.130 (0.087)
(o) Recruitment of senior engineers retired from MNCs, JVs, or large local firms			-0.068 (0.120)
(p) Headhunt of top management from MNCs, JVs, or large local firms			0.076 (0.124)
Number of Sources	-0.011 (0.034)	-0.003 (0.035)	0.025 (0.037)
Dummy variable (Indonesia)	-0.129 (0.666)	-0.297 (0.670)	-0.298 (0.701)
Dummy variable (Thai)	-0.934 (0.703)	-1.286 * (0.697)	-1.344 * (0.766)

Dummy variable (Vietnam)	-0.223	-0.041	-0.427
	(0.649)	(0.653)	(0.738)
/cut1	-3.199	-4.079	-3.198
	(1.069)	(1.121)	(1.093)
/cut2	-2.470	-3.353	-2.461
	(0.943)	(0.999)	(0.969)
/cut3	-1.860	-2.737	-1.843
	(0.881)	(0.939)	(0.911)
/cut4	-1.440	-2.303	-1.422
	(0.855)	(0.912)	(0.887)
/cut5	-0.693	-1.536	-0.699
	(0.837)	(0.890)	(0.870)
/cut6	-0.054	-0.893	-0.086
	(0.840)	(0.888)	(0.869)
/cut7	0.823	-0.028	0.750
	(0.858)	(0.897)	(0.883)
/cut8	1.935	1.065	1.802
	(0.879)		(0.897)
Number of observation	91	91	91
Log likelihood	-161.2	-161.2	-164.1
Pseudo R2	0.046	0.045	0.028

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

Note 2: Standard errors in parenthesis

Table A5 Research Linkages in Different Industry (Product Innovation) (Table 13)

	Food, beverages, tobacco			Textiles, Apparel, leather			Wood, wood products, Paper, paper products, printing		
	Selected model 1	Selected model 2	Selected model 3	Selected model 1	Selected model 2	Selected model 3	Selected model 1	Selected model 2	Selected model 3
Age (establishment)	0.000	-0.019	0.004	-0.006	0.000	-0.013	-0.003	-0.002	0.000
	(0.020)	(0.021)	(0.020)	(0.030)	(0.033)	(0.030)	(0.017)	(0.017)	(0.018)
Number of full-time employees (logarithmic)	0.185	0.127	0.120	0.248	0.283	0.227	0.077	0.017	0.046
	(0.183)	(0.194)	(0.186)	(0.167)	(0.175)	(0.168)	(0.199)	(0.199)	(0.199)
(e) Technical assistance financed/provided by government/public agency	-0.174			-0.057			-0.016		
	(0.108)			(0.097)			(0.099)		
(f) Technical assistance financed/provided by industrial/trade organizations	0.190 **			-0.047			-0.110		
	(0.095)			(0.106)			(0.115)		
(g) Technical assistance financed/provided by community organizations (NGOs or NPOs)	-0.050			-0.011			0.270 *		
	(0.110)			(0.103)			(0.154)		
(h) Technical assistance financed/provided by government owned financial institutions	0.182			0.074			0.033		
	(0.133)			(0.164)			(0.112)		
(i) Cooperation with universities/higher educational institutions		-0.091			-0.095			-0.014	
		(0.123)			(0.143)			(0.138)	
(j) Cooperation with government or public research institutes		0.334 **			0.058			-0.117	
		(0.138)			(0.128)			(0.105)	
(k) University professors or researchers personally closed contracts with your firm		-0.032			-0.157			0.091	
		(0.137)			(0.133)			(0.142)	
(l) Dispatch your engineers to universities/higher educational institutions		-0.236			0.027			-0.173	
		(0.160)			(0.204)			(0.150)	
(m) Dispatch your engineers to government or public research institutes		-0.044			-0.150			0.121	
		(0.154)			(0.239)			(0.154)	
(n) Recruitment of middle-ranking personnel or mid-carrier engineers			0.193 **			0.072			0.009
			(0.096)			(0.117)			(0.102)
(o) Recruitment of senior engineers retired from MNCs, JVs, or large local firms			-0.179			-0.184			0.058
			(0.143)			(0.138)			(0.144)
(p) Headhunt of top management from MNCs, JVs, or large local firms			0.269			0.071			-0.059
			(0.166)			(0.149)			(0.183)
Number of Sources	0.162 ***	0.188 ***	0.142 ***	0.120 **	0.150 ***	0.133 ***	0.037	0.077 **	0.057
	(0.040)	(0.048)	(0.040)	(0.051)	(0.049)	(0.048)	(0.038)	(0.039)	(0.036)
Dummy variable (Indonesia)	-0.496	-0.711	-0.356	0.446	0.265	0.331	0.628	0.293	0.536
	(0.594)	(0.608)	(0.599)	(0.848)	(0.859)	(0.834)	(0.660)	(0.723)	(0.655)
Dummy variable (Thai)	-0.266	-0.462	-0.239	-0.661	0.015	-1.099	-1.427	-1.944 *	-1.630 *
	(1.091)	(1.108)	(1.080)	(1.128)	(1.255)	(1.204)	(0.973)	(1.027)	(0.969)

Dummy variable (Vietnam)	0.070	-0.306	-0.408	0.111	0.268	-0.206	1.056	1.067	0.989
	(0.594)	(0.621)	(0.620)	(0.704)	(0.671)	(0.765)	(0.716)	(0.753)	(0.772)
/cut1	-0.616	-1.330	-0.524	-0.009	0.364	0.005	-1.548	-1.904	-1.552
	(1.062)	(1.088)	(1.053)	(0.948)	(1.001)	(0.953)	(1.066)	(1.145)	(1.076)
/cut2	0.841	0.134	0.957	0.968	1.386	0.996	-0.421	-0.743	-0.417
	(1.059)	(1.074)	(1.053)	(0.947)	(1.006)	(0.955)	(1.028)	(1.098)	(1.037)
/cut3	2.019	1.357	2.140	1.877	2.334	1.902	0.866	0.578	0.861
	(1.093)	(1.101)	(1.084)	(0.965)	(1.032)	(0.974)	(1.026)	(1.090)	(1.033)
/cut4	3.006	2.344	3.097	2.893	3.382	2.932	1.983	1.667	1.918
	(1.115)	(1.118)	(1.103)	(0.994)	(1.069)	(1.005)	(1.051)	(1.110)	(1.057)
Number of observation	84	84	84	72	72	72	65	65	65
Log likelihood	-103.8	-103.3	-103.7	-99.2	-97.5	-98.6	-87.6	-88.3	-89.8
Pseudo R2	0.137	0.141	0.137	0.090	0.105	0.095	0.106	0.098	0.084

	Coal, petroleum products, Chemicals, chemical products			Plastic, rubber products, Other non-metallic mineral products			Iron, steel, Non-ferrous metals, Metal products		
	Selected model 1	Selected model 2	Selected model 3	Selected model 1	Selected model 2	Selected model 3	Selected model 1	Selected model 2	Selected model 3
Age (establishment)	-0.038	-0.062 *	-0.037	-0.005	-0.004	-0.004	0.023	0.022	0.026
	(0.031)	(0.037)	(0.035)	(0.022)	(0.022)	(0.021)	(0.018)	(0.020)	(0.019)
Number of full-time employees (logarithmic)	0.784 **	0.995 **	0.802 **	0.461 **	0.618 ***	0.508 **	0.148	0.080	0.240
	(0.362)	(0.467)	(0.363)	(0.206)	(0.211)	(0.204)	(0.153)	(0.158)	(0.152)
(e) Technical assistance financed/provided by government/public agency	-0.215			-0.065			-0.065		
	(0.155)			(0.110)			(0.089)		
(f) Technical assistance financed/provided by industrial/trade organizations	-0.284 *			-0.285 ***			0.022		
	(0.150)			(0.108)			(0.098)		
(g) Technical assistance financed/provided by community organizations (NGOs or NPOs)	0.081			-0.008			0.186 **		
	(0.178)			(0.108)			(0.091)		
(h) Technical assistance financed/provided by government owned financial institutions	0.216			0.131			-0.029		
	(0.262)			(0.104)			(0.091)		
(i) Cooperation with universities/higher educational institutions		-0.269			-0.383 **			0.070	
		(0.464)			(0.166)			(0.102)	
(j) Cooperation with government or public research institutes		-0.059			0.025			-0.222 **	
		(0.353)			(0.129)			(0.110)	
(k) University professors or researchers personally closed contracts with your firm		-0.173			-0.012			0.084	
		(0.222)			(0.153)			(0.110)	
(l) Dispatch your engineers to universities/higher educational institutions		-0.237			0.161			-0.123	
		(0.199)			(0.169)			(0.101)	
(m) Dispatch your engineers to government or public research institutes		1.181 **			-0.002			0.006	
		(0.541)			(0.145)			(0.112)	
(n) Recruitment of middle-ranking personnel or mid-carrier engineers			-0.077			0.016			-0.180 **
			(0.161)			(0.103)			(0.086)
(o) Recruitment of senior engineers retired from MNCs, JVs, or large local firms			-0.153			-0.033			-0.186 *
			(0.143)			(0.119)			(0.100)
(p) Headhunt of top management from MNCs, JVs, or large local firms			-0.057			0.036			0.094
			(0.203)			(0.153)			(0.111)
Number of Sources	0.097	-0.068	0.113	0.090 *	0.109 *	0.035	-0.004	0.054	0.064
	(0.081)	(0.108)	(0.074)	(0.048)	(0.059)	(0.054)	(0.049)	(0.043)	(0.039)
Dummy variable (Indonesia)	-0.394	1.965	0.486	1.270	0.376	0.618	1.159	0.455	0.386
	(1.451)	(1.732)	(1.388)	(0.998)	(0.989)	(0.978)	(0.966)	(0.846)	(0.802)
Dummy variable (Thai)	-0.514	0.469	-0.466	-1.479 *	-2.090 **	-1.255	0.355	0.264	0.138
	(1.110)	(1.119)	(1.056)	(0.874)	(1.059)	(0.947)	(0.713)	(0.709)	(0.737)

Dummy variable (Vietnam)	0.315	1.049	0.491	1.869 ***	1.397 **	1.389 **	2.200 ***	2.255 ***	2.808 ***
	(1.084)	(1.095)	(0.966)	(0.619)	(0.639)	(0.580)	(0.570)	(0.585)	(0.589)
/cut1	-0.755	-0.434	0.158	0.740	1.754	1.165	0.198	-0.059	0.434
	(2.003)	(2.224)	(1.934)	(0.955)	(0.974)	(0.929)	(0.835)	(0.833)	(0.820)
/cut2	2.143	2.373	2.833	1.810	2.786	2.125	1.353	1.125	1.590
	(1.900)	(2.124)	(1.867)	(0.972)	(1.003)	(0.946)	(0.852)	(0.840)	(0.835)
/cut3	3.440	3.723	4.068	2.916	3.862	3.118	2.632	2.495	2.894
	(1.933)	(2.182)	(1.934)	(1.022)	(1.060)	(0.988)	(0.892)	(0.879)	(0.879)
/cut4				3.985	4.907	4.087	3.986	3.867	4.309
				(1.074)	(1.117)	(1.035)	(0.934)	(0.925)	(0.933)
Number of observation	41	41	41	75	75	75	93	93	93
Log likelihood	-38.8	-38.1	-41.0	-96.4	-97.6	-100.9	-132.6	-131.3	-131.0
Pseudo R2	0.204	0.219	0.159	0.147	0.137	0.107	0.099	0.108	0.109

	Machinery, equipment, tools			Computers & computer parts, Other electronics & components			Precision instruments, Automobile, auto parts, Other transportation equipments and parts		
	Selected model 1	Selected model 2	Selected model 3	Selected model 1	Selected model 2	Selected model 3	Selected model 1	Selected model 2	Selected model 3
Age (establishment)	-0.018	0.010	0.008	-0.003	-0.043	-0.006	-0.052 **	-0.060 **	-0.037
	(0.038)	(0.037)	(0.035)	(0.030)	(0.032)	(0.029)	(0.025)	(0.025)	(0.025)
Number of full-time employees (logarithmic)	0.300	0.406	0.408	0.577 ***	0.584 ***	0.638 ***	0.390 **	0.372 *	0.378 *
	(0.308)	(0.307)	(0.294)	(0.190)	(0.193)	(0.196)	(0.197)	(0.196)	(0.205)
(e) Technical assistance financed/provided by government/public agency	-0.227			0.173			0.072		
	(0.138)			(0.124)			(0.115)		
(f) Technical assistance financed/provided by industrial/trade organizations	-0.201			0.085			0.038		
	(0.125)			(0.118)			(0.119)		
(g) Technical assistance financed/provided by community organizations (NGOs or NPOs)	-0.051			-0.073			0.016		
	(0.134)			(0.094)			(0.130)		
(h) Technical assistance financed/provided by government owned financial institutions	0.260 *			0.077			0.262 *		
	(0.139)			(0.102)			(0.156)		
(i) Cooperation with universities/higher educational institutions		-0.116			-0.118			0.032	
		(0.169)			(0.134)			(0.129)	
(j) Cooperation with government or public research institutes		-0.326 *			-0.176			0.097	
		(0.167)			(0.134)			(0.153)	
(k) University professors or researchers personally closed contracts with your firm		-0.088			-0.119			0.035	
		(0.137)			(0.120)			(0.129)	
(l) Dispatch your engineers to universities/higher educational institutions		0.394 *			0.078			0.041	
		(0.205)			(0.170)			(0.139)	
(m) Dispatch your engineers to government or public research institutes		-0.850 ***			-0.165			0.080	
		(0.311)			(0.203)			(0.172)	
(n) Recruitment of middle-ranking personnel or mid-carrier engineers			0.240			-0.010			0.414 **
			(0.260)			(0.135)			(0.170)
(o) Recruitment of senior engineers retired from MNCs, JVs, or large local firms			0.160			-0.048			-0.166
			(0.130)			(0.111)			(0.218)
(p) Headhunt of top management from MNCs, JVs, or large local firms			-0.011			0.152			0.222
			(0.188)			(0.144)			(0.239)
Number of Sources	0.106	0.250 **	-0.041	-0.041	0.100	-0.019	-0.023	-0.034	-0.050
	(0.099)	(0.115)	(0.093)	(0.059)	(0.065)	(0.058)	(0.050)	(0.061)	(0.054)
Dummy variable (Indonesia)	16.907	14.616	17.262	-1.339	-2.888 **	-1.753	1.827	2.190	3.099 *
	-1233	-1019	-917	(1.114)	(1.124)	(1.127)	(1.383)	(1.338)	(1.624)
Dummy variable (Thai)	3.508 **	3.277	2.931 *	1.427	-0.037	1.445	0.986	1.260	1.791 *
	(1.681)	(2.008)	(1.733)	(1.050)	(1.125)	(1.074)	(0.885)	(0.854)	(0.916)

Dummy variable (Vietnam)	1.747 *	1.306	1.234	1.509 **	0.800	1.264 *	0.727	0.623	-0.235
	(1.025)	(1.041)	(1.146)	(0.632)	(0.614)	(0.675)	(0.642)	(0.622)	(0.764)
/cut1	-0.034	1.315	1.164	0.329	-0.002	0.566	-1.712	-2.125	-0.973
	(1.702)	(1.723)	(1.607)	(1.319)	(1.342)	(1.303)	(1.290)	(1.298)	(1.399)
/cut2	0.591	2.092	1.840	1.486	1.209	1.733	0.036	-0.352	0.927
	(1.712)	(1.774)	(1.639)	(1.281)	(1.286)	(1.267)	(1.149)	(1.137)	(1.292)
/cut3	2.399	4.387	3.545	1.847	1.570	2.098	1.433	1.043	2.391
	(1.738)	(1.884)	(1.668)	(1.280)	(1.281)	(1.269)	(1.139)	(1.117)	(1.292)
/cut4	3.981	6.015	4.897	4.019	3.713	4.209	2.515	2.077	3.544
	(1.778)	(1.945)	(1.707)	(1.339)	(1.331)	(1.332)	(1.169)	(1.143)	(1.334)
Number of observation	50	50	50	87	87	87	57	57	57
Log likelihood	-56.6	-54.1	-60.7	-89.3	-89.1	-91.2	-72.7	-73.9	-69.6
Pseudo R2	0.170	0.207	0.110	0.114	0.115	0.095	0.093	0.078	0.132

	Others		
	Selected model 1	Selected model 2	Selected model 3
Age (establishment)	-0.009 (0.009)	-0.001 (0.010)	-0.003 (0.009)
Number of full-time employees (logarithmic)	0.336 ** (0.151)	0.224 (0.155)	0.271 * (0.150)
(e) Technical assistance financed/provided by government/public agency	-0.091 (0.095)		*
(f) Technical assistance financed/provided by industrial/trade organizations	0.094 (0.086)		
(g) Technical assistance financed/provided by community organizations (NGOs or NPOs)	0.237 ** (0.098)		
(h) Technical assistance financed/provided by government owned financial institutions	0.048 (0.093)		
(i) Cooperation with universities/higher educational institutions		-0.097 (0.108)	
(j) Cooperation with government or public research institutes		-0.006 (0.113)	
(k) University professors or researchers personally closed contracts with your firm		0.059 (0.098)	
(l) Dispatch your engineers to universities/higher educational institutions		0.191 (0.126)	
(m) Dispatch your engineers to government or public research institutes		0.161 (0.128)	
(n) Recruitment of middle-ranking personnel or mid-carrier engineers			0.164 (0.091)
(o) Recruitment of senior engineers retired from MNCs, JVs, or large local firms			-0.023 (0.129)
(p) Headhunt of top management from MNCs, JVs, or large local firms			-0.025 (0.135)
Number of Sources	-0.045 (0.036)	-0.039 (0.036)	-0.008 (0.038)
Dummy variable (Indonesia)	-0.377 (0.733)	-0.522 (0.725)	-0.512 (0.757)
Dummy variable (Thai)	-0.706 (0.771)	-1.069 (0.751)	-1.031 (0.816)

Dummy variable (Vietnam)	-0.781	-0.700	-0.916
	(0.709)	(0.705)	(0.793)
/cut1	-1.466	-2.098	-1.242
	(0.926)	(0.964)	(0.955)
/cut2	-0.807	-1.441	-0.596
	(0.910)	(0.946)	(0.939)
/cut3	-0.143	-0.787	0.041
	(0.908)	(0.940)	(0.935)
/cut4	1.352	0.703	1.458
	(0.914)	(0.938)	(0.943)
Number of observation	91	91	91
Log likelihood	-119.5	-119.9	-122.9
Pseudo R2	0.070	0.067	0.043

Note 1: ***, ** and * indicate the significance level at the 1%, 5% and 10%
Note 2: Standard errors in parenthesis

Table A6 Research Linkages in Different Industry (Process Innovation) (Table 14)

	Food, beverages, tobacco			Textiles, Apparel, leather			Wood, wood products, Paper, paper products, printing		
	Selected model 1	Selected model 2	Selected model 3	Selected model 1	Selected model 2	Selected model 3	Selected model 1	Selected model 2	Selected model 3
Age (establishment)	0.022 (0.022)	0.012 (0.020)	0.014 (0.021)	0.003 (0.030)	0.017 (0.031)	0.003 (0.029)	0.034 (0.021)	0.031 (0.020)	0.036 * (0.021)
Number of full-time employees (logarithmic)	0.312 (0.209)	0.349 (0.224)	0.293 (0.214)	0.236 (0.176)	0.242 (0.183)	0.257 (0.177)	0.486 ** (0.238)	0.559 ** (0.232)	0.410 * (0.219)
(e) Technical assistance financed/provided by government/public agency	-0.206 * (0.107)			-0.067 (0.104)			0.030 (0.102)		
(f) Technical assistance financed/provided by industrial/trade organizations	0.032 (0.102)			-0.060 (0.113)			-0.036 (0.117)		
(g) Technical assistance financed/provided by community organizations (NGOs or NPOs)	-0.103 (0.117)			0.030 (0.113)			-0.158 (0.144)		
(h) Technical assistance financed/provided by government owned financial institutions	0.001 (0.129)			0.032 (0.189)			0.023 (0.118)		
(i) Cooperation with universities/higher educational institutions		0.080 (0.125)			-0.344 * (0.179)			0.026 (0.155)	
(j) Cooperation with government or public research institutes		0.135 (0.143)			0.125 (0.158)			0.092 (0.119)	
(k) University professors or researchers personally closed contracts with your firm		-0.375 *** (0.136)			-0.122 (0.155)			-0.218 (0.157)	
(l) Dispatch your engineers to universities/higher educational institutions		0.037 (0.150)			0.261 (0.229)			-0.373 ** (0.175)	
(m) Dispatch your engineers to government or public research institutes		-0.041 (0.144)			-0.317 (0.253)			0.196 (0.182)	
(n) Recruitment of middle-ranking personnel or mid-carrier engineers			0.047 (0.095)			-0.111 (0.130)			0.070 (0.110)
(o) Recruitment of senior engineers retired from MNCs, JVs, or large local firms			-0.169 (0.132)			-0.191 (0.161)			-0.168 (0.150)
(p) Headhunt of top management from MNCs, JVs, or large local firms			-0.093 (0.141)			0.063 (0.168)			-0.091 (0.180)
Number of Sources	0.046 (0.038)	0.012 (0.043)	0.046 (0.040)	0.116 * (0.059)	0.159 ** (0.061)	0.142 ** (0.059)	0.103 ** (0.044)	0.122 ** (0.048)	0.097 ** (0.042)
Dummy variable (Indonesia)	0.438 (0.595)	0.587 (0.635)	0.463 (0.613)	0.983 (0.845)	1.230 (0.859)	0.976 (0.797)	0.405 (0.757)	0.242 (0.807)	0.442 (0.746)
Dummy variable (Thai)	0.793 (1.084)	0.664 (1.090)	0.688 (1.071)	0.495 (1.426)	2.023 (1.755)	0.517 (1.461)	-1.937 * (1.175)	-2.040 (1.256)	-1.677 (1.131)
Dummy variable (Vietnam)	1.592 ** (0.729)	1.241 * (0.705)	0.920 (0.678)	-0.076 (0.720)	0.197 (0.754)	0.328 (0.769)	0.264 (0.813)	0.624 (0.885)	0.301 (0.919)

444

/cut1	-0.231	-0.313	-0.169	-0.014	0.440	0.066	0.754	0.845	0.527
	(1.113)	(1.165)	(1.149)	(1.016)	(1.079)	(1.009)	(1.289)	(1.306)	(1.198)
/cut2	0.186	0.159	0.248	0.407	0.874	0.494	0.971	1.078	0.745
	(1.096)	(1.147)	(1.131)	(1.022)	(1.088)	(1.016)	(1.283)	(1.300)	(1.192)
/cut3	1.177	1.208	1.181	1.101	1.628	1.215	2.052	2.254	1.856
	(1.094)	(1.139)	(1.120)	(1.039)	(1.110)	(1.034)	(1.285)	(1.299)	(1.192)
/cut4	2.055	2.070	2.014	2.063	2.703	2.200	3.599	3.986	3.435
	(1.117)	(1.157)	(1.137)	(1.056)	(1.141)	(1.057)	(1.335)	(1.372)	(1.249)
Number of observation	84	84	84	72	72	72	65	65	65
Log likelihood	-94.24	-93.28	-95.65	-79.64	-75.97	-78.91	-70.53	-66.41	-70.26
Pseudo R2	0.069	0.079	0.055	0.103	0.144	0.111	0.110	0.162	0.113

	Coal, petroleum products, Chemicals, chemical products			Plastic, rubber products, Other non-metallic mineral products			Iron, steel, Non-ferrous metals, Metal products		
	Selected model 1	Selected model 2	Selected model 3	Selected model 1	Selected model 2	Selected model 3	Selected model 1	Selected model 2	Selected model 3
Age (establishment)	0.040	0.030	0.067 *	-0.008	-0.004	0.006	0.029	0.015	0.024
	(0.031)	(0.031)	(0.037)	(0.024)	(0.025)	(0.025)	(0.023)	(0.026)	(0.023)
Number of full-time employees (logarithmic)	0.381	0.240	0.409	0.667 **	0.837 ***	0.834 ***	0.190	0.305 *	0.377 **
	(0.338)	(0.353)	(0.391)	(0.258)	(0.251)	(0.267)	(0.167)	(0.183)	(0.177)
(e) Technical assistance financed/provided by government/public agency	0.146 (0.162)			-0.036 (0.120)			-0.217 ** (0.093)		
(f) Technical assistance financed/provided by industrial/trade organizations	0.081 (0.156)			-0.249 ** (0.124)			0.097 (0.104)		
(g) Technical assistance financed/provided by community organizations (NGOs or NPOs)	0.063 (0.182)			0.047 (0.118)			0.021 (0.101)		
(h) Technical assistance financed/provided by government owned financial institutions	-0.290 (0.252)			0.146 (0.114)			-0.011 (0.102)		
(i) Cooperation with universities/higher educational institutions		0.130 (0.393)			-0.117 (0.213)			-0.100 (0.110)	
(j) Cooperation with government or public research institutes		-0.161 (0.306)			-0.133 (0.172)			-0.071 (0.121)	
(k) University professors or researchers personally closed contracts with your firm		-0.187 (0.251)			0.272 (0.207)			0.276 ** (0.134)	
(l) Dispatch your engineers to universities/higher educational institutions		-0.217 (0.186)			-0.137 (0.205)			0.118 (0.121)	
(m) Dispatch your engineers to government or public research institutes		0.393 (0.384)			0.183 (0.176)			-0.150 (0.135)	
(n) Recruitment of middle-ranking personnel or mid-carrier engineers			-0.200 (0.162)			0.004 (0.118)			-0.226 ** (0.096)
(o) Recruitment of senior engineers retired from MNCs, JVs, or large local firms			-0.404 ** (0.159)			-0.190 (0.138)			-0.134 (0.112)
(p) Headhunt of top management from MNCs, JVs, or large local firms			0.190 (0.197)			0.393 * (0.226)			-0.061 (0.119)
Number of Sources	0.056	0.017	0.106	0.134 **	0.090	0.087	0.008	-0.027	0.054
	(0.079)	(0.077)	(0.076)	(0.061)	(0.063)	(0.066)	(0.050)	(0.047)	(0.046)
Dummy variable (Indonesia)	-0.536	-0.391	-1.335	1.246	0.673	0.707	-0.073	0.744	-0.044
	(1.430)	(1.320)	(1.420)	(1.094)	(1.186)	(1.083)	(1.023)	(0.968)	(0.944)
Dummy variable (Thai)	-0.588	-0.676	-1.026	2.118	2.222	2.359 *	-0.137	-0.470	-0.096
	(1.089)	(1.011)	(1.045)	(1.292)	(1.407)	(1.396)	(0.774)	(0.784)	(0.787)
Dummy variable (Vietnam)	0.741	1.460	2.155 *	1.126 *	0.913	1.085 *	0.433	0.081	0.891
	(1.114)	(1.097)	(1.130)	(0.665)	(0.686)	(0.636)	(0.584)	(0.588)	(0.568)

446

/cut1	0.592	-1.037	0.311	2.110	2.845	3.019	-1.797	-1.625	-1.304
	(1.783)	(1.995)	(1.978)	(1.153)	(1.177)	(1.194)	(0.976)	(1.024)	(0.979)
/cut2	1.373	-0.246	1.298	2.942	3.693	3.841	-1.018	-0.831	-0.516
	(1.741)	(1.940)	(1.917)	(1.183)	(1.214)	(1.225)	(0.932)	(0.983)	(0.936)
/cut3	1.742	0.122	1.753	3.518	4.233	4.382	0.049	0.198	0.522
	(1.734)	(1.923)	(1.902)	(1.219)	(1.252)	(1.260)	(0.917)	(0.971)	(0.928)
/cut4	3.115	1.494	3.262	4.588	5.210	5.417	1.005	1.135	1.476
	(1.779)	(1.939)	(1.964)	(1.276)	(1.308)	(1.327)	(0.918)	(0.972)	(0.937)
Number of observation	41	41	41	75	75	75	93	93	93
Log likelihood	-45.58	-45.22	-42.53	-77.53	-78.47	-77.99	-106.6	-106.1	-105.4
Pseudo R2	0.073	0.080	0.135	0.173	0.162	0.168	0.048	0.053	0.059

	Machinery, equipment, tools			Computers & computer parts, Other electronics & components			Precision instruments, Automobile, auto parts, Other transportation equipments and parts		
	Selected model 1	Selected model 2	Selected model 3	Selected model 1	Selected model 2	Selected model 3	Selected model 1	Selected model 2	Selected model 3
Age (establishment)	0.147 *	0.167 **	0.095	0.079 *	0.021	0.048	-0.036	-0.031	-0.023
	(0.077)	(0.079)	(0.059)	(0.046)	(0.045)	(0.042)	(0.032)	(0.036)	(0.037)
Number of full-time employees (logarithmic)	0.322	0.586	0.968 **	0.512 **	0.667 **	0.730 ***	0.999 ***	0.983 **	0.738 **
	(0.381)	(0.391)	(0.414)	(0.239)	(0.265)	(0.261)	(0.367)	(0.380)	(0.314)
(e) Technical assistance financed/provided by government/public agency	-0.652 ***			0.074			-0.074		
	(0.245)			(0.128)			(0.163)		
(f) Technical assistance financed/provided by industrial/trade organizations	-0.039			-0.047			-0.094		
	(0.182)			(0.139)			(0.169)		
(g) Technical assistance financed/provided by community organizations (NGOs or NPOs)	0.008			-0.112			-0.068		
	(0.210)			(0.125)			(0.180)		
(h) Technical assistance financed/provided by government owned financial institutions	-0.083			0.159			0.560 **		
	(0.186)			(0.140)			(0.257)		
(i) Cooperation with universities/higher educational institutions		-0.217			-0.028			-0.111	
		(0.204)			(0.154)			(0.158)	
(j) Cooperation with government or public research institutes		-0.350			-0.473 ***			-0.247	
		(0.237)			(0.182)			(0.271)	
(k) University professors or researchers personally closed contracts with your firm		-0.272			0.055			-0.214	
		(0.168)			(0.173)			(0.197)	
(l) Dispatch your engineers to universities/higher educational institutions		0.617 *			0.006			0.051	
		(0.341)			(0.250)			(0.204)	
(m) Dispatch your engineers to government or public research institutes		-0.056			-0.021			5.661	
		(0.352)			(0.284)			(719)	
(n) Recruitment of middle-ranking personnel or mid-carrier engineers			-0.308			0.203			0.006
			(0.302)			(0.142)			(0.211)
(o) Recruitment of senior engineers retired from MNCs, JVs, or large local firms			0.388 **			-0.299 *			-0.101
			(0.178)			(0.153)			(0.219)
(p) Headhunt of top management from MNCs, JVs, or large local firms			0.536			0.201			0.235
			(0.346)			(0.204)			(0.242)
Number of Sources	0.367 **	0.289 **	0.055	0.032	0.171 **	0.042	-0.110 *	-0.142 **	-0.092
	(0.142)	(0.123)	(0.126)	(0.065)	(0.083)	(0.071)	(0.064)	(0.071)	(0.064)
Dummy variable (Indonesia)	11.831	13.321	19.413	16.865	19.354	18.004	3.273 **	3.177 *	3.778 **
	(2367)	(2401)	(5087)	(975)	(1017)	(1159)	(1.596)	(1.810)	(1.629)
Dummy variable (Thai)	17.932	18.397	19.172	0.568	-0.542	1.567	5.364 ***	4.745 ***	4.826 ***
	(2936)	(3204)	(6196)	(0.960)	(1.196)	(1.133)	(1.806)	(1.727)	(1.678)
Dummy variable (Vietnam)	0.642	0.708	1.775	3.171 ***	3.080 ***	2.863 ***	3.535 ***	3.504 ***	2.848 ***
	(1.165)	(1.161)	(1.344)	(0.805)	(0.846)	(0.842)	(1.072)	(1.020)	(1.084)

/cut1	0.897	2.730	2.228	3.177	3.938	4.560	2.451	2.005	1.791
	(1.954)	(1.928)	(1.830)	(1.577)	(1.701)	(1.651)	(1.680)	(1.693)	(1.634)
/cut2	1.821	3.752	3.273	3.331	4.094	4.719	2.759	2.307	2.060
	(1.912)	(1.917)	(1.810)	(1.579)	(1.703)	(1.653)	(1.698)	(1.707)	(1.644)
/cut3	4.266	5.764	5.435	4.287	5.100	5.782	4.177	3.823	3.307
	(1.955)	(2.018)	(1.882)	(1.615)	(1.740)	(1.707)	(1.840)	(1.829)	(1.730)
/cut4	5.153	6.414	6.097	5.264	6.150	6.835	4.787	4.545	3.862
	(2.022)	(2.064)	(1.930)	(1.666)	(1.799)	(1.772)	(1.888)	(1.878)	(1.762)
Number of observation	50	50	50	87	87	87	57	57	57
Log likelihood	-34.05	-36.83	-37.00	-70.88	-68.19	-68.86	-41.41	-37.26	-44.12
Pseudo R2	0.347	0.294	0.290	0.215	0.244	0.237	0.231	0.308	0.181

	Others		
	Selected model 1	Selected model 2	Selected model 3
Age (establishment)	0.017 (0.018)	0.016 (0.014)	0.016 (0.016)
Number of full-time employees (logarithmic)	-0.033 (0.157)	-0.200 (0.162)	-0.093 (0.153)
(e) Technical assistance financed/provided by government/public agency	0.013 (0.107)		
(f) Technical assistance financed/provided by industrial/trade organizations	-0.071 (0.099)		
(g) Technical assistance financed/provided by community organizations (NGOs or NPOs)	0.004 (0.115)		
(h) Technical assistance financed/provided by government owned financial institutions	0.217 * (0.119)		
(i) Cooperation with universities/higher educational institutions		-0.009 (0.122)	
(j) Cooperation with government or public research institutes		-0.034 (0.131)	
(k) University professors or researchers personally closed contracts with your firm		0.033 (0.123)	
(l) Dispatch your engineers to universities/higher educational institutions		-0.167 (0.143)	
(m) Dispatch your engineers to government or public research institutes		0.323 ** (0.161)	
(n) Recruitment of middle-ranking personnel or mid-carrier engineers			0.092 (0.095)
(o) Recruitment of senior engineers retired from MNCs, JVs, or large local firms			-0.125 (0.126)
(p) Headhunt of top management from MNCs, JVs, or large local firms			0.164 (0.133)
Number of Sources	0.026 (0.040)	0.030 (0.040)	0.051 (0.042)
Dummy variable (Indonesia)	0.087 (0.752)	0.040 (0.757)	-0.009 (0.782)
Dummy variable (Thai)	-1.335 * (0.774)	-1.537 ** (0.783)	-1.650 ** (0.818)
Dummy variable (Vietnam)	0.377 (0.773)	0.566 (0.772)	0.051 (0.847)

/cut1	-2.940	-3.791	-2.968
	(1.032)	(1.094)	(1.036)
/cut2	-2.059	-2.905	-2.073
	(0.959)	(1.021)	(0.964)
/cut3	-0.875	-1.676	-0.882
	(0.918)	(0.970)	(0.926)
/cut4	-0.163	-0.944	-0.179
	(0.913)	(0.959)	(0.920)
Number of observation	91	91	91
Log likelihood	-97.39	-96.68	-98.12
Pseudo R2	0.070	0.077	0.063

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

Note 2: Standard errors in parenthesis

Table A7 Estimation Results of Characterization of Innovation (Table 15)

	Significant change in packaging or appearance design					Significant improvement of an existing product/service				
	Full model	Selected model 1	Selected model 2	Selected model 3	Selected model 4	Full model	Selected model 1	Selected model 2	Selected model 3	Selected model 4
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
Age (establishment)	-0.001	-0.002	-0.001	-0.002	-0.001	0.018	0.014	0.017	0.018 *	0.017
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Number of full-time employees (logarithmic)	0.211 ***	0.201 ***	0.207 ***	0.208 ***	0.191 ***	0.082	0.101	0.115	0.105	0.067
	(0.066)	(0.064)	(0.064)	(0.064)	(0.064)	(0.087)	(0.084)	(0.083)	(0.083)	(0.084)
Textiles, Apparel, leather	-0.056	-0.088	-0.057	-0.169	-0.104	0.320	0.285	0.217	0.210	0.254
	(0.299)	(0.292)	(0.290)	(0.293)	(0.290)	(0.386)	(0.378)	(0.372)	(0.374)	(0.379)
Wood, Paper products	0.187	0.179	0.139	0.230	0.216	0.071	0.070	0.024	0.057	0.147
	(0.329)	(0.313)	(0.318)	(0.314)	(0.311)	(0.391)	(0.381)	(0.383)	(0.379)	(0.382)
Coal, Chemical products	0.304	0.177	0.215	0.170	0.161	1.055	0.946	0.971	0.957	1.017
	(0.393)	(0.380)	(0.375)	(0.380)	(0.374)	(0.647)	(0.637)	(0.632)	(0.633)	(0.637)
Iron, Metal products	-0.760 ***	-0.704 ***	-0.721 ***	-0.648 **	-0.618 **	-0.754 **	-0.743 **	-0.873 ***	-0.820 ***	-0.753 **
	(0.274)	(0.262)	(0.264)	(0.262)	(0.259)	(0.313)	(0.304)	(0.304)	(0.300)	(0.302)
Computers, Other electronics	0.187	0.281	0.271	0.302	0.328	0.538	0.646	0.589	0.596	0.601
	(0.315)	(0.307)	(0.308)	(0.309)	(0.307)	(0.468)	(0.460)	(0.451)	(0.454)	(0.457)
Automobile, Other transportation	0.150	0.070	0.132	0.110	0.114	0.816	0.791	0.723	0.754	0.787
	(0.387)	(0.373)	(0.382)	(0.376)	(0.376)	(0.579)	(0.572)	(0.572)	(0.569)	(0.573)
(a) Internal sources of information and own R&D efforts	-0.087 **	-0.080 **				0.056	0.083 *			
	(0.039)	(0.036)				(0.049)	(0.047)			
(b) Cooperation with local firms (100% local capital)	0.010	0.022				0.040	0.061			
	(0.040)	(0.038)				(0.052)	(0.049)			
(c) Cooperation with MNCs (100% non-local capital)	0.092 *	0.092 *				0.075	0.058			
	(0.054)	(0.052)				(0.076)	(0.073)			
(d) Cooperation with Joint Ventures	-0.065	-0.055				-0.028	-0.002			
	(0.049)	(0.047)				(0.067)	(0.065)			
(e) Technical assistance financed/provided by government/public agency	-0.060		-0.077 **			-0.012		0.024		
	(0.042)		(0.039)			(0.057)		(0.053)		
(f) Technical assistance financed/provided by industrial/trade organizations	0.003		-0.015			0.003		0.006		
	(0.041)		(0.039)			(0.056)		(0.053)		
(g) Technical assistance financed/provided by community organizations (NGOs or NPOs)	-0.008		-0.008			0.008		0.001		
	(0.044)		(0.042)			(0.063)		(0.060)		
(h) Technical assistance financed/provided by government owned financial institutions	0.172 ***		0.156 ***			0.115		0.128 **		
	(0.049)		(0.046)			(0.070)		(0.065)		
(i) Cooperation with universities/higher educational institutions	-0.104 **			-0.108 **		0.041			0.050	
	(0.047)			(0.044)		(0.063)			(0.060)	

452

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(j) Cooperation with government or public research institutes	0.004 (0.049)			0.022 (0.045)		0.042 (0.066)			0.087 (0.063)	
(k) University professors or researchers personally closed contracts with your firm	-0.036 (0.048)			-0.037 (0.046)		-0.046 (0.068)			-0.023 (0.065)	
(l) Dispatch your engineers to universities/higher educational institutions	-0.099 * (0.053)			-0.069 (0.050)		-0.045 (0.071)			-0.033 (0.069)	
(m) Dispatch your engineers to government or public research institutes	0.130 ** (0.059)			0.126 ** (0.057)		-0.080 (0.074)			-0.064 (0.071)	
(n) Recruitment of middle-ranking personnel or mid-carrier engineers	0.052 (0.041)				0.029 (0.037)	0.096 * (0.050)				0.126 *** (0.046)
(o) Recruitment of senior engineers retired from MNCs, JVs, or large local firms	-0.029 (0.049)				-0.027 (0.045)	-0.105 (0.064)				-0.099 (0.062)
(p) Headhunt of top management from MNCs, JVs, or large local firms	0.018 (0.055)				0.005 (0.051)	0.057 (0.076)				0.040 (0.071)
Number of Sources	0.028 (0.018)	0.027 * (0.015)	0.017 (0.016)	0.037 ** (0.016)	0.027 * (0.015)	0.033 (0.021)	0.033 * (0.019)	0.034 * (0.019)	0.049 ** (0.020)	0.050 *** (0.019)
Dummy variable (Indonesia)	0.545 * (0.294)	0.624 ** (0.274)	0.606 ** (0.278)	0.550 ** (0.274)	0.604 ** (0.275)	0.072 (0.356)	0.177 (0.337)	0.185 (0.334)	0.072 (0.331)	0.018 (0.334)
Dummy variable (Thai)	-0.444 (0.310)	-0.406 (0.295)	-0.399 (0.296)	-0.507 * (0.298)	-0.452 (0.297)	-0.174 (0.378)	-0.143 (0.363)	-0.129 (0.361)	-0.142 (0.358)	-0.212 (0.363)
Dummy variable (Vietnam)	1.529 *** (0.286)	1.431 *** (0.248)	1.355 *** (0.230)	1.456 *** (0.232)	1.275 *** (0.233)	1.156 *** (0.377)	1.210 *** (0.335)	1.457 *** (0.316)	1.510 *** (0.317)	1.227 *** (0.324)
Constant	-1.118 *** (0.381)	-1.027 *** (0.373)	-1.075 *** (0.371)	-1.136 *** (0.370)	-1.144 *** (0.372)	-0.322 (0.474)	-0.247 (0.471)	-0.151 (0.461)	-0.143 (0.460)	-0.161 (0.462)
Number of observation	715	715	715	715	715	715	715	715	715	715
Log likelihood	-398.1	-413.5	-410.6	-411.0	-417.4	-266.9	-273.5	-274.5	-275.8	-273.1
Pseudo R2	0.142	0.109	0.115	0.114	0.101	0.145	0.124	0.120	0.116	0.125

	Development of a totally new product/service based on the existing technologies for your establishment					Development of a totally new product/service based on new technologies for your establishment				
	Full model	Selected model 1	Selected model 2	Selected model 3	Selected model 4	Full model	Selected model 1	Selected model 2	Selected model 3	Selected model 4
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
Age (establishment)	-0.008	-0.008	-0.008	-0.008	-0.008	-0.010	-0.009	-0.008	-0.010	-0.009
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Number of full-time employees (logarithmic)	0.245 ***	0.258 ***	0.258 ***	0.250 ***	0.239 ***	0.245 ***	0.250 ***	0.253 ***	0.256 ***	0.239 ***
	(0.067)	(0.066)	(0.066)	(0.066)	(0.066)	(0.064)	(0.062)	(0.062)	(0.062)	(0.062)
Textiles, Apparel, leather	-0.012	-0.051	-0.081	-0.076	-0.068	-0.321	-0.339	-0.356	-0.394	-0.350
	(0.305)	(0.301)	(0.299)	(0.299)	(0.300)	(0.287)	(0.279)	(0.278)	(0.279)	(0.276)
Wood, Paper products	-0.210	-0.246	-0.236	-0.217	-0.196	-0.008	-0.097	-0.049	-0.040	-0.033
	(0.318)	(0.309)	(0.310)	(0.307)	(0.308)	(0.302)	(0.291)	(0.295)	(0.293)	(0.290)
Coal, Chemical products	0.931 **	0.866 *	0.873 *	0.861 *	0.877 *	0.637	0.575	0.681 *	0.599	0.622 *
	(0.460)	(0.454)	(0.452)	(0.453)	(0.452)	(0.388)	(0.374)	(0.374)	(0.372)	(0.374)
Iron, Metal products	-0.437	-0.466 *	-0.450 *	-0.448 *	-0.412	-0.491 *	-0.505 **	-0.468 *	-0.508 **	-0.450 *
	(0.269)	(0.264)	(0.264)	(0.262)	(0.263)	(0.263)	(0.253)	(0.252)	(0.252)	(0.252)
Computers, Other electronics	-0.358	-0.337	-0.290	-0.294	-0.311	0.820 ***	0.878 ***	0.911 ***	0.966 ***	0.871 ***
	(0.297)	(0.291)	(0.289)	(0.290)	(0.290)	(0.306)	(0.297)	(0.298)	(0.297)	(0.296)
Automobile, Other transportation	-0.085	-0.143	-0.092	-0.106	-0.094	-0.171	-0.165	-0.071	-0.186	-0.217
	(0.391)	(0.385)	(0.386)	(0.385)	(0.387)	(0.368)	(0.356)	(0.359)	(0.357)	(0.358)
(a) Internal sources of information and own R&D efforts	-0.070 *	-0.058				-0.018	-0.028			
	(0.038)	(0.036)				(0.036)	(0.034)			
(b) Cooperation with local firms (100% local capital)	0.043	0.058				0.022	0.027			
	(0.039)	(0.038)				(0.037)	(0.035)			
(c) Cooperation with MNCs (100% non-local capital)	0.029	0.026				0.111 **	0.114 **			
	(0.055)	(0.054)				(0.051)	(0.049)			
(d) Cooperation with Joint Ventures	-0.004	0.004				0.007	0.018			
	(0.049)	(0.048)				(0.046)	(0.044)			
(e) Technical assistance financed/provided by government/public agency	0.000		0.002			-0.084 **		-0.098 ***		
	(0.042)		(0.039)			(0.039)		(0.036)		
(f) Technical assistance financed/provided by industrial/trade organizations	0.004		0.002			0.008		0.001		
	(0.041)		(0.039)			(0.038)		(0.036)		
(g) Technical assistance financed/provided by community organizations (NGOs or NPOs)	0.034		0.028			0.054		0.067 *		
	(0.044)		(0.042)			(0.040)		(0.038)		
(h) Technical assistance financed/provided by government owned financial institutions	0.041		0.045			0.066		0.053		
	(0.046)		(0.043)			(0.042)		(0.039)		
(i) Cooperation with universities/higher educational institutions	0.024			0.031		-0.019			-0.032	
	(0.048)			(0.046)		(0.045)			(0.042)	

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(j) Cooperation with government or public research institutes	-0.025 (0.048)			-0.018 (0.046)		-0.144 *** (0.047)			-0.118 *** (0.043)	
(k) University professors or researchers personally closed contracts with your firm	-0.033 (0.048)			-0.028 (0.047)		0.028 (0.045)			0.048 (0.043)	
(l) Dispatch your engineers to universities/higher educational institutions	-0.003 (0.054)			0.006 (0.053)		-0.014 (0.050)			0.003 (0.048)	
(m) Dispatch your engineers to government or public research institutes	0.000 (0.058)			0.009 (0.057)		0.090 (0.056)			0.108 ** (0.054)	
(n) Recruitment of middle-ranking personnel or mid-carrier engineers	0.060 (0.041)				0.057 (0.038)	0.036 (0.040)				0.032 (0.036)
(o) Recruitment of senior engineers retired from MNCs, JVs, or large local firms	-0.026 (0.048)				-0.016 (0.046)	-0.035 (0.045)				-0.037 (0.043)
(p) Headhunt of top management from MNCs, JVs, or large local firms	0.008 (0.056)				0.001 (0.053)	0.115 ** (0.054)				0.126 ** (0.051)
Number of Sources	0.046 ** (0.018)	0.052 *** (0.016)	0.044 *** (0.016)	0.056 *** (0.017)	0.053 *** (0.016)	0.029 * (0.018)	0.033 ** (0.015)	0.045 *** (0.016)	0.052 *** (0.016)	0.036 ** (0.015)
Dummy variable (Indonesia)	0.448 (0.302)	0.437 (0.286)	0.528 * (0.286)	0.447 (0.284)	0.473 (0.288)	0.638 ** (0.299)	0.669 ** (0.279)	0.493 * (0.279)	0.572 ** (0.278)	0.617 ** (0.281)
Dummy variable (Thai)	-0.081 (0.311)	-0.102 (0.303)	-0.062 (0.303)	-0.108 (0.303)	-0.095 (0.306)	-0.003 (0.313)	0.044 (0.300)	0.051 (0.300)	-0.024 (0.302)	-0.019 (0.302)
Dummy variable (Vietnam)	0.698 ** (0.274)	0.797 *** (0.246)	0.875 *** (0.226)	0.924 *** (0.228)	0.786 *** (0.235)	-0.375 (0.267)	-0.203 (0.234)	-0.180 (0.213)	-0.068 (0.215)	-0.077 (0.222)
Constant	-1.195 *** (0.386)	-1.145 *** (0.382)	-1.195 *** (0.379)	-1.158 *** (0.376)	-1.240 *** (0.380)	-1.402 *** (0.374)	-1.414 *** (0.364)	-1.359 *** (0.360)	-1.406 *** (0.360)	-1.441 *** (0.363)
Number of observation	715	715	715	715	715	715	715	715	715	715
Log likelihood	-401.3	-404.1	-405.2	-406.1	-405.3	-432.8	-446.8	-446.4	-445.8	-447.7
Pseudo R2	0.096	0.089	0.087	0.085	0.087	0.118	0.090	0.090	0.092	0.088

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

Note 2: Standard errors in parenthesis

Table A8 Estimation Result of Upgrading Innovation (Table 16)

	Full model		Selected model 1	Selected model 2	Selected model 3	Selected model 4
	Coef.		Coef.	Coef.	Coef.	Coef.
Age (establishment)	-0.006		-0.006	-0.005	-0.005	-0.005
	(0.006)		(0.006)	(0.006)	(0.006)	(0.006)
Number of full-time employees (logarithmic)	0.243	***	0.259 ***	0.264 ***	0.264 ***	0.245 ***
	(0.060)		(0.058)	(0.059)	(0.058)	(0.059)
Textiles, Apparel, leather	-0.189		-0.240	-0.255	-0.276	-0.243
	(0.258)		(0.253)	(0.252)	(0.253)	(0.252)
Wood, Paper products	0.101		0.002	0.059	0.064	0.090
	(0.278)		(0.272)	(0.274)	(0.272)	(0.271)
Coal, Chemical products	0.884	**	0.798 **	0.874 **	0.813 **	0.837 **
	(0.372)		(0.360)	(0.357)	(0.359)	(0.360)
Iron, Metal products	-0.488	**	-0.513 **	-0.506 **	-0.533 **	-0.469 **
	(0.232)		(0.226)	(0.226)	(0.224)	(0.226)
Computers, Other electronics	0.795	***	0.859 ***	0.888 ***	0.918 ***	0.855 ***
	(0.298)		(0.293)	(0.293)	(0.293)	(0.292)
Automobile, Other transportation	-0.062		-0.062	-0.021	-0.112	-0.113
	(0.344)		(0.334)	(0.339)	(0.337)	(0.336)
(a) Internal sources of information and own R&D efforts	-0.004		-0.007			
	(0.033)		(0.031)			
(b) Cooperation with local firms (100% local capital)	0.014		0.024			
	(0.034)		(0.033)			
(c) Cooperation with MNCs (100% non-local capital)	0.096	**	0.097 **			
	(0.047)		(0.046)			
(d) Cooperation with Joint Ventures	-0.008		0.004			
	(0.041)		(0.040)			
(e) Technical assistance financed/provided by government/public agency	-0.070	*		-0.073 **		
	(0.036)			(0.033)		
(f) Technical assistance financed/provided by industrial/trade organizations	0.012			0.007		
	(0.034)			(0.033)		
(g) Technical assistance financed/provided by community organizations (NGOs or NPOs)	0.045			0.050		
	(0.036)			(0.035)		
(h) Technical assistance financed/provided by government owned financial institutions	0.058			0.051		
	(0.038)			(0.036)		
(i) Cooperation with universities/higher educational institutions	-0.020				-0.033	
	(0.041)				(0.039)	
(j) Cooperation with government or public research institutes	-0.097	**			-0.077 **	
	(0.040)				(0.038)	

(k)	University professors or researchers personally closed contracts with your firm	0.014				0.033
		(0.041)				(0.040)
(l)	Dispatch your engineers to universities/higher educational institutions	-0.019				-0.003
		(0.045)				(0.044)
(m)	Dispatch your engineers to government or public research institutes	0.086 *				0.100 **
		(0.051)				(0.050)
(n)	Recruitment of middle-ranking personnel or mid-carrier engineers	0.057				0.053
		(0.037)				(0.034)
(o)	Recruitment of senior engineers retired from MNCs, JVs, or large local firms	-0.038				-0.035
		(0.042)				(0.039)
(p)	Headhunt of top management from MNCs, JVs, or large local firms	0.091 *				0.096 **
		(0.051)				(0.048)
	Number of Sources	0.046 ***	0.050 ***	0.058 ***	0.066 ***	0.053 ***
		(0.017)	(0.014)	(0.015)	(0.015)	(0.015)
	Dummy variable (Indonesia)	0.698 **	0.736 ***	0.612 **	0.633 **	0.689 **
		(0.282)	(0.268)	(0.267)	(0.267)	(0.270)
	Dummy variable (Thai)	0.087	0.119	0.132	0.056	0.076
		(0.293)	(0.284)	(0.285)	(0.286)	(0.288)
	Dummy variable (Vietnam)	0.303	0.423 *	0.461 **	0.553 ***	0.460 **
		(0.242)	(0.215)	(0.198)	(0.201)	(0.209)
	/cut1	-0.332	-0.310	-0.362	-0.323	-0.273
		(0.352)	(0.346)	(0.343)	(0.341)	(0.344)
	/cut2	-0.258	-0.236	-0.288	-0.249	-0.199
		(0.351)	(0.345)	(0.342)	(0.340)	(0.343)
	/cut3	0.957	0.964	0.911	0.952	1.003
		(0.350)	(0.344)	(0.340)	(0.339)	(0.343)
	/cut4	2.062	2.040	1.987	2.028	2.077
		(0.357)	(0.350)	(0.347)	(0.345)	(0.349)
	Number of observation	715	715	715	715	715
	Log likelihood	-769.69	-781.20	-780.93	-780.60	-781.01
	Pseudo R2	0.080	0.067	0.067	0.067	0.067

Note 1: ***, ** and * indicate the significance level at the 1%, 5% and 10%
Note 2: Standard errors in parenthesis