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Revitalization of Japanese Industrial Agglomeration undergoing Structural Changes: Some Empirical Facts from Statistics and Field Surveys

—Building Asian Linkages through Restructuring of Mechanical Industry Agglomeration—

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While production bases are increasingly being shifted to East Asia, Japanese industrial agglomeration is part of this drastic adjustment process. In order to overcome the hollowing-out of industry, small- and medium-sized enterprises located within the industrial agglomeration are taking various innovative measures.

The present paper focuses on three purposes. The first is to identify an overview of the effects of the shift in production to East Asia on the domestic industrial agglomerations by using statistics; secondly, to identify how overseas production by large firms in particular industrial agglomeration districts affects local small- and medium-sized enterprises and the resulting division-of-labor structure

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by using case studies, and, thirdly, to consider what adjustments within an industrial agglomeration are required to overcome industrial hollowing-out.

This paper presents a view of how to overcome the hollowing-out of industry. Local core enterprises forming one part of a domestic industrial agglomeration can essentially contribute to overcoming the hollowing-out of industry by becoming deeply involved in the industrial linkages developing in East Asia. This view may sound like a paradox since involvement in East Asia may, in itself, have certain risk leading to the hollowing-out of industry. The author considers, however, that it is very important for local Japanese economies to get involved in East Asia's rapidly-growing "emerging markets" and take advantage of the power of growth as a driving force for reconstructing industrial agglomerations.

I Trends in Domestic Districts of Industrial Agglomeration reflected in National Statistics

Firstly, it is necessary to identify changes in the overall situation within the industrial agglomeration districts by analyzing the industrial statistics. In the 1990s, the Ministry of Economy, Trade and Industry promoted the revitalization of industrial agglomeration under the Law for the Revitalization of Local Industrial Agglomeration. The number of establishments in basic technology industrial agglomeration districts (Agglomeration A) operating under this legislation stands at 99,493, or 29.2% of the establishments covered by the industrial statistics. The number of establishments in the agglomeration districts of specific small- and medium-sized enterprises (Agglomeration B) stands at 110,635, or 32.4% of the total. Excluding duplications, about half of the establishments are located in districts with revitalization plans. It is now necessary to look at changes in the major industrial statistics, focusing on those districts covered by the legislation.

(1) Trends in the Country - Agglomerations A and B

Table 1 shows the national trends. The total number of manufacturers declined slightly between 1985 and 1990, and the margin of decline widened between 1990 and 1995 and between 1995 and 2000. Despite a slight increase in the number of employees between 1985 and 1990, it increasingly declined thereafter. The value of product shipments grew by 21.9% between 1985 and 1990 but it declined by 1%+ per annum between 1990 and 1995, and between 1995 and 1999.

Table 1. Major National Statistics

Numbers of establishments	1985	1990	1995	2000	Growth 00/85	90/85	95/90	00/95
National total	438,518	435,997	387,726	341,421	-22.1%	-0.6%	-11.1%	-11.9%
Agglomeration A	131,751	130,803	114,529	99,493	-24.5%	-0.7%	-12.4%	-13.1%
Agglomeration B	148,983	146,591	128,786	110,635	-25.7%	-1.6%	-12.1%	-14.1%
① Textile/apparel	79,548	76,484	65,951	55,644	-30.0%	-3.9%	-13.8%	-15.6%
② Metal/machinery	98,649	96,286	83,067	70,735	-28.3%	-2.4%	-13.7%	-14.8%
③ Foods	4,946	4,892	4,565	4,019	-18.7%	-1.1%	-6.7%	-12.0%
④ Other	37,853	37,557	33,674	29,031	-23.3%	-0.8%	-10.3%	-13.8%
Numbers of employees	1985	1990	1995	2000	00/85	90/85	95/90	00/95
National total	10,889,949	11,172,829	10,320,583	9,183,833	-15.7%	2.6%	-7.6%	-11.0%
Agglomeration A	3,315,475	3,297,359	3,009,276	2,611,265	-21.2%	-0.5%	-8.7%	-13.2%
Agglomeration B	3,198,900	3,226,700	2,968,917	2,596,718	-18.8%	0.9%	-8.0%	-12.5%
① Textile/apparel	1,577,415	1,567,830	1,420,067	1,231,296	-21.9%	-0.6%	-9.4%	-13.3%
② Metal/machinery	1,988,858	1,935,650	1,742,812	1,482,111	-25.5%	-2.7%	-10.0%	-15.0%
③ Foods	118,209	123,141	117,798	103,064	-12.8%	4.2%	-4.3%	-12.5%
④ Other	830,154	849,311	790,558	690,601	-16.8%	2.3%	-6.9%	-12.6%
Product shipment (million yen)	1985	1990	1995	2000	00/85	90/85	95/90	00/95
National total	265,320,551	323,372,603	306,029,559	300,477,604	13.3%	21.9%	-5.4%	-1.8%
Agglomeration A	86,636,940	100,976,806	92,178,195	86,862,898	0.3%	16.6%	-8.7%	-5.8%
Agglomeration B	74,471,498	85,951,062	81,304,652	77,925,872	4.6%	15.4%	-5.4%	-4.2%
① Textile/apparel	37,184,563	41,890,279	39,185,305	37,420,527	0.6%	12.7%	-6.5%	-4.5%
② Metal/machinery	47,128,895	52,430,645	46,995,661	43,131,071	-8.5%	11.2%	-10.4%	-8.2%
③ Foods	2,602,828	2,939,752	2,805,206	2,587,063	-0.6%	12.9%	-4.6%	-7.8%
④ Other	18,405,169	21,966,590	21,078,844	19,976,398	8.5%	19.4%	-4.0%	-5.2%
Total added value (million yen)	1985	1990	1995	2000	00/85	90/85	95/90	00/95
National total	97,826,414	127,332,346	127,594,504	121,183,136	23.9%	30.2%	0.2%	-5.0%
Agglomeration A	31,964,220	39,550,718	38,284,735	34,804,444	8.9%	23.7%	-3.2%	-9.1%
Agglomeration B	27,362,309	34,450,864	34,778,865	32,119,695	17.4%	25.9%	1.0%	-7.6%
① Textile/apparel	13,253,273	16,641,988	16,688,568	15,250,483	15.1%	25.6%	0.3%	-8.6%
② Metal/machinery	18,503,749	21,722,524	20,552,714	18,711,489	1.1%	17.4%	-5.4%	-9.0%
③ Foods	812,423	1,041,739	1,096,217	1,014,970	24.9%	28.2%	5.2%	-7.4%
④ Other	7,015,240	9,071,986	9,370,670	8,592,214	22.5%	29.3%	3.3%	-8.3%
Value productivity (10,000yen/person)	1985	1990	1995	2000	00/85	90/85	95/90	00/95
National total	898	1,140	1,236	1,320	46.9%	26.9%	8.5%	6.7%
Agglomeration A	964	1,199	1,272	1,333	38.3%	24.4%	6.1%	4.8%
Agglomeration B	855	1,068	1,171	1,237	44.6%	24.8%	9.7%	5.6%
① Textile/apparel	840	1,061	1,175	1,239	47.4%	26.3%	10.7%	5.4%
② Metal/machinery	930	1,122	1,179	1,262	35.7%	20.6%	5.1%	7.1%
③ Foods	687	846	931	985	43.3%	23.1%	10.0%	5.8%
④ Other	845	1,068	1,185	1,244	47.2%	26.4%	11.0%	5.0%

Note: ② includes plastic, ③ includes aquatic processing, ④ includes lacquer ware, paper, wooden furniture, china, stone, etc.
Source: Edited by Japan Small Business Research Institute from the Industrial Statistics (municipalities).

In terms of the number of establishments, employees and product shipments in Agglomeration A and Agglomeration B in the table, both the numbers of establishments and employees in the districts declined more than the national total. The number of employees declined more in Agglomeration A than in Agglomeration B. The decline reflects a large drop in the number of establishments/employees related to machinery and metal industries (especially in large cities). The decline in the number of establishments and employees in Agglomeration B is mainly associated with the textile and apparel industries. The decline in the number of establishments and employees seems to reflect the extinction of small firms or downsizing to establishments with three staff members or less.

On the other hand, the value of product shipments increased by 0.3% and 4.6% in Agglomeration A and Agglomeration B respectively, between 1985 and 2000. However these figures are as well behind the national rate of growth of 13.3%. Agglomeration A suffered seriously from poor growth, reflecting the sluggish machinery and metal industries.

(2) Trends of Major Agglomeration Districts

Changes in the number of establishments and the value of product shipments in major agglomeration districts constituting Agglomerations A and B (Table 2) are considered.

Table 2. Number of Establishments in Agglomeration Areas

	Number of Establishments							
	(million yen)				Growth			
	1985	1990	1995	2000	00/85	90/85	95/90	00/95
1. Large metal/machinery								
Ota Ward, Tokyo	4,996	4,322	3,483	3,077	-38.4%	-13.5%	-19.4%	-11.7%
Sumida Ward, Tokyo	3,349	2,947	2,344	1,934	-42.3%	-12.0%	-20.5%	-17.5%
Kawasaki City, Kanagawa	3,349	3,275	2,659	2,376	-29.1%	-2.2%	-18.8%	-10.6%
Higashiosaka City, Osaka	5,693	5,653	4,915	4,366	-23.3%	-0.7%	-13.1%	-11.2%
2. Local metal/machinery								
Kitakami City, Iwate	299	332	330	307	2.7%	11.0%	-0.6%	-7.0%
Ota City, Gunma	813	842	749	709	-12.8%	3.6%	-11.0%	-5.3%
Nagaoka City, Niigata	928	971	916	772	-16.8%	4.6%	-5.7%	-15.7%
Okaya City, Nagano	634	597	516	460	-27.4%	-5.8%	-13.6%	-10.9%
Suwa City, Nagano	356	346	289	285	-	-2.8%	-	-1.4%
Hamamatsu City, Shizuoka	3,497	3,366	2,831	2,544	-27.3%	-3.7%	-15.9%	-10.1%
Ibara City, Okayama	271	252	210	185	-31.7%	-7.0%	-16.7%	-11.9%
Fukuyama City, Hiroshima	1,660	1,751	1,653	1,466	-11.7%	5.5%	-5.6%	-11.3%
Niihama City, Ehime	331	328	294	286	-13.6%	-0.9%	-10.4%	-2.7%
Saijo City, Ehime	189	194	163	153	-19.0%	2.6%	-16.0%	-6.1%
Kitakyushu City, Fukuoka	1,931	1,941	1,725	1,528	-20.9%	0.5%	-11.1%	-11.4%
3. Towns centering around a major manufacturer								
Hitachinaka City, Ibaraki	381	386	366	330	-13.4%	1.3%	-5.2%	-9.8%
Hitachi City, Ibaraki	848	803	674	599	-29.4%	-5.3%	-16.1%	-11.1%
Kariya City, Aichi	611	635	557	542	-11.3%	3.9%	-12.3%	-2.7%
Chiryu City, Aichi	234	235	200	199	-15.0%	0.4%	-14.9%	-0.5%
Hiroshima City, Hiroshima	2,413	2,309	2,074	1,727	-28.4%	-4.3%	-10.2%	-16.7%
Higashihiroshima City, Hiroshima	287	308	339	296	3.1%	7.3%	10.1%	-12.7%
4. Local agglomeration								
Kiryu City, Gunma	1,199	1,231	985	765	-36.2%	2.7%	-20.0%	-22.3%
Tsubame City, Niigata	985	957	828	702	-28.7%	-2.8%	-13.5%	-15.2%
Sanjo City, Niigata	864	843	784	665	-23.0%	-2.4%	-7.0%	-15.2%
Sabae City, Fukui	814	836	758	690	-15.2%	2.7%	-9.3%	-9.0%
Gifu City, Gifu	1,927	1,774	1,581	1,250	-35.1%	-7.9%	-10.9%	-20.9%
Kurashiki City, Okayama	1,630	1,480	1,308	1,162	-28.7%	-9.2%	-11.6%	-11.2%
Arita Town, Saga	180	178	159	135	-25.0%	-1.1%	-10.7%	-15.1%
Fuchu City, Hiroshima	505	481	472	395	-21.8%	-4.8%	-1.9%	-16.3%
5. Emerging areas								
Sapporo City, Hokkaido	1,609	1,735	1,584	1,666	3.5%	7.8%	-8.7%	5.2%
Kashiwa City, Chiba	416	449	425	385	-7.5%	7.9%	-5.3%	-9.4%
Otsu City, Shiga	526	483	414	364	-30.8%	-8.2%	-14.3%	-12.1%

Note: Due to the change in response method to industrial statistics questionnaire by Seiko Epson in Suwa City, the data is not continuous after 1995. Therefore, the growth rate is not calculated.
Source: Edited by Small Business Research Institute from the Industrial Statistics (municipalities).

The following is a list of districts suffering from a decline of 20% or more in the number of establishments between 1985 and 2000. (1) Ota and Sumida Wards, and Kawasaki and Higashiosaka Cities in the urban agglomerations of machinery and metal industries experienced a large decline of 30% or more. A decline of 20% or more was recorded in (2) Okaya, Hamamatsu, Kitakyushu, Ihara and Otsu Cities in the local agglomerations of machinery and metal industries; (3) Hitachi and Hiroshima Cities in the agglomeration districts centering around a major manufacturer, and (4) Kiryu, Gifu and Kurashiki Cities in textile agglomerations, Tsubame/Sanjo Cities producing metal tableware, and Arita Town and Fuchu City local industrial districts, recorded a decline exceeding 20%.

There has been a remarkable decline in the number of establishments in the machinery and metal agglomerations in large cities or the former four great industrial districts, towns centering around a major manufacturer affected by a slump, apparel- and-textile-related agglomeration districts, and consumable producing districts. Industrial agglomerations and production districts, which supported the economic growth of Japan and the underlying division of labor and social structure, are facing a growth deadlock or even risk of decay.

There are, on the other hand, districts with an increasing number of establishments or small declines of 10% or less. For example: Kitakami, Sapporo, Kashiwa and Higashi-Hiroshima Cities. The number declined slightly by only 11.3% in Kariya City. These districts have successfully invited firms from major cities and created new industries. In Kariya City, for example, the number of establishments was maintained due to the international competitiveness of parent companies supporting local industry.

Table 3. Product Shipments in Agglomeration Areas

	Product Shipment							
	(million yen)				Growth			
	1985	1990	1995	2000	00/85	90/85	95/90	00/95
1. Large metal/machinery								
Ota Ward, Tokyo	1,725,803	1,729,222	1,343,798	1,097,271	-36.4%	0.2%	-22.3%	-18.3%
Sumida Ward, Tokyo	710,260	752,953	603,753	469,235	-33.9%	6.0%	-19.8%	-22.3%
Kawasaki City, Kanagawa	6,757,880	6,408,772	5,123,073	4,069,736	-39.8%	-5.2%	-20.1%	-20.6%
Higashiosaka City, Osaka	1,624,938	1,935,349	1,567,317	1,280,642	-21.2%	19.1%	-19.0%	-18.3%
2. Local metal/machinery								
Kitakami City, Iwate	158,876	265,046	321,860	367,399	131.2%	66.8%	21.4%	14.1%
Ota City, Gunma	1,115,108	1,169,146	1,267,005	1,452,497	30.3%	4.8%	8.4%	14.6%
Nagaoka City, Niigata	339,372	472,339	465,406	470,436	38.6%	39.2%	-1.5%	1.1%
Okaya City, Nagano	236,869	283,846	271,172	258,989	9.3%	19.8%	-4.5%	-4.5%
Suwa City, Nagano	320,732	240,429	134,886	141,972	-	-25.0%	-	5.3%
Hamamatsu City, Shizuoka	1,800,329	2,064,370	1,965,927	2,016,425	12.0%	14.7%	-4.8%	2.6%
Ibara City, Okayama	142,537	181,068	190,609	147,049	3.2%	27.0%	5.3%	-22.9%
Fukuyama City, Hiroshima	1,196,574	1,445,964	1,325,035	1,362,901	13.9%	20.8%	-8.4%	2.9%
Niihama City, Ehime	494,819	488,109	465,795	480,192	-3.0%	-1.4%	-4.6%	3.1%
Saijo City, Ehime	386,795	364,153	363,480	388,518	0.4%	-5.9%	-0.2%	6.9%
Kitakyushu City, Fukuoka	2,732,877	2,510,078	2,282,599	1,958,631	-28.3%	-8.2%	-9.1%	-14.2%
3. Towns centering around a major manufacturer								
Hitachinaka City, Ibaraki	839,637	911,070	820,789	836,275	-0.4%	8.5%	-9.9%	1.9%
Hitachi City, Ibaraki	1,106,193	1,548,479	1,494,151	1,172,902	6.0%	40.0%	-3.5%	-21.5%
Kariya City, Aichi	998,512	1,444,079	1,210,215	1,261,589	26.3%	44.6%	-16.2%	4.2%
Chiryu City, Aichi	120,517	171,474	135,083	137,850	14.4%	42.3%	-21.2%	2.0%
Hiroshima City, Hiroshima	1,866,170	2,842,700	2,080,063	1,857,678	-0.5%	52.3%	-26.8%	-10.7%
Higashihiroshima City, Hiroshima	367,990	534,716	563,531	550,467	49.6%	45.3%	5.4%	-2.3%
4. Local agglomeration								
Kiryu City, Gunma	388,109	454,452	462,751	394,745	1.7%	17.1%	1.8%	-14.7%
Tsubame City, Niigata	188,759	211,693	186,238	155,260	-17.7%	12.2%	-12.0%	-16.6%
Sanjo City, Niigata	170,553	235,076	239,202	207,525	21.7%	37.8%	1.8%	-13.2%
Sabae City, Fukui	200,968	243,763	215,406	209,914	4.5%	21.3%	-11.6%	-2.5%
Gifu City, Gifu	439,019	489,268	399,981	317,622	-27.7%	11.4%	-18.2%	-20.6%
Kurashiki City, Okayama	3,708,716	3,387,634	3,399,460	3,009,515	-18.9%	-8.7%	0.3%	-11.5%
Arita Town, Saga	25,880	36,977	27,413	16,281	-37.1%	42.9%	-25.9%	-40.6%
Fuchu City, Hiroshima	277,129	375,120	341,132	306,079	10.4%	35.4%	-9.1%	-10.3%
5. Emerging areas								
Sapporo City, Hokkaido	651,833	831,972	745,089	702,940	7.8%	27.6%	-10.4%	-5.7%
Kashiwa City, Chiba	410,612	512,275	379,853	378,739	-7.8%	24.8%	-25.8%	-0.3%
Otsu City, Shiga	432,355	482,489	445,291	451,749	4.5%	11.6%	-7.7%	1.5%

Note: The note in Table 2 applies to Suwa city here.
Source: Edited by Small Business Research Institute from the Industrial Statistics (municipalities).

Product shipment figures are given in Table 3. This table shows that: (1) the value declined markedly in the major city agglomerations between 1985 and 2000: 36.4% in Ota Ward, 33.0% in Sumida Ward, 39.8% in Kawasaki City and 21.2% in Higashiosaka City. In terms of local machinery and metal agglomerations, Suwa City experienced a remarkable decline of 55.7% and Kitakyushu City a drop of 28.3%.

There are some local machinery and metal agglomerations not facing declining shipment values. Shipments grew by 131.2% in Kitakami City, 30.3% in Ota City and 38.6% in Nagaoka City. Local machinery and metal agglomerations show different performances when compared to the major cities.

The agglomeration districts featuring local production show a decline in the value of product shipments. This declined, between 1985 and 2000, by 27.7% in Gifu City, 18.9% in Kurashiki City (Both are textile and apparel agglomerations), and 18.9% in Arita City (A local chinaware agglomeration). An increase in emerging industrial areas was also noticed. The value grew by 7.8% in Sapporo City and 4.5% in Otsu City.

Overall, the major city industrial agglomerations in the machinery and metal industries in large cities, some local machinery and metal industries and local textile production districts have shrunk remarkably over the past 15 years, as seen above. However there has been some increase in the major industrial statistics or a small decline, amid severe environmental changes, in some local machinery and metal agglomerations and emerging industrial districts. With this in mind it is useful to study some cases in detail.

II Restructuring Industrial Agglomerations in the Chuetsu Region, Niigata Prefecture

Overseas production shifts by major firms representing a region and their falling behind in international competition affects related smaller firms greatly. On the whole, worsening statistical figures, as seen above, reflect these factors.

In this and the next sections, the case of the Chuetsu Region, Niigata Prefecture, is discussed as an example of the industrial agglomerations mentioned above. This area was selected because of: (1) a relatively small decline in the number of establishments, and employees and product shipments and added value growth; (2) concentration of various industries in a region, unaffected by the conditions of specific large firms, and (3) the possibility of industry-university cooperation due to the presence of engineering universities.

(1) Overview of the Region

The Chuetsu Region, with Nagaoka City as a center, has developed machinery and metal industries agglomerations as well as life-related industries such as textiles from the prewar period. It has developed varied and affluent industrial agglomerations, as exemplified by the machine tools, precision machinery and electronic machinery industries in Nagaoka, Kashiwazaki and Ojiya Cities, the metal tableware, houseware and tools industries in Tsubame and Sanjo Cities, textiles in Tochio, Kamo and Mitsuke Cities, and foods and furniture in other areas.

The region started initiatives for industry-education cooperation for promotion of science and technology, and revitalization of business activities early. Due to the relocation of Niigata University's Faculty of Engineering, in 1977, the Nagaoka University of Technology was established for basic research and studies in the region.

In Nagaoka, the secondary industry share in the total industries remained almost the same at 25% or so from the 1970s. Machinery, metal and apparel industries occupied larger shares of 20.1%, 13.9% and 13.7%, respectively, in the total manufacturing industry, in terms of the number of establishments. On the other hand, electric machinery, general machinery, foods, apparel and metal industries occupy greater shares in terms of the number of employees, in addition to the value of product shipments, with 21.5% (employees), 18.5%, 13.3%, 10.2% and 8.6%, respectively. Precision machinery had a share of 16.5% in terms of product shipment value.

While the metal, mechanical processing and apparel industries are composed of small establishments with 10 employees or less, the electric machinery and precision machinery industries feature relatively large establishments. In the 1990s, the number of establishments and employees decreased to about 85% of the 1990 level. The product shipment value reached its peak in 1997 and 1998 but remained in 1999 and 2000.

The relevant administrative agencies are either prefectural or city-based. The Department of Industry and Labor, Niigata Prefecture, is leading industrial development in Niigata. The department oversees the Small Business Promotion Agency, which provides loans and business assistance to small- and medium-sized enterprises. The Industrial Research Institute of Niigata Prefecture in Nagaoka City provides technical assistance to small- and medium-sized enterprises.

Fifteen towns and cities surrounding Nagaoka City and Niigata Prefecture jointly established the Shinanogawa Technopolis Development Organization to perform various programs for the higher agglomeration of industries and high technologies within the region.

(2) Emerging East Asia and Restructuring of Major Firms

The small- and medium-sized enterprises in the Chuetsu Region, as described above, have been significantly affected in recent years by the changes within large establishments in the region due to the emerging East Asian economies.

A. Review of Outsourcing by Machine Tool and Industrial Machinery Manufacturers

Many traditional manufacturers, engaged in manufacturing machine tools or industrial machinery, are located in the Nagaoka area.

Tsugami, for example, has developed and manufactured high-precision, high-performance, and high-speed machine tools and industrial machinery, targeting the high-end segments of multipurpose products. It has various customers ranging from information-communication, home electric products, car manufacturing, industrial machinery and medical machinery industries. Half of its sales have been exported to East Asia in recent years.

Tsugami has established a product brand in the high-end segment but has coped with fluctuations in sales by outsourcing mechanical processing and casting. Sales stood at 12.3 billion yen in 2000, 21.7 billion yen and 15.6 billion yen in subsequent years, showing large fluctuations before and after the IT boom. Due to a decline in sales after the collapse of the IT bubble, Tsugami reduced its level of outsourcing.

The share of material procurement expenses in terms of product cost is about 60%, and is mainly composed of units from Fanuc. The outsourcing share declined in recent years to 10-20%. In order to fully operate the workforce and equipment within the group under declining sales, the company intends to outsource casting and other unequipped operations, while maintaining mechanical processing in-house. Tsugami Tool, an affiliated company, is in charge of mechanical processing for the group and outsources some of the operations that are beyond its capacity.

Tamagawa Machinery is another traditional manufacturer that launched its Nagaoka plant in 1935. Being set up as the machinery division of Mitsubishi Materials after the war, it became independent in 1978 and was renamed Tamagawa Machinery in 1990. It produces custom powder molding presses, industrial sintering furnaces, semiconductor manufacturing equipment and other major products with a workforce of 142.

Tamagawa's sales have also fluctuated: 6 billion yen in 2000, 10 billion yen in 2001 and 5 billion yen in 2002. The semiconductor business is the major cause of the fluctuation. Capital investment depends on the semiconductor cycle. About 30% of the sales constitute a growing export. Many of the importers are located in East Asia, which are often Japanese manufacturers based there.

The company is outsourcing a significant amount, dealing with 130 companies mainly within the prefecture. It has broad transactions with firms with longstanding relations and has called back retirees at times of high production. During a period of decreasing orders, it has reduced the amount of purchases per supplier while maintaining the relationship. This has been the situation for the last few years.

B. International Division of Labor and Restructuring of an Autoparts Manufacturer (Nippon Seiki)

Nippon Seiki, based in Nagaoka, is a major firm producing measuring instruments for automobiles. The instruments account for 70% of sales. It has a close connection with Honda, which purchases 90% of the required instruments from Nippon Seiki. The company went abroad with Honda and established plants in the USA, the UK, Thailand, China and Indonesia. Independent of Honda, it has a 70% share of supplies to Fuji Heavy Industries and about 30% in supplies to Mitsubishi Motors, in terms of automobile instruments.

It has been increasing its sales in recent years for both motorcycles and four-wheeled cars. The production increase is mainly attributed to overseas demand as domestic production is remaining flat. While the demand for motorcycles in Japan has fallen below 1 million, it is rapidly increasing in China, India and Brazil. Japanese motorcycle manufacturers are expected to produce overseas and overseas production will increase further mainly for motorcycles. There are many

manufacturers of four-wheel cars, including Honda, in China, which will become a strategic market.

In addition, there has been a shift in recent years from mechanically processed meters to a combination of electronic and molded parts. The company is considering re-importing old-fashioned meters mainly composed of mechanically processed parts and producing state of the art meters in Japan.

For these reasons, the company has had to review its outsourcing. It reduced outsourcing mechanical processing and molding, while increasing the purchasing and outsourcing of electronic components. The company now has 250 vendors with 90 mechanical processing companies, whose share has decreased in recent years from 50% to 20%+ across all components.

C. Production Shift to East Asia and Domestic Restructuring by Electronic Machinery Manufacturers (Alps Electric)

Overseas production by electronic machinery manufacturers is increasing. Several of these manufacturers in the Chuetsu Region, including Alps Electric and Densei-Lambda, increased overseas production in China and Southeast Asia, and downsized their subcontracting.

Alps Electric has had many of its plants in the Tohoku Region, but has produced magnetic heads since 1967 in the Chuetsu Region. The Koide Plant in the Niigata Prefecture produced VTR heads and audio appliances up until the late 1980s. The Nagaoka plant was established in 1984 to produce HDD heads and expanded its scope thereafter. After 1984, the Koide plant specialized in AV heads, and the Nagaoka plant in HDD heads.

During its expansion, the company formed a business group of many subcontractors in the region, and a regional subcontractor association was established. About 20 companies were engaged in business related to the company mainly in pressing, molding, and other processing, as well as components assembly and final assembly.

After 1992, Alps Electric increased its overseas production. The Niigata Division exported the unprofitable domestic operation of audio heads and VTR voice heads to China and Malaysia, and closed the subcontractor association. The company’s subcontractors have been reduced to five companies. The domestic business specialized in equipment-intensive processes which require no subcontracting.

The shift in production to China in the early 1990s resulted in a remarkable decline in the production and employment of the company’s exclusive subcontractors. Many of the firms have renovated their management through diversified business relations, increased orders and diversified operations based on the processing and development technologies they have acquired over time. Their customers are now diversified out side of the region and even include Korean firms including Samsung and Daewoo. In the late 1990s, some firms achieved a rebound in employment thanks to such innovative policies (Table 4 A/B).

Table 4A. Subcontractors Relating to Magnetic Application Division (Niigata Division) of Alps Electric (1990/1995)

		1990			1995			
Name	Location	ajor items of manufacture/sale	Annual Sales (JPY)	Number of employees	Major items of manufacture/sales	Annual Sales (JPY)	Capital (JPY)	Number of employees
IK Electronics	Suibara-machi, Kitakanbara Gun	Magnetic head manufacturing	N.A.	360	Manufacture of magnetic heads and electromagnetic relays (power relays)	N.A.	15 million	195
UK Industries	Higashi-Honcho, Joetsu City	Magnetic head assembly	N.A.	147	Return to textile industry (narrow woven synthetic fabrics)	N.A.	N.A	N.A
EM Electronics	Yoshida-machi, Nishikanbara Gun	Manufacture of VTR magnetic head	N.A.	185	Manufacture of VTR magnetic heads, design and mounting of printed circuit boards, manufacture and sale of interior lighting furniture, design of control and distribution boards, sale of compressor, power generator and pneumatic appliances	N.A.	10 million	144
OS Electronics	Yunotani-mura, Kita-Uonuma Gun	Manufacture of VTR magnetic head	N.A.	120	Manufacture of VTR magnetic heads and processing by precision machinery	N.A.	10 million	98
UM Manufacturin	Muikamachi, Minami-Uonuma Gun	Production of audio magnetic head	N.A.	76				
KG Electric	Muikamachi, Minami-Uonuma Gun	Manufacture of parts, tools and molds for magnetic heads	N.A.	107	Precision press molds, precision pressing and magnetic head parts	1.5 billion	50 million	83
SK Electric	Horinouchi-machi, Kita-Uonuma Gun	Parts processing and assembly of audio/VTR magnetic heads. Processing of HDD heads.	7 billion	350	Processing of audio/VTR magnetic head parts, processing and assembly of core sliders of HDD magnetic heads, processing of parts for mobile telecom equipment, energy saving equipment and machine processing of tools	1.9 billion	20 million	150
SS Electric	Koide-machi, Kita-Uonuma Gun	Manufacture of coils, laminate cores and chips.	N.A.	170	Manufacture of electronic parts (magnetic head, audio, VTR, PC)	3.5 billion	18 million	200
TB Industries	Muikamachi, Minami-Uonuma Gun	Manufacture of VTR chips and assembly of VTR heads.	N.A.	166				
TM Industries	Irihirose-mura, Kita-Uonuma Gun	Manufacture of the core laminate for audio/VTR	N.A.	43				
NY Electronics	Niitsu City	Manufacture of magnetic heads for audio, VTR and computer.	N.A.	958	Manufacture of audio, VTR and computer magnetic heads, processing of ceramics and silicone	9 billion	88 million	600
HL Electronics	Mishima-machi, Santo Gun	Manufacture of various magnetic heads for audio and video.	N.A.	295	Assembly and manufacture of audio and video magnetic heads, assembly and manufacture of odometer of cars, manufacture of electronic automobile parts	N.A.	10 million	166
HM Electro	Ojiya City	Manufacture of electrostatic meter and remover. Precision processing of coils and magnetic materials.	3 billion	116	Manufacture and sale of electrostatic remover, air cleaner, etc., processing of coils and precision polishing and cutting of magnetic materials	2.7 billion	40.5 million	129
HZ Electronics	Nagaoka City	Manufacture of magnetic heads	N.A.	316	Manufacture of magnetic heads and various electronic parts, development, design and manufacture of various FA equipment, development and design of image processing equipment	N.A.	20 million	128
MS Electronics	Teradomari-machi, Mishima Gun	Manufacture of magnetic heads, speed meter liquid crystal, tool molds and automatic machinery	N.A.	530	Design, development and manufacture of magnetic heads, liquid crystal, electronic parts, electric automobile parts, metal press parts, vender parts, precision molds and equipment for rationalization and energy saving	5.3 billion	30 million	515

Source: Compiled by the author with reference to -- List of Members of Niigata Association of Electronic and Machinery Industry, "Firms in Ojiya and Kitauonuma" by the local employment security council and Hello Work Ojia, "Companies in Niigata" by Niigata Socioeconomic Research Center, as well as individual interview materials and websites of the companies listed.

Table 4B. Subcontractors Relating to Magnetic Application Division (Niigata Division) of Alps Electric (2001)

Name	Address	2001 Major items of manufacture/sales	Annual Sales (JPY)	Capital (JPY)	of employees	Major customers	Remarks
IK Electronics	Suibara-machi, Kita-kanbara Gun	Electromagnetic relays, magnetic heads, HDD cleaners and equipment for production of electronic parts	3.3 billion	20 million	130	N.A.	Focusing on in-house development of automation and energy saving equipment.
UK Industries	Higashi-Honcho, Joetsu City	Return to textile industry (narrow woven synthetic fabrics)	N.A.	N.A.	N.A.	N.A.	Holds a technology to weave various fabrics in narrow width including glass, nylon and carbon.
EM Electronics	Yoshida-machi, Nishikanbara Gun	Design and mounting of printed circuit boards, manufacture of controllers and electronic applications, sale of multimedia electric products, sale of compressor and pneumonic devices	N.A.	15 million	28	Hokuetsu Industries (making compressor, diesel generator and construction vehicles), etc.	Originally a subsidiary of Hokuetsu Industries (a capital of 3.4 billion yen and 562 employees. Now a wholly owned subsidiary of Alps Electronic and relocated personnel within the group.
OS Electronics	Yunotani-mura, Kita-Uonuma Gun						Closed
UM Manufacturin	Muikamachi, Minami-Uonuma						Closed
KG Electric	Muikamachi, Minami-Uonuma Gun	Precision press molds, precision pressing, magnetic head parts	1.6 billion	50 million	79	Alps Electric, Towa Electric, Sankyo Seiki Mfg., JVC, Techreco	An integrated producer, mainly of precision metal press products, from designing, manufacturing, pressing to annealing molds
SK Electric	Horinouchi-machi, Kita-Uonuma Gun	Processing VTR head cores, micron and submicron mechanical processing, membrane formation, bonding and fabrication, glass sputtering/bonding, precision assembly (clean room assembly and inspection)	N.A.	41.15 million	167	Sanyo Electronic Device, NEC Kansai, Kuroda Electric, Toshiba, Hitachi Metals, Yamagata Mitsumi, JVC, TDK, Matsushita Electronic Components, LG, Daewoo Electronics, Samsung Electro-Mechanics	A company with technology for micron grinding ultra-hard materials and precision assembly. Capable of making tools, automatic equipment and energy saving equipment. Assembly and inspection conducted with related two companies to reduce cost.
SS Electric	Koide-machi, Kita-Uonuma Gun	Manufacture of electronic parts (magnetic head, audio, VTR, PC)	1.5 billion	18 million	90	N.A.	Manufactures not only magnetic heads but also HDD.
TB Industries	Muikamachi, Minami-Uonuma						Closed
TM Industries	Irihirose-mura, Kita-Uonuma Gun						Closed
NY Electronics	Niitsu City	Manufacture of magnetic head parts for audio/VTR/computer, processing and assembly of fine ceramics, manufacture of parts for mobile telecom equipment	13 billion	187.32 million	550	Alps Electric, Hitachi Metals, Toshiba Ceramics, Yamagata Kinseki	From its start, a technology development company, capable of designing production process and automating lines, and develop various equipment.
HL Electronics	Mishima-machi, Santo Gun	Assembly and manufacture of various magnetic heads for audio and video, assembly and manufacture of car odometer, manufacture of car electronic parts, liquid crystal module parts	N.A.	10 million	189	Alps Electric, Nippon Seiki, Hitachi Ltd., JVC, Niigata Seimitsu	Focuses on integrated production system and design planning for quality improvement, short lead time and cost reduction.
HM Electro	Ojiya City	Manufacture and sale of electrostatic remover, air cleaner, etc., production of custom automation machines, manufacture of various coils and cutting of magnetic materials	2.1 billion	40.5 million	113	Alps Electric, Kanazawa Murata Manufacturing, Mitsui & Co., Nippon Seiki	Own products, various electrostatic removers and high-performance air cleaner.
HZ Electronics	Nagaoka City	Manufacture of various magnetic heads by precision grinding technology, design, manufacture and improvement of production equipment and tools	N.A	20 million	120	Alps Electric, Kyocera, NGK Insulators, Matsushita Electric Industrial, Kuramoto Seisakusho	Assigned the business in 1997 to Kuramoto Seisakusho (maker of glass plate maker for liquid crystal in Miyagi Pref.)
MS Electronics	Teradomari-machi, Mishima Gun	Design, development and manufacture of magnetic heads, liquid crystal, electronic parts, electric automobile parts, metal press parts, vending machine parts, precision molds and equipment for rationalization and energy saving	N.A.	35 million	355	Nippon Seiki, Corona, Toshiba Machine, Matsushita Electric Works	Development of high value added products by unique technology, development and manufacture of FA equipment. An integrated production system from design to assembly.

Source: The same as Table 2A.

(3) Management Innovation of Small- and Medium-sized Enterprises and Restructuring of Industrial Agglomerations

The change in managerial environment surrounding large establishments, mentioned above, has affected small- and medium-sized enterprises in the region, some of which have started some brave initiatives (Table 5).

Table 5. Innovative Small- and Medium-sized Companies in the Chuetsu Region

Machine Tools and Industrial Machinery Manufacturers

Taiyo Koki
A grinder maker established in 1986, with 107 employees and annual sales of 2.3 billion yen. It independently developed vertical and cylindrical grinders, which are delivered to clients through trading firms, etc. It controls 90% of the market for vertical grinders. Twenty percent of the employees are engaged in research and development reflecting the company's commitment to R&D. As an affiliate of Mori Seiki, it is developing clients, particularly automakers and component makers.

Sanshin
A polishing system maker established in 1955, with 25 employees and annual sales of 500 million yen. It was originally an OEM subcontractor but started to develop its own products around 1980 following a change of president. It successfully developed a tape polishing system for finishing, using lapping films, to strengthen its business. It is now developing CMP for semiconductor and printed circuit boards, and media-related manufacturing systems for CDs and DVDs and polishing systems for liquid crystal devices and PDPs as new businesses.

Clean Technology
A system maker in the fields of liquid crystal devices and PDPs established in 1990, with 58 employees and annual sales of 3 billion yen. Mr. Nishizawa, a former project manager of hard disks at Alps Electric, established the company as a spin-off. Starting from surface inspection systems for hard disks, the company expanded sales by developing and manufacturing cleaning systems for liquid crystal devices, color filters and PDPs, using dry cleaning technology. It then added hot plate systems, cold plate systems and excimer light radiation systems, which are sold both in Japan and overseas including Taiwan and Korea.

Mechanical Processors

Oi
Originally started as Oi Tool in 1985, the company was established in 1988, with 50 employees and annual sales of 900 million yen. The company is a mechanical processor which integrates design, cutting and assembly, and has the capacity to receive large orders from 30 to 40 customers both in and outside the region. It is focused on technical training and successor firms, and established Kashiwa Co. as a spin-off.

Asahi-Seiki Manufacturing
The company started as a component processor for machine tools after World War II and started manufacturing metal plates for snow vehicles of Ohara Tekkyo from 1970. It has 45 employees with capital of 10 million yen and annual sales of 500 million yen. The company is a mechanical processor integrating precision processing technology, metalworking and assembly, and is able to receive extensive orders from makers both in and outside the region. A member of Keyaki, a joint development group.

Nishi Tekkojo, West
Nishi Tekkojo, established in 1979, was originally a machine processing subcontractor but started developing its own products in 1997, including electric stone milling machines (micro powder) mainly for businesses. West is its sales company, which receives orders from hotels, restaurants and food companies. In recent years, it also performs processing under contract, using its milling machines.

Foundry Industry

Shinagawa Casting
A traditional casting maker established in 1932, with annual sales of 1.2 billion yen, 53 employees and capital of 10 million yen. As the mass-production of small castings is increasingly shifting overseas, the company is developing various items for limited-number, large castings. It is also striving to be competitive through stronger marketing due to the difficulty of maintaining differential casting technologies. Customers are located in the region and in the Kanto Region. It is increasing orders through the joint efforts of a cooperation association across industries. It has a group of companies including those engaged in wooden molds, shot blasting and thermal processing.

Ogasawara Casting
A casting maker with 28 employees and capital of 10 million yen. The present president took over the family business in his 20s. The company receives orders from within the prefecture and from Kita-Kanto and Nagano Prefecture. The president is developing new markets and the company offers various-item limited-number production and short lead times. It has invested in a wooden mold warehouse and added a high-frequency induction furnace.

Tokyo Lost-Wax Ind.
This company was established in 1988 by Mr. Iguchi, a former teacher of the Faculty of Engineering, Niigata University. It has 55 employees and capital of 35 million yen. It processes precise and complicated shapes by the lost-wax method instead of using wooden molds. The components are used in atomic energy equipment, aircraft, office equipment and appliances, vessels, and various other areas with 90% of customers from outside the prefecture. Recently, it started test-manufacturing in-house molds using optical forming technology by 3D-CAD.

Designer

Hiroi Koki
A designer company established in 1964 by the present chairman, following his departure from Tsugami, with 5 employees and capital of 10 million yen. It undertakes commissioned works relating to outsourcing of design by customers and integrated operations ranging from design, manufacture and product delivery in response to customer requests. Its integrated operation is increasing recently, including a small machining center, NC lathe and lapping machine. It is involved in promoting municipal orders and the chairman is an advisor at the Nagaoka University of Technology.

A. Medium-sized Machine Tool and Industrial Manufacturers: Secondary Inauguration and International Development

In the 1990s, medium-sized independent machine tool, industrial machinery and equipment manufacturers emerged in the Nagaoka area in addition to the traditional machine tool and industrial machinery manufacturers. Some of these were secondary developments succeeding family businesses or spin-offs from major firms.

Taiyo Koki, for example, is a grinding machine manufacturer with 107 employees, specializing in the planning, developing, designing and selling of various grinding machines, including CNC vertical combination grinders, with annual sales of 2.3 billion yen. President Mr. Watanabe, who was engaged in designing and engineering cylindrical grinders after joining Tsugami, established an independent design office in 1996. From the fourth year, he launched a full-scale machine tool business for further development and completed a new assembly plant by capital increase.

The company designed their machines after those of major firms at first and sold them at a lower price, which turned out to be unprofitable. They later strengthened their product development. The company is currently pursuing the development and manufacture of high-end industrial machinery, keeping in mind those competitive products made in Europe. It has delivered 76 units to 27 companies and has a 90% share in the vertical grinder market.

The company focuses on research and development in order to constantly develop high-end machinery. Twenty percent of the company’s personnel are researchers and 10% of the sales income is used for research and development, a very high figure. It develops two or three new models annually.

Clean Technology is another spin-off-type of venture business. The company produces liquid crystal and PDP-related equipment. It was established in August 1990 by Mr. Nishizawa (President), who was a hard disk product manager at Alps Electric. The major business lines are: UV drycleaners, hotplates, cold-plates, and excimer photon sources. The company focuses on product development with sales standing at 3 billion yen, capital of 10 million yen, and 58 employees, including 15 engaged in design and development.

Following establishment, the company modified the HD surface inspection

equipment, which Mr. Nishizawa was developing in his former workplace, and sold it to NEC, Sony and Asahi Glass. Mr. Nishizawa began full-scale development of the equipment at NARIC (the Shinanogawa Technopolis Development Organization incubation facilities), and commercialized the HD equipment business with assistance from that organization.

Thereafter, the company started to develop equipment for cleaning liquid crystals, color filters and PDPs using dry-cleaning technology. The Liquid Crystal Division of Nippon Seiki originally asked the company to set up the business. Nippon Seiki knew that the liquid crystal yield could be greatly improved by UV exposure in liquid crystal cleaning lines and suggested that the company make the manufacturing equipment. Clean Technology successfully commercialized the product with the cooperation of the Liquid Crystal Division of Nippon Seiki. When it started manufacturing the equipment in 1996, the company's sales nearly tripled.

The product destinations are changing. The equipment related to liquid crystal was originally delivered mainly to Japanese firms. The contribution of Japanese manufacturers to the company's sales rapidly declined from 80% to 10% in three years and the contribution of Korean and Taiwanese customers increased to 40% and 40%, respectively.

B. Innovative Response of Mechanical Processing and Casting Manufacturers

Along with the development of medium-sized firms in the areas of machine tools and industrial machinery, mechanical processing and casting firms are gaining power. To survive as a specialist, they have improved their equipment and expanded their plants, and developed integrated production systems that combine multiple processes and assembly. Some of them are willing to commercialize their own products.

OI, for example, is an integrated processor, designing, grinding and assembling products. It has equipment to manufacture precision machinery components and assemble machines and is able to process and assemble machinery components for industrial machinery and semiconductor inspection.

The present president launched OI Tool in 1985 and basically pursued an expansionist path. A new plant was constructed in 1991. An assembly

plant was constructed in the following year and expanded in 1995. The second and third plants were completed successively in 1997. The sales stood at 313.4 million yen in 1991 and 921.42 million yen in 1995, the latter level being maintained thereafter. The company has 30-40 major vendors.

The company sought external markets from the beginning and endeavored to receive orders from outside the region. Sales doubled due to increased orders from System Seiko in the early 1990s and Clean Technology in the late 1990s, but the company became more dependent on specific customers. As such dependence involves greater risk, the company is now trying to diversify its customers over a larger areas.

The company has an integrated production policy, doing everything within the organization from component processing to assembly. Customers are keen to have such integrated outsourcing available and industrial machinery/equipment manufacturers, such as Clean Technology and System Seiko, find the company very convenient.

Ogasawara Casting is another innovative foundry in the region. The company produces cast metals for machine tools (e.g. grinders, precision NC grinders, machining centers, etc.), and for industrial machinery (e.g. semiconductor-related equipment, turbo chargers, gas turbines, printing machines, etc.). The company has 28 employees and capital of 10 million yen. The present president succeeded to the family business at the age of 20.

Ogasawara Casting is characterized by its extensive external marketing, thorough various-item small-lot production and a short lead-time. The company has many customers outside the region. The present president started actively marketing outside the region with a contract from Akebono Machine in Saitama Prefecture. Ogasawara has some 30 customers in over a wide area ranging from Kita-Kanto to Nagano (half inside, half outside the region). Akebono Machine, Eguro, Citizen Precision Machinery and Toshiba Machine Machinery are extra-regional customers. In addition to Tsugami and Niigata Engineering within the region, Taiyo Koki, System Seiko, Corona and Clean Technology are some of the company’s increasing number of recent customers.

The company’s positive marketing is reflected in the attitude of the president. The president meets new customers and will travel anywhere to draw up business deals even if there is only an outside chance of

winning the contract. As there are few firms in Kita-Kanto and Nagano that can produce relatively large castings, personal communication contributes to a wider client base. As the strength of domestic production lies in various-item small-lot production and a short lead-time in recent years, the company has established a system to produce large items as well as lighter items, and can respond to an order for only a single unit.

The company takes utmost care in the management of wooden molds, processes and materials. In a group of firms, including neighboring wooden mold manufacturers, painters and machine processors, the company has shortened the lead-time by integrated production: wooden molds (foaming type)→castings→painting→machine processing→delivery. Some firms are positively procuring external orders, thus contributing to the company's marketing.

C. Networking Designers

In addition to the manufacturers mentioned above, there are firms in the Nagaoka area that are designing machine tools and industrial machinery. In an area of complex division of labor, designers create a network of firms in the region and coordinate with extra-regional firms.

Hiroi Koki originates from a design office established by the present president's father in 1964, as a spin-off from Tsugami, a major local firm. It designs machine tools, various dedicated types of machine, peripheral appliances and assembly machines as well as optical and semiconductor-related equipment.

Major equipment designed by the company includes: small machining centers, NC lathes, lapping machines, various types of energy-saving and assembly equipment. Its major customers are small machine tool manufacturers in the region as well as manufacturers of optical equipment and semiconductor manufacturing equipment, including those outside the prefecture.

The company undertakes integrated services in response to outsourcing design from customers, coordinating component processing and assembly according to the customers' requests, and delivery of the equipment. The latter service became the company's major business as a general

contractor. The company has about 30 subcontractors. It coordinates the whole process, taking advantage of their strengths in casting, component processing and surface treating.

The company is currently pursuing more customers outside the prefecture. To this end, Hiroi Koki's strength lies in its information on its design capability as well as the detailed information on the technological capability of local firms.

Designers need ample quality information. The company monitors market trends by frequently visiting districts outside the prefecture and academic societies. It fully understands the local processors' technical capabilities and selects subcontractors in response to specific customers' requests.

(4) Relations with Authorities and Universities

Administrative agencies and universities positively support the innovative measures of small- and medium-sized enterprises. Nagaoka City is subsidizing research and development activities and promoting order-soliciting activities, both inside and outside the region. The City is achieving this by publicly offering technological development, which these firms can apply to. Machine tool and industrial machinery manufacturers, as well as the above-mentioned processors, are positively pursuing technological development and actively using the administrative programs (Table 6).

Table 6. Projects Receiving Nagaoka Frontier Challenge Subsidies (fiscal 2001, 2002)

Fiscal 2001

Company Name	Project Name
Active	Development of multi-core optical connector measurement equipment
Almo	Research and development of casting sand for better environment
West	Development of continuous production system for ultra-fine powder
Clean Technology	Development of HP heater plate and CP cooling plate
Sanshin	Systematization of silicon wafer processing and development of beveling grinding equipment
Shinada	Development of instant vacuum disinfection equipment
Sinterland	Research and development for manufacturing high-performance silica glass
Select	Development of high-speed pH treatment technology for chemical and other plants
Tokyo Lost-Wax Ind.	Development of energy-saving technology for cutting and finishing process in precision casting and prototyping cutting and finishing equipment
Toei	Development of equipment for solidification of powders
Nagai Seiki	Development of special rice polisher
Nagumo Denso	Development of high power amplifier for UV disinfection lamp
Niigata Soy Sauce Cooperative	Development of a new manufacturing system for multi-layer sediment remover by baffle plate
Newtone	Building application protection service using the Internet
Produce	Development of electrode coating equipment for microchips
Mashima Tekkojo	Development of shock absorber for electric drills

Fiscal 2002

Company Name	Project Name
Active	Development of automatic single-core ferrule measuring equipment
West	Research and development of ceramic mortar and its shape
WebDo	Development of remote control system for FOMA
SKD	Development of core grinding equipment using lens light axis
Green Energy	Development of heat conversion system attached to ACE0.5 furnace
Nagaoka Molds	Development of gate bush for ceramic materials
Newtone	Preparation of vector data processing components for Internet webs
Hiroi Koki	Research and development of mirror surface lapping using piezoelectric element
Placade Japan	Building video chat system
Maruei Machine Works	Research into the technology for space-saving mounting of wide grindstone in grinders
Mohri Mfg.	Development of 3D CAD/CAM technology using photographs

Source: Based on the data obtained in August 2002 through the direct survey.

Niigata Prefecture established the Niigata Industrial Creation Organization and is supporting new businesses mainly through its Small Business Promotion Agency, as well as its Department of Industry and Labor, Industrial Research Institute of Niigata Prefecture, Technopolis Development Organization, and in cooperation with research institutes, local support centers and specialized organizations. The organization's funding base involves a venture capital program, which is proving to be promising.

Universities are also seeking ties with industries. Nagaoka University of Technology has employed visiting professors from private firms (Alps Electric, NEC) as industry-education coordinators, and is promoting laboratory-based joint research and idea dissemination for local industries (Table 7).

Table 7. "Exchange Fair and Exhibition between Local Firms and Nagaoka University of Technology" (August 24, 2002)

No	Name of exchange	Firm	Laboratory
1	Clinical engineering study group	Kenseisha, Himu Electro, Caretech, Industrial Research Institute of Niigata Prefecture	Medical bioengineering laboratory
2	Nagaoka study group of medical welfare egineering	Mizuho Ikakogyo, Yonex	Medical welfare engineering laboratory, sports engineering and law laboratory
3	Network for developing future industrial technology	Hakkai Creates	Nano device laboratory, high-temperature material laboratory, system control laboratory, new material processing laboratory, material physical property laboratory, liquid crystal device laboratory, Network for Developing Future Industrial Technology
4	Robot study group	Technical Development Institute Co., FTech, AT System, Hitachi Metals MPF	Robot mechanics laboratory
5	Power electronics study group	Twinbird, Densei-Lambda, Shinko Electric Machinery, Niigata Giken, Core System	Power electronics laboratory, power control laboratory, mechatronics laboratory, energy system laboratory, power system laboratory
6			Mechanical control engineering laboratory 1
7	Machine safety engineering study group		Machine safety engineering laboratory
8			Material processing laboratory
9			Ultrasonic and nondestructive measurement laboratory
10			Material strength and joint engineering laboratory
11			Material dynamics laboratory
12			Precision processing and mechanism laboratory
13		Kuraki	
14		Imai Seimitsu Rashi Mfg.	
15		Nippon Seiki	
16		OM Ltd.	
17		Keyaki Group	
18	Recycled concrete study group		Concrete laboratory, salt damage laboratory
19			Ground laboratory
20			Ground environment laboratory
21	Nagaoka business model study group	Nagai, BSN Information Network Service, IT Square, AC's, Crypt Software, KASIX Kashiwazaki Information Development Center	Nagaoka business model study group, advanced e-learning laboratory, human system engineering laboratory
22	Information media study group		Computer system laboratory
23			Applied image measurement laboratory
24		Trytech	Image compression laboratory
25			Chaos fractal applied engineering laboratory
26	Fungi technology study group	Ichimasa Kamaboko, Mitsuwa Kogyo, Osawa Kako, Green Sangyo, Miyatou	Fungi technology study group
27	HP study group for creating future industries	Echigo Seika, Chuetsu Kobo Mfg., Niigata Soy Sauce Cooperative	HP study group for creating future industries
28	Food chemicals group	Asahi-shuzo, Yamazaki Jozo	Applied biology laboratory
29	Air pressure CVD study group	Azuma Technox, Ulvac Techno, Tokki, Tokita CVD Systems, Optoquest	Saito laboratory
30			Semiconductor engineering laboratory
31			Extreme energy density engineering laboratory
32			Electronic device and surface analysis laboratory
33			Ceramic science laboratory
34	Magnesium study group	Tsubamex, Toyo Rikagaku Kenkyusho Co., Tokyo Lost-Wax Ind., Yoshikawa, Moriteck, Sumitomo Metals (Naoetsu), Nomizu Machine Mfg.	Advanced light metal material laboratory
35		Hokuetsu Metal	
36	Electro chemistry study group	Yoshikawa Sangyo, Regulus	Fuel-cell laboratory, micro-electrode laboratory, electric analysis laboratory
37	Niigata regional burning study group	Ebara Jitsugyo, Green Energy	Reactive physiochemistry laboratory
38	PTC research and development committee	Electric Floor Heating Association, Sunrize Industry	Functional composite material laboratory, computer engineering laboratory

Source: "Exchange Fair and Exhibition between Local Firms and Nagaoka University of Technology" (August 2002) by the University

Firms are also positively committed to such administrative reform and industry-education cooperation. Hiroi Koki, for example, is playing a vital role in fostering business assistance by municipalities by acting as a coordinator. It introduces local firms to parties outside the prefecture in order to solicit the activities of cities and chambers of commerce and industry. Its chairman is a technical advisor of the Nagaoka University of Technology.

III International Division of Labor and Restructuring of Industrial Agglomeration: Utilization of Local Resources and Involvement within Asian Linkages

As mentioned above, major establishments restructured the outsourcing system throughout the 1990s and some small- and medium-sized enterprises were obliged to go bankrupt or close. Some firms emerged from this by utilizing the efforts of widespread marketing, new product development and diversification.

Medium-sized equipment manufacturers placed new products on the markets by utilizing the power of research and development and expanding the scope of marketing in other parts of Japan and East Asia. They expanded sales to Japanese firms going abroad as well as Korean and Taiwanese firms competing with Japanese firms.

Moreover medium-sized firms are utilizing the regional division of labor and the resources accumulated in the region in order to expand their businesses.

Firstly, they cooperate with processors. Medium-sized manufacturers can devote their resources to planning, development and marketing by cooperating with those processors that are aggressive in their technological innovation, and are thus able to expand their businesses by networking outside the labor force. On the other hand, powerful processors are strengthening their technological development in response to the demands of medium-sized manufacturers. Some coordinator firms are emerging in the region and trying to network processors.

Secondly, the knowledge base of public assistance organizations and universities can be utilized. Medium-sized machinery manufacturers have

been growing in recent years and are very active in developing technologies and new products. These firms use prefectural and municipal subsidies for development and new products as well as incubation centers to limit product development expenses. Many of them also have ties with universities and industrial technology centers and are thus able to use the external knowledge resources positively.

Administrative agencies and universities are promoting industry-education liaison and order-soliciting activities in response to industry requests. The prefecture and municipalities developed systems for new product and technology development by small- and medium-sized enterprises through mutual cooperation. Universities are also promoting the liaison by retaining experienced engineers from private firms and are active in commercializing ideas.

Industrial agglomerations can create new business and industry within a region. The diversified division of labor and networks in a region creates an external effect in the managerial innovation of individual firms. An innovative medium-sized machinery manufacturer cannot create a business alone but is able to do so with cooperation from various processors. Administrative agencies and universities are providing a public service in terms of smooth managerial innovation.

A region has abilities to foster human resources and technologies and to create new knowledge and technology through spillover benefits. Large technological firms and innovative firms develop human resources. Some of them create independent businesses or work for local small- and medium-sized enterprises after retirement. Spin-off and networking promotes the spread of new technologies and business models in a region, which other companies can learn from. The spread of knowledge and technology will, in turn, foster the creation of new intelligence.

Emerging East Asian economies are indeed influencing Japanese industrial agglomerations' tendency to hollow-out. The collapse of the existing division of labor in the agglomerations triggered a new response from small- and medium-sized enterprises. Innovative medium-sized firms are positively involved in the industrial linkages formed in East Asia and are taking advantage of the growth in the area. They will be the main actors in restructuring the regional division of labor and in embodying the competitiveness that creates and maintains the difference from and interdependence with production in East Asia.