The FORMATION OF INDUSTRIALCLUSTERS IN ASIA AND REGIONAL INTEGRATION
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Midterm Report

Chapter 8

Agglomeration and Local Innovation Network in Japanese SMEs: Analysis of the Information Linkage

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1. Introduction

The revitalization of Japanese SMEs (small- and medium-sized enterprises) is one of the most important issues in Japanese economy, and weakening SMEs surely leads to losing competitiveness of whole Japanese manufacturing industries, since the former is essential basis for the latter. Countless measures to revitalize the industrial sector have been implemented so far by all levels of government, from central to local, especially and a significant amount of public funding has been poured into various projects, such as promoting venture businesses or supporting academia/industry/government collaboration. The reality of Japanese SMEs, however, shows that revitalization has not acheived. Thus far, such policy measures have not been successful in promoting SMEs's revitalization.

There are lots of way of achieving upgrading and innovation; one is that each SMEs is responsible and mobilizes all resources to it, and the other is that the region has responsibilities and utilizes all policy measures available to achieve it. In other words, the former is the framework of market mechanism, while the latter that of public policy. This paper analyzes innovation via the public policy. For the local innovation policy, the most important matter is how for SMEs to obtain cutting-edge information on technology, market conditions, financing, etc. which are essential to innovation. The key player in this context is local R&D institutions which own technology. For innovation, SMEs have to equip themselves with higher technology and management. One means to achieving this is the industrial cluster policy, which aims to revitalize regional industries and SMEs by agglomerating firms which are large or new start-ups, research institutions related to high or low technologies, and universities with research of cutting-edge technology. The rationale is provided by Fujita, Krugman, and Venables [1999], Krugman [1991], Porter [1980], Saxenian [1994], for instance. The essence of these theories, in the present context, lies in the flow of information generated by agglomeration; that is, in regions where firms and research institutions cluster, collaboration and competition among those parties and organizations create not chaos, but rather the "coherent power" of vitalization. In the previous paper, we

refer to this process as the "endogenous innovation process".[1] Once a region develops sufficient power to create something new, the process can repeat itself to yield another such upgrading and innovation.

The authors have been conducting research so far in order to formulate how industrial clustering occurs mainly in East Asian economies, and the hypothesis we are postulating is referred to as the "Flowchart Approach" initiated by Kuchiki [2007]. Based on accumulated studies such as Kuchiki and Tsuji [2005], Tsuji, Miyahara, Ueki, and Somrote [2006] Tsuji, Giovannetti and Kagami [2007], Tsuji, Miyajara, and Ueki [2008], and Kuchiki and Tsuji [2009], the Flowchart Approach has been verifying and elaborating. Industrial clustering itself, however, is not the final aim to vitalize the regional as well as national economies, but it is one effective method to trigger economic activities. One more important role of agglomeration is that it is fundamental basis of innovation or industrial upgrading in industrial clusters. This role of clustering has been emphasized by many authors such as Porter [1980], Saxenian [1994], and Fujita, Krugman, and Venables [1999], as already mentioned. This paper thus aims to initiate the so-called "Flowchart Approach to endogenous innovation process" inside an industrial cluster, and makes an attempt to postulate how industrial clustering transforms into the upgrading and innovation process. In order to analyze this process, at first we have to clarify how firms inside of a cluster are conducting innovation and upgrading and how their activities are different from those outside of a cluster.

This paper aims to verify the following two hypotheses: (i) a relationship between innovation and industrial clustering formed by regional SMEs; and (ii) information flow, or quality of linkage among SMEs and regional R&D institutions. Regarding (i), we compare the performance of innovation by SMEs inside and outside of the cluster. If we prove that the former has larger number of innovation that that of the latter, then industrial clustering surely matters to innovation. Regarding (ii), we analyzes the relationship among SMEs and regional R&D institutions in terms of information flow among them, namely, we choose the following three variables as proxy for them: (i) geographic proximity of distance between a SME and regional R&D institutions; (ii) frequency of communications between them; and (iii) subcontractors of large firms. There is no need for explanation for (i) and (ii), since it is reasonable to measure of information flow among them. The aim of (iii) is required some explanation. The underlining hypothesis is that SMEs in the hierarchical production system organized by large firms may have more information than independent SMEs. The former can receive more information regarding technology, management, market, etc. from mother

[1] See Tsuji and Miyahara [2009] for endogenous innovation process.

companies.

In order to verify the above hypotheses, we conducted an extensive mail survey to 5,000 SMEs which were authorized as "innovative" by the Small and Medium Enterprise Agency, and divided these 5,000 SMEs into two groups, those inside or outside a cluster. By comparing the two groups, we analyze how industrial clusters and regional research institutions influence innovations and the upgrading of SMEs.[2]

The paper consists of the following sections. Section 2 presents the contents of the mail survey conducted in October and November 2007. In Section 3, the methodology of the statistical analysis; and the results of estimations are presented in section 4. In the final section, conclusions and suggestions for the further research will be briefly presented.

2. Mail Survey

First, the contents of the mail survey, conducted in October and November 2007, and a summary of the results are presented.

2.1 Objectives of Mail Survey

The objective of this mail survey was to obtain and analyze data to verify two hypotheses: (i) the relationship between SME innovation and industrial clustering; and (ii) the relationship between SME innovation and regional collaboration with research facilities such as universities and other public research institutions. To verify these, we selected SMEs authorized as "innovative" by the Small and Medium Enterprise Agency, which aims to support SMEs and assist their survival in the current severe circumstances. The Agency authorizes SMEs as innovative and supports the restructuring of their businesses to expand into new fields or the upgrading of their technologies.[3.] In this paper, we divide them into two groups: that is, SMEs inside and outside of a cluster.[4] We then compare these two groups in order to examine whether there are differences in upgrading and innovation; that is, we examine how industrial clusters and regional collaboration promote the upgrading and innovation of SMEs.

[2] The same mail surveys for inquiring industrial upgrading and innovations in East Asia were conducted in October-November, 2007 and 2008 in Indonesia, the Philippines, Thailand and Vietnam, and the results are found in Tsuji and Ueki [2008] and Machikita, Miyahara, Tsuji, and Ueki [2009].

[3] The New Business Promotion Act for SMEs, which was legislated in 1999. A total of 30,931 firms have been authorized as of December 2007.

[4] Areas referred to as a "cluster" accord with those defined by the Regional Industry Activating Act, which was legislated in 1997. The aim of this Act is to strengthen the basis of regional economies by promoting clustering industries in the region.

2.2. Characteristics of Respondent SMEs

We chose the SME sample as follows: we calculated the share of each prefecture with regard to the total number of authorized SMEs, and multiplied this by 5,000, which is the total number of mail questionnaires we wanted to send. This results in the number of mails to be sent to each prefecture. Then, we divided this number by the number of years in which there are SMEs authorized according to share, and thereby obtained the number of firms to choose in each prefecture. Finally, we selected SMEs inside a cluster and those outside of a cluster.

The questionnaire was then sent in November, 2007 to 2,000 SMEs inside and 3,000 outside of a cluster. A total of 889 valid responses were received. The overall response rate was 17.8%. The numbers of replies from SMEs inside and outside of a cluster are 316 (35.6%) and 573 (64.5%), respectively. Key questions regarding our hypotheses discussed in the previous section which are (i) a relationship between innovation and industrial clustering formed by regional SMEs; and (ii) information flow among SMEs and regional R&D institutions. Accordingly, for (i) we asked distance between them in Question VII 6-6, namely, "*How many minutes does it take by car (or equivalent) to reach partners (other companies, universities, and research institutes) with whom you collaborate on new projects?*" The replies to this question are summarized in Table 1. The interesting results are: (i) more than half SMEs are located within one hour driving areas from collaborating partners; and (ii) the percentage of SMEs located within this distance are greater than that of SMEs outside a cluster. This indicates that in industrial clusters, SMEs and collaborating research facilitates are located closely each other. Regarding (ii), we prepare the two questions, namely, Question II 6-5, namely, *"How often do you communicate R&D partners?"* The replies to this question are summarized in Table 2, which indicates that (i) about 40% of respondents SMEs communicate once in one or two weeks, and (ii) 27.7% of them once a month. The relationship with other firms as a source of information through mother firms is asked in I (5), namely, *"Company profile. Mark the following questions which are applicable: (1) self product; (2) order from Keiretsu company; (3) order from non-keiretsu company; and others"*. The replies to this question are summarized in Table 3, which indicates that approximately two thirds of respondents sell their own product, and 11.8% of them are related with *Keiretsu* company. This indicates that most SMEs were independent manufacturers or selling their products to non-*Keiretsu* firms.[5]

[5] SMEs in Ohta ward in metropolitan Tokyo tend to supply their products to *Keiretsu*; in contrast, those in Higashi-Osaka are more commonly independent manufacturers. See Tsuji et al.[2005]

Table 1: Distance between SMEs and collaborating partners

	Inside of cluster		Outside of cluster		Total	
	freq.	%	freq.	%	freq.	%
within 30 minutes	92	29.11	129	22.51	221	24.86
30 minutes to 1 hour	87	27.53	139	24.26	226	25.42
1 to 1.5 hours	10	3.16	33	5.76	43	4.84
1.5 to 2 hours	16	5.06	46	8.03	62	6.97
2 hours	24	7.59	56	9.77	80	9.00
too far to go by car	9	2.85	15	2.62	24	2.70
no reply	78	24.68	155	27.05	233	26.21
Total	316	100.00	573	100.00	889	100.00

Table 2: Frequency of communications

5 Frequency of Communications						
	within cluster		out of cluster		Total	
Everyday	13	4.1	11	2	24	2.7
Once in two or three days	26	8.2	60	10.8	86	9.7
Once a week	79	25	124	21.6	203	22.8
Once in two weeks	62	19.6	103	18	165	18.6
Once a month	78	24.7	167	29.1	245	27.7
Unknown	58	18.4	108	18.8	166	18.7

Table 3: Production linkage (sub-contructing)

	inside of cluster		outside of cluster		total	
	freq.	%	freq.	%	freq.	%
self products	200	63.29	367	64.05	567	63.78
orders from *keiretsu* company	25	7.91	80	13.96	105	11.81
orders from non-*keiretsu* company	85	26.90	132	23.04	217	24.41
Others	14	4.43	23	4.01	37	4.16
no reply	8	2.53	12	2.09	20	2.25
Total	316	100.00	573	100.00	889	100.00

Table 4 indicates the distribution of the year of establishment, which is evenly distributed, particularly in total, except over 50 years. However, SMEs outside a cluster have rather large variance. Tables 5 and 6 show the size of SMEs in terms of capital and employees,

respectively. The numbers of SMEs, which firm sizes in terms of capital are 10-20 million yen and over 50 million yen, account for more than 50%. Table 7 shows industry; most of the SMEs are engaged in the manufacturing sector, and this bias is often found in the data related to the Small and Medium Enterprise Agency. Table 8 explains the specific category within manufacturing, showing that food, metal, general machinery, and electrics are the major industries.

Table 4: Year of establishment

	inside of cluster		outside of cluster		total	
	freq.	%	freq.	%	freq.	%
0 - 10 years ago	38	12.03	64	11.17	102	11.47
10 - 20 years ago	44	13.92	114	19.90	158	17.77
20 - 30 years ago	52	16.46	80	13.96	132	14.85
30 - 40 years ago	51	16.14	101	17.63	152	17.10
40 - 50 years ago	49	15.51	57	9.95	106	11.92
over 50 years ago	77	24.37	136	23.73	213	23.96
no reply	5	1.58	21	3.66	26	2.92
total	316	100.00	573	100.00	889	100.00

Table 5: Amount of capital

	inside of cluster		outside of cluster		total	
	freq.	%	freq.	%	freq.	%
under 10 million yen	32	10.13	74	12.91	106	11.92
10 - 20 million yen	136	43.04	222	38.74	358	40.27
20 - 30 million yen	49	15.51	81	14.14	130	14.62
30 - 40 million yen	46	14.56	58	10.12	104	11.70
40 - 50 million yen	0	0.00	0	0.00	0	0.00
over 50 million yen	49	15.51	130	22.69	179	20.13
0	1	0.32	2	0.35	3	0.34
no reply	3	0.95	6	1.05	9	1.01
total	316	100.00	573	100.00	889	100.00

Table 6: Number of employment

	inside of cluster		outside of cluster		total	
	freq.	%	freq.	%	freq.	%
under 4	25	7.91	42	7.33	67	7.54
4 - 9	57	18.04	98	17.10	155	17.44
10 - 19	66	20.89	126	21.99	192	21.60
20 - 49	101	31.96	150	26.18	251	28.23
50 - 99	42	13.29	107	18.67	149	16.76
over 100	23	7.28	47	8.20	70	7.87
no reply	2	0.63	3	0.52	5	0.56
total	316	100.00	573	100.00	889	100.00

Table 7: Category of Industry

	inside of cluster		outside of cluster		total	
	freq.	%	freq.	%	freq.	%
construction	17	5.38	34	5.93	51	5.74
manufacturing	231	73.10	420	73.30	651	73.23
wholesale/retail	32	10.13	43	7.50	75	8.44
information and communications	5	1.58	15	2.62	20	2.25
traffic	2	0.63	7	1.22	9	1.01
other service industry	14	4.43	44	7.68	58	6.52
others	14	4.43	26	4.54	40	4.50
no reply	2	0.63	2	0.35	4	0.45
total	316	100.00	573	100.00	889	100.00

Table 8: Category of manufacturing

	inside of cluster		outside of cluster		total	
	freq.	%	freq.	%	freq.	%
Food	15	6.49	65	15.48	80	10.65
Textiles	12	5.19	15	3.57	27	3.60
Wood	2	0.87	21	5.00	23	3.06
Print	14	6.06	18	4.29	32	4.26
Chemistry	6	2.60	9	2.14	15	2.00
Plastic	9	3.90	20	4.76	29	3.86
Rubber	3	1.30	2	0.48	5	0.67
Leather	0	0.00	0	0.00	0	0.00
Steel	6	2.60	8	1.90	14	1.86
Metal	46	19.91	49	11.67	95	12.65
general machinery	23	9.96	53	12.62	76	10.12
Communication	9	3.90	19	4.52	28	3.73
Electric	20	8.66	31	7.38	51	6.79
Transport	10	4.33	16	3.81	26	3.46
precision equipment	16	6.93	25	5.95	41	5.46
Others	40	17.32	65	15.48	105	13.98
no reply	0	0.00	4	0.95	4	0.53
Total	231	100.00	420	100.00	751	100.00

The total amount of sales in the most recent year is shown in Table 9. Most of the SMEs have a larger amount of sales; in particular, those in the 100-300 million yen and over 1 billion yen categories accounted for a greater than 25% share, respectively. Table 10 indicates the trend in sales within the most recent three years, showing that more than half have been increasing sales, but that the share of SMEs inside a cluster with increasing or decreasing sales is larger than that outside of SMEs outside a cluster. In addition, related to profits, shown in Table 11, a greater percentage of SMEs inside a cluster achieved a surplus than SMEs outside a cluster. From these observations, the business performance of authorized SMES inside clusters is, in general, better than that outside clusters. In this regard, The New Business Promotion Act for SMEs is considered successful.

Table 9: Recent Annual Sales

	inside of cluster		outside of cluster		total	
	freq.	%	freq.	%	freq.	%
under 50 million yen	25	7.91	56	9.77	81	9.11
50 - 100 million yen	31	9.81	56	9.77	87	9.79
100 - 300 million yen	75	23.73	152	26.53	227	25.53
300 - 500 million yen	44	13.92	69	12.04	113	12.71
500 million - 1 billion yen	58	18.35	103	17.98	161	18.11
over 1 billion yen	82	25.95	136	23.73	218	24.52
no reply	1	0.32	1	0.17	2	0.22
Total	316	100.00	573	100.00	889	100.00

Table 10: Trend of sales amount within recent 3 years

	inside of cluster		outside of cluster		total	
	freq.	%	freq.	%	freq.	%
decreasing	56	17.72	94	16.40	150	16.87
same	93	29.43	183	31.94	276	31.05
increasing	166	52.53	294	51.31	460	51.74
no reply	1	0.32	2	0.35	3	0.34
total	316	100.00	573	100.00	889	100.00

Table 11: Balance of revenues and costs recent 3 years

	inside of cluster		outside of cluster		total	
	freq.	%	freq.	%	freq.	%
surplus	159	50.32	275	47.99	434	48.82
balanced	108	34.18	196	34.21	304	34.20
deficit	46	14.56	98	17.10	144	16.20
no reply	3	0.95	4	0.70	7	0.79
total	316	100.00	573	100.00	889	100.00

Regarding R&D expenditures, Table 12 indicates that nearly 50% of SMEs spent less than 5% of total sales on R&D, but that nearly 12% did not invest in R&D. These are because of their small firm size. There are no large differences between SMEs inside and outside a cluster, but the latter seemed to have greater R&D expenditures.

Table 12: Ratio of R&D expenditures to total sales

	inside of cluster		outside of cluster		total	
	freq.	%	freq.	%	freq.	%
under 5%	125	54.11	219	52.14	344	45.81
5 - 10%	43	18.61	83	19.76	126	16.78
10 - 20%	31	13.42	57	13.57	88	11.72
over 20%	22	9.52	20	4.76	42	5.59
0%	30	12.99	57	13.57	87	11.58
no reply	65	28.14	137	32.62	202	26.90
total	316	100.00	573	100.00	889	100.00

Finally, distribution by year of authorization by Small and Medium Enterprise Agency is indicated in Table 13. Some SMEs were authorized more than once, and the number of authorizations has been increasing, except 2007.

Table 13: Year of authorization

	Inside of cluster				Outside of cluster				total			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
1990	0	0	0	0	1	0	0	0	1	0	0	0
1991	0	0	0	0	1	0	0	0	1	0	0	0
1995	0	0	0	0	1	0	0	0	1	0	0	0
1997	1	0	0	0	3	0	0	0	4	0	0	0
1998	2	0	0	0	2	0	0	0	4	0	0	0
1999	9	0	0	0	7	1	0	0	16	1	0	0
2000	26	0	0	0	28	1	0	0	54	1	0	0
2001	13	1	0	0	30	2	0	0	43	3	0	0
2002	14	1	0	0	57	2	1	0	71	3	1	0
2003	35	4	0	0	67	7	1	0	102	11	1	0
2004	38	5	1	0	72	10	2	0	110	15	3	0
2005	57	6	0	0	96	15	4	1	153	21	4	1
2006	85	22	0	0	111	32	1	0	196	54	1	0
2007	18	11	1	0	49	22	0	2	67	33	1	2
no reply	18	266	314	316	48	481	564	570	66	747	878	886
Total	316	316	316	316	573	573	573	573	889	889	889	889

2.3 Innovation

From replies of respondents, characteristics of upgrading and innovations can be seen as follows.

(a) Upgrading

In this paper, we define industrial upgrading as represented by the following examples: (1) from being subcontractors for simple work to producing intermediate goods; (2) from producing intermediate goods to final products; and (3) from simple to complex or precision work. Question V consists of the following six sub-questions regarding upgrading and innovation:

V.1. We upgraded business activities; for example, we upgraded from being subcontractors for simple work to producing intermediate goods, from producing intermediate goods to final products, or from simple to complex or precision work.
V.2. We started supplying new products or services.
V.3. We introduced new production or supply methods, such as CAD/CAM, cell manufacturing systems, Internet marketing, or shortened distribution channels.
V.4. We obtained new customers.
V.5. We found new suppliers.
V.6. We established new sections in charge of R&D or venture businesses.

Question V.1. is related to industrial upgrading and Questions V.2.–V.6 to innovation. We asked the above questions with regard to four different time periods:

(1). Period I (January 2005-Sepetember 2007)
(2). Period II (January 2002-December 2004)
(3). Period III (January 1999-December 2001)
(4). Period IV (before 1998)

Table 14: Number of upgrading and innovation: replies to Question V

Period I (Jan. 2005 to Sept. 2007)						
	Inside of cluster		Outside of cluster		Total	
	freq.	%	freq.	%	freq.	%
Upgraded business activities.	72	0.23	99	0.17	171	0.19
Supply of new products or services.	187	0.59	322	0.56	509	0.57
Introduction of new production or supply methods.	116	0.37	223	0.39	339	0.38
Obtaining new customers.	199	0.63	342	0.60	541	0.61
We found new suppliers.	110	0.35	197	0.34	307	0.35
Establishment of new sections in charge of R&D or venture	67	0.21	106	0.18	173	0.19
Did nothing above	9	0.03	17	0.03	26	0.03
No reply	18	0.06	38	0.07	56	0.06
Total	778	2.46	1344	2.35	2122	2.39
Period II (Jan. 2002 to Dec. 2004)						
	Inside of cluster		Outside of cluster		Total	
	freq.	%	freq.	%	freq.	%
Upgraded business activities.	46	0.15	74	0.13	120	0.13
Supply of new products or services.	138	0.44	236	0.41	374	0.42
Introduction of new production or supply methods.	86	0.27	157	0.27	243	0.27
Obtaining new customers.	155	0.49	290	0.51	445	0.50
We found new suppliers.	89	0.28	148	0.26	237	0.27
Establishment of new sections in charge of R&D or venture	47	0.15	67	0.12	114	0.13
Did nothing above	19	0.06	43	0.08	62	0.07
No reply	33	0.10	65	0.11	98	0.11
Total	613	1.94	1080	1.88	1693	1.90
Period III (Jan. 1999 to Dec. 2001)						
	Inside of cluster		Outside of cluster		Total	
	freq.	%	freq.	%	freq.	%
Upgraded business activities.	29	0.09	68	0.12	97	0.11
Supply of new products or services.	97	0.31	176	0.31	273	0.31
Introduction of new production or supply methods.	50	0.16	102	0.18	152	0.17
Obtaining new customers.	137	0.43	231	0.40	368	0.41
We found new suppliers.	65	0.21	120	0.21	185	0.21
Establishment of new sections in charge of R&D or venture	33	0.10	44	0.08	77	0.09
Did nothing above	49	0.16	83	0.14	132	0.15
No reply	55	0.17	100	0.17	155	0.17
Total	515	1.63	924	1.61	1439	1.62
Period IV (before 1998)						
	Inside of cluster		Outside of cluster		Total	
	freq.	%	freq.	%	freq.	%
Upgraded business activities.	38	0.12	70	0.12	108	0.12
Supply of new products or services.	80	0.25	151	0.26	231	0.26
Introduction of new production or supply methods.	38	0.12	81	0.14	119	0.13
Obtaining new customers.	105	0.33	188	0.33	293	0.33
We found new suppliers.	63	0.20	96	0.17	159	0.18
Establishment of new sections in charge of R&D or venture	28	0.09	35	0.06	63	0.07
Did nothing above	64	0.20	111	0.19	175	0.20
No reply	67	0.21	133	0.23	200	0.22
Total	483	1.53	865	1.51	1348	1.52

Figure 1 (a): Trend of upgrading and innovation

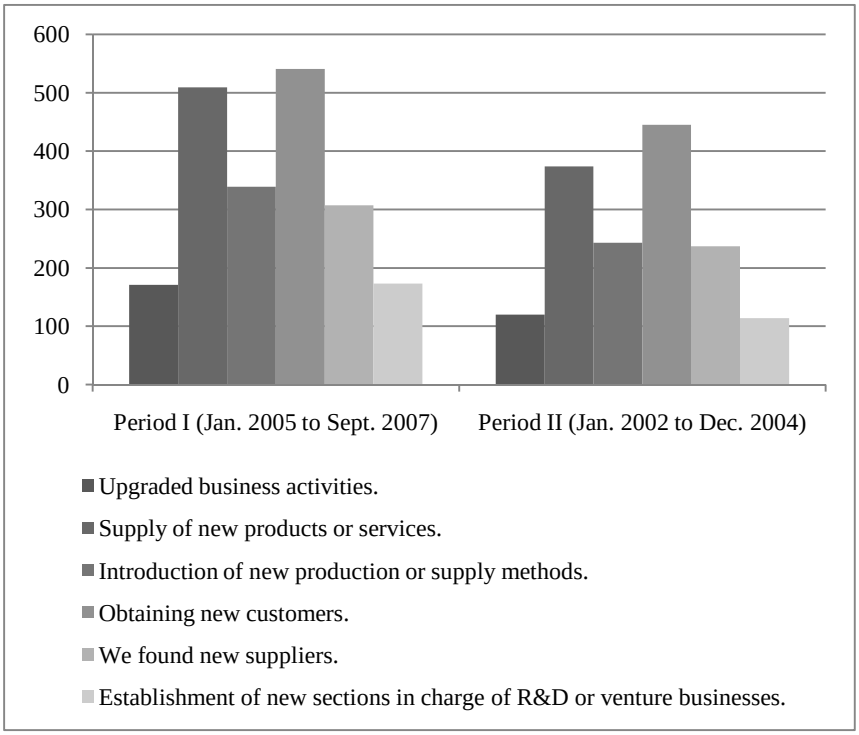
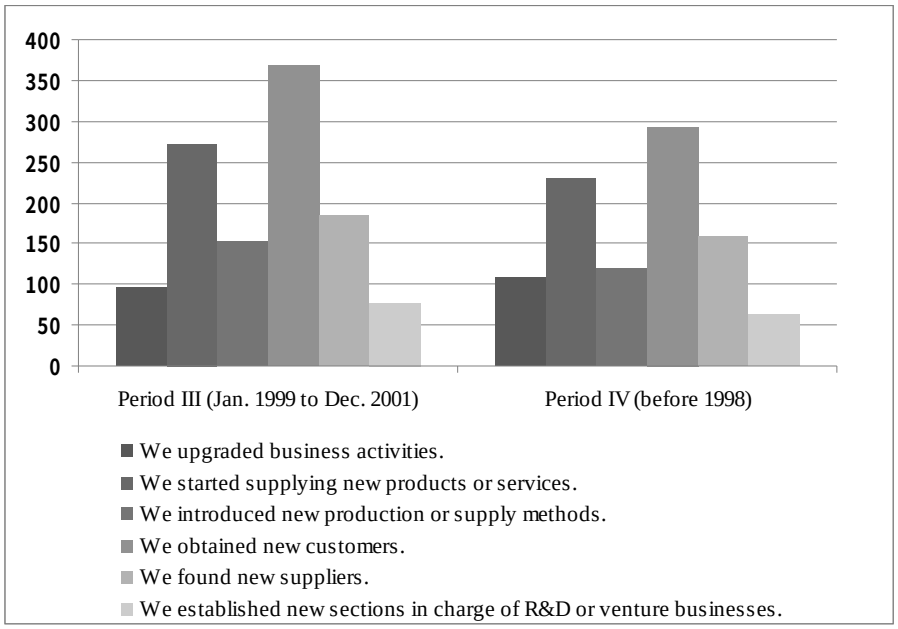


Table 14 and Figure 1 (a) (b) indicate trends in upgrading and innovation, and Table 14 shows those numbers inside and outside a cluster and percentages divided by the total numbers of SME. Overall, the number of upgrades and innovation has been increasing, except with regard to upgrading in Period IV. Obtaining new customers (V.4.), supply of new products and services (V.2.), and introduction of new production or supply methods (V.3.) show large increases in recent periods, and the SMEs analyzed here have been attempting these activities intensively, with more than two-thirds of SMEs successful in achieving upgrading and innovations in Period I. In what follows, we analyze the background to these improvements in performance. On comparison of SMEs inside and outside a cluster, from Table 14 it follows that there are noticeable differences in these activities.

Figure 1 (b): Trend of upgrading and innovation



(b) Innovation

SMEs were also asked in question V.3.about their achievements related to three types of innovations, which are the number of patents applied for, that of registered, and that of new products and services developed. The replies on those questions are summarized in Table 15, 16, and 17, respectively.

Table 15: Number of patents applied for

	Inside of cluster		Outside of cluster		Total	
	freq.	%	freq.	%	freq.	%
0	105	33.23	194	33.86	299	33.63
under 5	85	26.90	141	24.61	226	25.42
5 - 10	18	5.70	21	3.66	39	4.39
10 - 15	4	1.27	6	1.05	10	1.12
15 - 20	1	0.32	4	0.70	5	0.56
over 20	0	0.00	2	0.35	2	0.22
No reply	103	32.59	205	35.78	308	34.65
Total	316	100.00	573	100.00	889	100.00

Table 15 and 16 show that more percentage of SMEs inside a cluster achieved patents applied for and patent registered in the most recent three years than that of SMEs outside a

cluster, especially in the class with under 5 times. Moreover, this characteristic is revealed much clear in regard to for the number of new products and services developed, which is indicated in Table 17. More percentage of SMEs inside a cluster experienced these products innovations than that of SMEs outside a cluster.

Table 16: Number of patents registered

	Inside of cluster		Outside of cluster		Total	
	freq.	%	freq.	%	freq.	%
0	133	42.09	231	40.31	364	40.94
under 5	61	19.30	102	17.80	163	18.34
5 - 10	2	0.63	10	1.75	12	1.35
10 - 15	1	0.32	4	0.70	5	0.56
15 - 20	1	0.32	0	0.00	1	0.11
over 20	1	0.32	1	0.17	2	0.22
No reply	117	37.03	225	39.27	342	38.47
Total	316	100.00	573	100.00	889	100.00

Table 17: Number of new products and services developed

	Inside of cluster		Outside of cluster		Total	
	freq.	%	freq.	%	freq.	%
0	27	8.54	60	10.47	87	9.79
under 10	137	43.35	219	38.22	356	40.04
10 - 30	22	6.96	35	6.11	57	6.41
30 - 50	7	2.22	5	0.87	12	1.35
50 - 100	17	5.38	44	7.68	61	6.86
over 100	10	3.16	6	1.05	16	1.80
No reply	96	30.38	204	35.60	300	33.75
Total	316	100.00	573	100.00	889	100.00

2.4 Summary of Survey Results

From the above discussions, we can summarize the results of mail survey in comparison of two groups SMEs inside and outside a cluster as follows.

(a) Upgrading and innovation

In recent years such as Period I and II, relatively more SMEs inside a cluster

experienced upgrading than those outside a cluster. On the other hand, in Period III and IV, the latter achieved more than the former. This implies that recently SMEs inside a cluster became more active than before. Regarding various types of innovations shown in Table 14, there is no distinct difference, on the other hand, in terms of innovations defined by patents, the differences between two groups can be found. SMEs inside a cluster achieved more patents applied for, patents registered, and new products and services developed than those outside a cluster in the most recent three years

(b) Characteristics of SMEs

Here we summarize the results of the mail survey. Originally, we selected 5,000 SMEs, including 2,000 inside and 3,000 outside a cluster to receive the questionnaire, and received 889 replies, 316 from inside and 573 from outside a cluster. The ratio of replies from the two samples is closely similar to that of the original sample. The characteristics of the two respondent groups of SMEs are also closely similar in firm size and category of industry. There are a number of differences in the variety of firms within the manufacturing sector. Moreover, other characteristics such as type of relationship with other firms, namely, self-products, keiretsu, or non-keiretsu, as well as business indicators, such as the amount of sales and profits, are closely similar among the two groups.

(c) R&D investment

According to Table 11, two-thirds of SMEs in the two groups spent less than 5%, including 0%, of sales on R&D investment, which is the basis of upgrading and innovation. Even though R&D investment was small, they seem to have achieved reasonably good results in upgrading and innovation, as indicated by Table 11. This can be analyzed by rigorous statistical methods in what follows.

(d) R&D ratio and business performances

Two interesting observations were found in the results of the mail survey, namely that the relationship between R&D ratio and trend of sales, and business performance. Table 18 indicates these relationships. More than 60% of SMEs with an R&D ratio of 0% showed a decrease in or the same sales, and 17% had negative profits. These numbers decrease as R&D ratio increases. However, the percentage of SMEs with an R&D ratio over 20% in which sales were decreasing or the same was more than those with an R&D ratio of 0%.[6] The larger amount of R&D investment made their business worse, and a higher R&D ratio did not necessarily lead to greater sales. The same trend is applicable to business performance, which is shown in Table 19. These findings indicate that there is an optimal ratio of R&D.

[6] With regard to this point, no clear difference is found between SMEs inside and outside a cluster.

Table 18: Ratio of R&D and sales trend

		Funds for R&D											
		0%		0 - 5%		5 - 19.9%		over 20%		no reply		total	
		freq.	%	Freq.	%	freq.	%	freq.	%	freq.	%	freq.	%
Trend of sales amount within 3 years	decreasing	18	20.69	67	15.37	28	20.00	4	16.67	33	16.34	150	16.87
	same	35	40.23	131	30.05	32	22.86	11	45.83	67	33.17	276	31.05
	increasing	34	39.08	237		80	57.14	9	37.50	100	49.50	460	51.74
	no reply		0.00	1	0.23		0.00		0.00	2	0.99	3	0.34
	total	87	100.00	436	100.00	140	100.00	24	100.00	202	100.00	889	100.00

Table 19: Ratio of R&D and business performance

		Funds for R&D											
		0%		0 - 5%		5 - 19.9%		over 20%		no reply		total	
		freq.	%	Freq.	%	freq.	%	freq.	%	freq.	%	freq.	%
Balance of revenues and costs within 3 years	surplus	42	48.28	230	52.75	54	38.57	3	12.50	105	51.98	434	48.82
	balanced	29	33.33	154	35.32	52	37.14	7	29.17	62	30.69	304	34.20
	deficit	15	17.24	48	11.01	34	24.29	14	58.33	33	16.34	144	16.20
	no reply	1	1.15	4	0.92		0.00		0.00	2	0.99	7	0.79
	total	87	100.00	436	100.00	140	100.00	24	100.00	202	100.00	889	100.00

3. Results of Estimation

Here we use rigorous econometric analysis to investigate the hypothesis that industrial clustering in certain regions promotes innovation.

3.1 Variables

(a) Category of SME

In this analysis, SMEs are selected according to their location, that is, whether they are located inside or outside of a luster. The definition of cluster is due to METI (MITI). In addition we asked SMEs whether they think they are located inside a cluster. This ask their subjective impression. According to these two questions, SMEs can be classified into following four categories:

	Thought to be inside a cluster**	Thought to be outside a cluster**
Inside a cluster*	III	I
Outside a cluster*	II	0

where * denotes clusters that are approved by the Regional Industry Activating Act and ** clusters that SEMs think they are located in their answers to our questionnaire.

Since the Ministry admitted cluster, boundaries of cluster are the same as those of local government. This definition excludes SMEs located in the registered city, for instance, but they are far away from a cluster, while it contains ones which are not located in the registered city but located closely to a cluster. The above classification distinguishes the former type of SMEs as I and II, respectively.

In the questionnaire, Question V asks SMEs about the results of industrial upgrading and innovations in different periods: namely, Period I (January 2005-Sepetember 2007); Period II (January 2002-December 2004); Period III (January 1999-December 2001); and Period IV (before 1998). Especially, we focus on recent two periods such as Period I and II. We choose dependent and independent variables for analysis from the questionnaire.

(b) Dependant variables

Industrial upgrading in this paper is defined according to several practices, namely from subcontracting simple works to producing intermediate goods, from producing intermediate goods to producing final products, or from simple to precise works. If SMEs experienced these kinds of upgrading during the above period, they reply “yes”. These replies of SMEs are taken as independent variables. The number of upgrading in four periods is already shown in Table 14 and Figure 1.

In addition, the questionnaire asks about innovations more concretely in the following way: (1) the number of patents applied for; (2) the number registered; and (3) the number of new products and services developed in the above four periods separately. The variables related to (1) and (2) were assigned a value of 0 if the SME did not experience innovation, 1 if the number was 1 to 4, and 2 if more than 5. The variable related to (3) was assigned a value of 1 if there no new products and services were developed, 1 if there were 1 to 9, and 2 if there were more than 10. These three kinds of numbers for each type of innovation are taken as dependent variables. Since three categories as defined earlier have rather small numbers in comparison with upgrading, which are shown in Tables 14, 15, 16 and Figure 1.

(c) Independent variables

The independent variables were as follows: (1) characteristics such as firm size in terms

of the number of employees and the amount of capital, the year of establishment and the relationship with large company such as *Keiretsu*; (2) business indicators such as sales amount and profits; (3) managerial orientation, which presents the attitude or behavior of top management towards upgrading and innovation; (4) attitude of employees or organization towards upgrading and innovation; (5) location of SMEs inside or outside a cluster; (6) frequency of communications bewteen SMEs and local R&D institutions such as universities, regional research facilities and other collaborating institutions; and (7) distance from those partners. These are examples; the complete list of dependent variables is shown in the summary statistics in Table 20.

Table 20: Summary Statistics

Variable					Obs	Mean	Std. Dev.	Min	Max
Dependent Variable									
V	1	1	Upgraded:	from Jan. 2005 to Sept. 2007	845	0.208	0.406	0	1
V	1	2		from Jan. 2002 to Dec. 2004	802	0.151	0.358	0	1
V	1	3		from Jan. 1999 to Dec. 2001	743	0.133	0.34	0	1
V	1	4		before 1988	698	0.16	0.367	0	1
V	3	2	Number of patents applied.		902	1.116	0.849	0	2
V	3	3	Number of patents registered.		902	1.054	0.911	0	2
V	3	4	Number of new products and services developed.		902	1.417	0.651	0	2
I	1		Year of establishment		876	1969	34.345	1659	2007
Independent Variable									
I	2		Amount of capital(logarithm)		890	7.472	0.968	4.382027	11.72126
I	3		Number of employees (part-time employees working at least 8 hours are counted as one full-time employee)	from 4 to 9	902	0.175	0.38	0	1
I	3			from 10 to 19	902	0.216	0.412	0	1
I	3			from 20 to 49	902	0.283	0.451	0	1
I	3			from 50 to 99	902	0.166	0.373	0	1
I	3			100 and over	902	0.078	0.268	0	1
I	7		Sales trend over the last three years		902	0.519	0.5	0	1
—			Inside or outside of industrial cluster	(Takes 1 if locate inside the cluster, takes 0 otherwise)	902	0.365	0.482	0	1
IV	1	1	The top management of your company:	pays attention to how well employees work together.	876	4.059	0.764	1	5
IV	1	2		demands that employees follow routine procedures.	873	3.425	0.888	1	5
IV	1	3		Checking quality of working severely.	875	3.679	0.88	1	5
IV	1	4		is interested in employees' experience for nurturing.	874	3.709	0.848	1	5
IV	1	5		gives power and responsibility to the offices.	878	4.018	0.736	1	5
IV	1	6		listens to employees' ideas and proposals.	874	4.021	0.726	1	5
IV	1	7		keeps employees informed about management/company policies and developments.	873	3.969	0.842	1	5
IV	1	8		encourages employees to expand their skill set.	872	3.54	0.78	1	5
IV	1	9		promotes competition among employees.	875	3.187	0.85	1	5
IV	1	10		accumulates data on past successes and failures.	875	3.465	0.904	1	5
IV	1	11		encourages employees to take risks and challenge themselves.	871	3.56	0.873	1	5

IV	1	12		takes the leadership role in the planning of new business.	873	3.803	0.911	1	5
IV	2	1	The management:	challenges itself with new ideas and methods.	883	4.101	0.753	1	5
IV	2	2		places more emphasis on creating new technologies than updating existing ones.	876	3.411	0.854	1	5
IV	2	3		introduces new products faster than competitors.	875	3.707	0.967	1	5
IV	2	4		invests most of the budget in R&D.	871	2.921	1.104	1	5
IV	2	5		puts more effort into selling existing products than doing R&D for new ones.	873	2.951	0.864	1	5
IV	2	6		considers changes in the business environment opportunities rather than threats.	871	3.821	0.814	1	5
IV	2	7		adopts new strategies faster than competitors.	875	3.689	0.828	1	5
IV	2	8		makes decisions by looking forward and anticipating future business environments.	875	3.889	0.734	2	5
IV	3	1	Your employees or organization:	considers employees' spontaneous learning to be an important factor in company development	875	3.999	0.84	1	5
IV	3	2		makes efforts to analyze the successes and failures of past projects.	872	3.495	0.87	1	5
IV	3	3		always analyzes competitors.	871	3.046	0.897	1	5
IV	3	4		attempts to study not only core technology but also other related types.	871	3.443	0.835	1	5
IV	3	5		are able to act on their own, without orders from the management.	873	3.479	0.853	1	5
IV	3	6		is discussed extensively among employees.	872	3.288	0.856	1	5
IV	3	7		is discussed extensively management.	872	3.399	0.838	1	5
IV	3	8		understand what they should do.	874	3.618	0.781	1	5
IV	3	9		understand the company's direction.	875	3.655	0.787	1	5
IV	3	10		recognize that the development of new business is important for the future of the company.	871	3.61	0.877	1	5
VII	1		Is the area where your company is located an industrial cluster, that is, are other companies, business groups, or universities also located there?		902	0.325	0.469	0	1
VII	6	1	How many minutes does it take by car (or equivalent) to reach partners (other companies, universities, and research institutes) with whom you collaborate on new projects?	within 30 minutes	656	0.337	0.473	0	1
VII	6	2		from 30 minutes to 1 hour	656	0.345	0.476	0	1
VII	6	3		from 1 to 1.5 hours	656	0.066	0.248	0	1
VII	6	4		from 1.5 to 2 hours	656	0.095	0.293	0	1
VII	6	5		over 2 hours	656	0.122	0.327	0	1

VII	6	6	too far to go by car	656	0.037	0.188	0	1

3.2 Models for estimations

(a) Innovation model

The first model aims to test the hypothesis such as the relationship between innovation and industrial clustering. As dependent variables, we took data related to the number of new products and services developed in recent three years such as period 2005-7 and 2002-4, as enquired about in Question V-3. As for independent variables, we take the following SMEs' characteristics: (1) year of establishment; (2) amount of capital; (3) number of employees; and (4) type of industry, and (5) trend in sales amount in the most recent 3 years, and in addition, we consider (6) the location of the SME inside or outside of a cluster and distance from regional research facilities such as universities and (7) frequency of communications between them as independent variables. By utilizing these variables, we estimate according to the category of SME such as I, II, and III by taking IV as normalization. In this model, we use the Ordered Logit Model for analysis, since these data are enquired about in three categories.

(b) Quality of linkage

In this model, the dependent is the same variable as the previous model, that is, the number of new products and services. As for independent variables, in addition to those listed in model (a), we add the production linkage, that is, whether SMEs have their own products, technology or their trade partners are either *Keiretsu* or *non-Keiretsu* company. In this model, we also add managerial characteristics of COEs. We also use the Ordered Logit Model for analysis, since these data are enquired about in three categories.

3.3. Result of estimation: innovation model

We present the results for the estimations of innovation model and quality of linkage separately, beginning with innovation. The results of estimation are shown in Table 21. The factors that promote innovation are summarized as follows:

Table 21: Estimation of innovation

	I. Inside/not thought			II. Outside/thought			III. Inside/thought		
Independent variable	coeffi	t-value		coeffi	t-value		coeffit	t-value	
Year of establishment1	0	-1.42	+	0	0.74		0	-0.82	
Amount of capital	0	0.02		0	-1.32	+	0	-1.39	+
Number of employee	-0.08	-0.73		0.17	1.55	+	0.09	0.75	
construction	-0.29	-0.48		-0.06	-0.09		-0.17	-0.23	
manufacturing	0.15	0.33		0.97	1.94	*	0.28	0.56	
wholesale and retail	0.03	0.05		-0.25	-0.36		0.3	0.46	
Other services	-0.11	-0.19		-1.01	-1.15		-1.01	-1.14	
Trend of sales	0.14	0.56		0.04	0.15		0.57	1.88	*
Amount of R&D	0.02	0.83		0.04	2.22	**	0.06	2.98	**
Frequency of communications	-0.27	-2.46	**	-0.1	-0.86		-0.01	-0.05	
Distance from partners	-0.07	-0.89		-0.22	-2.58	**	-0.33	-3.09	**
constant	10.28	1.5	+	-7.74	-0.84		5.63	0.67	

Note 1: ***, **, *, and + stand for the significance level at the 1%, 5%, 10% and 20%, respectively.

(a) Amount of capital: firm size

Firm size in term of capital has positively significance to type II and III SMEs at the 15% level, even though the percentage is low. This shows that the larger SEMs become, the higher performance they achieve. SMEs of Type I which are outside of a cluster are irrelevant to their size.

(b) R&D expenditures

The number of innovation by SMEs of Thpe II and III is strongly related to the R&D expenditures, and its significance level is 5%. SMEs of Type I are irrelevant to their R&D expenditures. This result is rather natural.

(c) Distance from regional R&D partner

Distance from regional R&D partner is also highly significant to SMEs of Type II and III. The sign is negative, and this implies that the further are they located, the less the number of innovation becomes. The values of coefficients are approximately close to those of R&D expenditures, and this indicates that distance from regional R&D partner is as important as R&D expenditures.

(d) Frequency of communications

Another important factor is the frequency of communications, but this is not significantly related to innovation to SMEs in clusters. For Type I SMEs, which are outside of a cluster and they themselves think that they are outside a cluster, it has negative significant at the 5% level. This implies that the less chance of communications creates more innovation, but this is against the reality.

3.4 **Result of estimation: linkage model**

In order to analyze how the production linkage has a relationship with innovation, we asked SMEs about their production networks by asking who partners of trade are; that is, they are subcontracting of mother company, not subcontracting, or independent. In so doing, we construct an estimation model shown in Table 22. In addition, we added another group questions asking the types of management, that is, managerial orientation of top management. The underling hypothesis is that the production structure can be selected according to managerial orientation of CDE. We estimated in four periods. According to the results of estimation, the following variables are found to be significant.

(a) Linkage

Subcontracting is not significant for all four periods, while “holding own product, technology, and services” which are characteristics of independent SMEs are positively significant for all periods and non-subcontracting for the most two recent periods. “Sub-contracting” which is a merit to connecting to larger company is not significant for all period. One reason for this is that the number of sample of this category is relatively small.

(b) Size of SMEs

In most recent period, the mount of capital is significant at the 5% level, while the number of employers in the past three periods. In sum, the size of SMEs matters to innovation.

(c) Managerial orientations

The type of COE who stress on “Development of new customers” is positively related to innovation for all four periods. Moreover, those who concern about “Development of new products and services” and “Human resource management” are also positively related for the most recent period. “Technology and know-how” is also significant for Period III and IV.

(d) Category of SMEs

Category II and III are basically positively significant to the number of innovation. This estimation also shows that SMEs inside of a cluster have better performance for innovation.

Table 22: Estimation of linkage model

Independent variable		2005-2007		2002-2004		1999-2001		befpre 1998	
		coeffi.	t-value	coeffi.	t-value	coeffi.	t-value	coeffi.	t-value
Size	year of establishment	0.00	1.15	0.00	-0.01	0.00	-0.86	0.00	-1.02
	Amount capital	0.00	3.08 **	0.00	1.51 +	0.00	1.49 +	0.00	1.06
	Employee	0.01	0.25	0.10	1.76 *	0.21	3.30 **	0.30	4.53 **
Industry	Construction	0.17	0.49	0.44	1.25	-0.11	-0.30	-0.03	-0.09
	Manufacturing	0.11	0.45	0.60	2.39 **	0.31	1.26	0.60	2.23 **
	Wholesale, retail	0.25	0.84	0.85	2.67 **	0.68	2.09 **	0.79	2.30 **
	other services	0.15	0.47	0.59	1.65 *	0.30	0.80	0.01	0.01
Linkage	Hold own products, services, and technology	0.35	1.53 +	0.50	2.14 **	0.40	1.63 +	0.48	1.88 *
	Sub-contracting	0.10	0.38	0.09	0.34	-0.10	-0.35	-0.05	-0.17
	Sale to non-subcontracting	0.33	1.45 +	0.40	1.66 *	0.19	0.76	0.30	1.17
Managerial Orientation	Development of new product	0.29	1.88 *	0.17	1.05	0.26	1.59 +	0.51	2.91 **
	Development of new technology	-0.11	-0.69	0.12	0.75	0.11	0.66	0.11	0.63
	Development of new customers	0.45	3.03 **	0.44	2.90 **	0.34	2.18 **	0.41	2.54 **
	More tie with current customers	0.01	0.07	0.28	1.65 *	-0.02	-0.12	0.16	0.93
	Cooperation of other firms	0.25	1.25	0.28	1.33 +	0.01	0.05	-0.32	-1.37 +
	Collaboration of Other R&D institutions	-0.06	-0.29	-0.11	-0.47	0.27	1.16	-0.05	-0.20
	Accumulation of technology and know-how	0.02	0.15	0.11	0.68	0.32	1.86 *	0.51	2.88 **
	Human resource development	0.23	1.30 +	0.25	1.38 +	0.19	0.99	0.22	1.11
	Utilization of new personnel's	-0.25	-1.20	-0.34	-1.57 +	0.04	0.17	-0.07	-0.32
Cluster	Category I	-0.01	-0.06	0.10	0.55	-0.14	-0.76	-0.22	-1.12
	Category II	0.05	0.26	0.24	1.31 +	0.32	1.65 *	-0.28	-1.37 +
	Category III	0.47	2.31 **	0.29	1.37 +	0.46	2.09 **	0.15	0.69
Const.	/cut1	1.58		-0.52		-2.96		-2.68	
	/cut2	4.34		1.72		-1.22		-1.04	
	/cut3	5.64		3.12		0.24		0.30	
	/cut4	6.80		4.16		1.43		1.35	
	/cut5	7.88		5.32		2.74		2.21	
	/cut6	9.17		6.56		3.93		3.39	

4. Conclusions

This paper attempts to analyzing conditions for SMAs to promote innovation by comparing the performances achieved by SMEs inside and outside a cluster. That is, examine whether the regional innovation system is constructed and is functioning well or not. In so doing, we identify how innovation is achieved, that is, we extract factors which effect innovation. Among them, we focus on collaborating with local R&D institutions, in other words, SMEs' linkage or collaborating with regional innovation agencies such as universities, R&D institutions established by either local governments or local business organizations.

The estimation found the following results:

- **Distance from regional R&D partners**

For SMEs of Type II and III, which are located inside a cluster, distance from regional R&D partner is also highly significant and their estimated coefficients are approximately close to those of R&D expenditures, which are supposed to have strong effect to innovation. We verify that distance from regional R&D partner is quite important for SMEs innovation.

- **Frequency of communications**

The frequency of communications is not significantly related to innovation to SMEs in clusters. The distance and frequency have different meaning. Close distance from R&D partner implies that SMEs can obtain suitable consultations when they need, but frequency of communication does not guarantee the realization of innovation.

- **Production linkage**

It seems that SMEs are in the production networks of larger company such as *Keiretus* have a priority in obtaining information on technology, consumers, customers and the market. The estimation showed that the production linkage with *Keiretsu* is not significant, while SMEs which do not hold this kind of networks but hold their own technology, know-how, and new products achieved better performance of innovation.

Based on an extensive mail survey, this paper provides a number of new insights into the upgrading and innovation achieved by Japanese SMEs. The results confirm the role of industrial clustering as a factor in promoting upgrading and innovation, particularly with regard to the most recent five years. SMEs inside a cluster achieved better performances in terms of frequencies of upgrading and numbers of innovations in comparison with those outside a cluster. This is consistent with reality, in that the national and regional governments have made great efforts in areas such as deregulation and funding. The margin of differences in all accounts is not great, rather small. The results of econometric analysis show the differences with a small significance level. There remain still problems to be solved.[7]

These results on foundations of SEMs innovation provide important policy recommendations for constructing the regional innovation system. The R&D institutions are in this sense indispensable, but this result does not teach us what kind of relationship required, what incentive schemes are required for two partners to maintain the relationship, and what are the best policy to support their relationship. Those are the next topics of our research.

Several issues related to these models warrant further research. First, we do not include the characteristics of each cluster. Regions have different regional resources which are incorporated in the upgrading and innovation of regional SMEs; that is, the number of universities, junior colleges, banks, legal offices, college students, industrial structures, and so on.[8] Second, policy measures are important to the fostering of regional clusters, and this leads to the question of strategy to encourage the development of industrial clusters. In the global

[7] It is said that 70% of authorized SMEs are not satisfied with the current New Business Promotion Act for SMEs.

[8] Imagawa [2007], for instance, uses these regional resources, including the number of restaurants, to estimate factors related to clustering in the IT industry.

context, Kuchiki and Tsuji [2005], [2008], [2009], Tsuji and Miyahara [2009], Tsuji, Miyahara, and Ueki [2008], Tsuji et al. [2006], and Tsuji and Ueki [2008] have proposed and verified these-called "Flowchart Approach," to agglomeration which successfully explains the recent growth of East Asian industrial clusters. One of the final objectives of the present paper is to apply analysis to the development of consistent policies for building successful industrial clusters. Third, the process how accumulated tacit information and knowledge among agents inside a cluster turned to be implicit upgrading and innovation, and this process is not expressed in terms of any mathematical equations or any solid formula.[9]

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[9] This process can be expressed in the form of stochastic differential equations, see Fujita and Thisse [2002].

References

Fujita, M., P. Krugman, and A. Venables [1999] *The Special Economy: Cities, Region, and International Trade*, Cambridge, MA, MIT Press.

Fujita, M. and J-F. Thisse [2002] Economics Agglomeration:Cities, Industrial Location, and Regional growth, Cambridge, Cambridge University Press.

Imagawa, T., [2005] "Japan: Remedies to Activate Local Cities," pp. 299-318, in Kuchiki and Tsuji [2005].

Imagawa, T., [2007] "Information Technology and Economic Growth: Discovering the Informational Role of Density," in Tsuji, Giovannetti, and Kagami [2007].

Krugman, P. [1991] *Geography and Trades,* Cambridge, MA, MIT Press.

Kuchiki [2007] "Agglomeration of Exporting Firms in Industrial Zones in Northern Vietnam: Players and Institutions," in Tsuji, Giovannetti, and Kagami [2007], pp97-138.

Kuchiki, A., and M. Tsuji (eds) [2005], *Industrial Clusters in Asia: Analyses of their Competition and Cooperation*, Palgrave Macmillan.

Kuchiki, A. and M. Tsuji [2008] *The Flowchart Approach to Industrial Cluster Policy*, Palgrave Macmillan, January 2008.

Kuchiki, A. and M. Tsuji [2009] *From Agglomeration to Innovation: Upgrading Industrial Clusters in Emerging Economies*, forthcoming from Palgrave Macmillan in 2009.

Machikita, T., S. Miyahara, M. Tsuji, and Y. Ueki [2009] "Linked versus Non-Linked Firms in Innovation: The Effect of Economies of Network in Agglomeration," mimeograph, ERIA.

Porter, M. E. [1980] *The Competitive Advantage of Nations*, New York, Free Press.

Saxenian, A. L. [1994] *Regional Advantage: Culture and Competition in Silicon Valley and Route 128,* Cambridge, MA, Harvard University Press.

Tsuji, M., E. Giovannetti and M. Kagami (eds) [2007] *Industrial Agglomeration and New Technologies: A global perspective*, Edward Elgar.

Tsuji, M., S. Miyajara, and Y. Ueki [2008] "An Empirical Examination of the Flowchart Approach to Industrial Clustering: Case Study of Greater Bangkok, Thailand," in Kuchiki and Tsuji (eds) [2008].

Tsuji, M., and S. Miyajara [2009] "Empirical Analysis of the Relationship between Upgrading and Innovation of Japanese SMEs and Industrial Clustering," in Kuchiki and Tsuji (eds) [2009].

Tsuji, M., S. Miyahara, Y. Ueki, and K. Somrote [2006], "An Empirical Examination of

Factors Promoting Industrial Clustering in Greater Bangkok, Thailand," *Proceedings of 10th International Convention of the East Asian Economic Association*.

Tsuji, M. and Y. Ueki [2008] "Consolidated Multi-countries Analysis of Agglomeration, in M. Ariff ed., *Analyses of Industrial Agglomeration, Production Networks and FDI Promotion*, ERIA Research Project Report 2007 No. 3, ERIA (Economic Research Institute for ASEAN and East Asia).