

NISTEP REPORT NO.47

Trends in Technology Exports from Japan
— 1994 Fiscal Year —

November 1996

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Third Policy-Oriented Research Group

National Institute of Science and Technology Policy (NISTEP)
Science and Technology Agency

Translation from
Japanese version

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I. Introduction

Japan's technology trade has in recent years been expanding in parallel with the sharply accelerating globalization of economic activity. Statistics on the trade are prepared by the Bank of Japan and the Management and Coordination Agency. (Footnote 1) According to the Bank of Japan, the country's technology trade in FY 1994 recorded exports of ¥542.7 billion (up 24.7% year-to-year) and imports of ¥856.1 billion (up 8.3%). The corresponding figures for the Management and Coordination Agency were ¥462.1 billion (up 15.4%) and ¥370.7 billion (up 2.1%). The amounts do not agree precisely but it is clear in both cases that the growth rate of exports is far higher.

This Institute carries out an annual trend analysis of technology imports entitled "Trend Analysis of Foreign Technology Introduction," based on reports of the conclusion/amendment of technology import contracts filed pursuant to with The Foreign Exchange and Foreign Trade Management Law. No such analysis has been undertaken for exports. To gain an understanding of the actual situation in technology trade, details must be analyzed--including the nature of the technology, its forms (in terms of patents, knowhow, etc.), contract formats, and the financial interests of the signatories to technology trade contracts. Starting in FY 1991 this Institute has therefore conducted an annual survey of private-sector corporations and publishes the results under the title "The Actual State of Japan's Technology Exports." The latest deals FY 1994's exports contracts.

In this report we have for the first time added research on a trial basis for companies capitalized at less than ¥1 billion.

We hope that this report will be useful as a resource for forecasting trends in Japan's technology trade.

1) Originators and Types of Japan's Major Technology Trade Statistics

Originator	Content	Categories
Bank of Japan	Import/export contract amounts	Money amounts only
Management and Coordination Agency	Numbers and amounts of import/export contracts	Industrial sectors, geographical breakdown, new/continuing contracts breakdown

For further details, see "Technology Trade Statistics of Japan" (NISTEP Study Reference No. 26), published by this Institute.

II. Survey Methods

1. Contents of Survey Questionnaire

This survey was aimed primarily at understanding the status of technology exports and illustrating the special characteristics of Japan's technology trade. This Institute has been publishing annually its "Trend Analysis of Foreign Technology Introduction," covering technology imports from overseas; the questions in the present survey were prepared along similar lines so that results can be compared and contrasted. The export contracts covered by the present survey are new contracts concluded within the period 1 April 1994 ~ 31 March 1995.

"Technology exports" are here defined as the transfer of industrial property rights (patents, utility models, designs, trademarks) or rights connected with technological knowhow, the establishment of usufructuary rights, and/or the provision of technological guidance/ instruction. (Reference Material 1 contains a list of the survey questions.)

2. Survey Methods

The following is an outline of the survey.

- (1) Survey Target Companies: Corporations capitalized at ¥1 billion or more and involved in R&D activities or connected in some way with technology trade (1,569 companies)
- (2) Survey method: Questionnaires by mail, directly to intellectual property managers or R&D managers in the aforementioned corporations
- (3) Survey period: 6 February 1996 (questionnaires mailed) to 26 February 1996 (reply deadline)
- (4) Response results: 900 companies (57.4%)

3. Attribute Distribution of Response Samples

A breakdown by capitalization and industry sector of the survey targets and of the respondents is shown in Figure 2-1, Table 2-1, of the following section.

[Remarks]

* The industrial sectors of the companies in this report were taken from the "Directory of Companies and Enterprises" compiled by the Statistics Bureau of the Management and Coordination Agency, as in the case of the Institute's "Analysis of Trends in Technology Imports"; similarly, companies not listed therein were assigned to sectors in accordance with the Administrative Management Agency's "Japan Standard Industrial Sectors" (1984, Notification No. 2).

* The letter "N" shown in this report's graphs represents the number of samples. Where any section of the questionnaire was left blank, that response was excluded from its count.

Figure 2-1: Capitalization of Companies Covered in Survey and Companies Responding to Survey

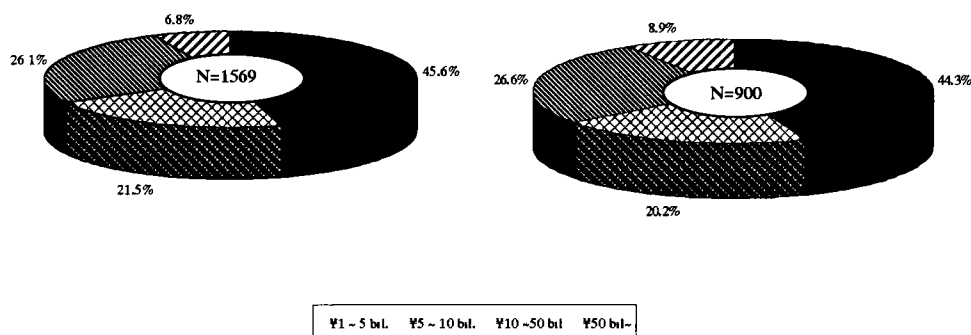


Table 2-1: Industrial Sectors of Companies Surveyed

Industry	Surveyed	Responded	Response Rate (%)
(1) Agriculture, forestry & fisheries	4 (0.3)	2 (0.2)	50.0
(2) Mining	8 (0.5)	7 (0.8)	87.5
(3) Construction	122 (7.8)	82 (9.1)	67.2
(4) Food	95 (6.1)	44 (4.9)	46.3
(5) Textiles	47 (3.0)	24 (2.7)	51.1
(6) Paper/pulp	30 (1.9)	13 (1.4)	43.3
(7) Printing and publishing	9 (0.6)	3 (0.3)	33.3
(8) Integrated chemicals	95 (6.1)	50 (5.6)	52.6
(9) Edible oils and paints	21 (1.3)	13 (1.4)	61.9
(10) Pharmaceuticals	54 (3.4)	32 (3.6)	59.3
(11) Other chemical products	32 (2.0)	19 (2.1)	59.4
(12) Petroleum products	24 (1.5)	11 (1.2)	45.8
(13) Plastic products	28 (1.8)	15 (1.7)	53.6
(14) Rubber products	13 (0.8)	8 (0.9)	61.5
(15) Ceramics	49 (3.1)	33 (3.7)	67.3
(16) Iron and steel	53 (3.4)	32 (3.6)	60.4
(17) Nonferrous metals	45 (2.9)	27 (3.0)	60.0
(18) Fabricated metal products	53 (3.4)	33 (3.7)	62.3
(19) Machinery	156 (9.9)	90 (10.0)	57.7
(20) Electrical equipment	78 (5.0)	47 (5.2)	60.3
(21) Communications, electronics	143 (9.1)	91 (10.1)	63.6
(22) Automobiles	69 (4.4)	40 (4.4)	58.0
(23) Other transport equipment	33 (2.1)	20 (2.2)	60.6
(24) Precision instruments	32 (2.0)	16 (1.8)	50.0
(25) Other manufacturing	57 (3.6)	30 (3.3)	52.6
(26) Transportation, communication, public utilities	39 (2.5)	25 (2.8)	64.1
(27) Wholesaling, retailing	93 (5.9)	40 (4.4)	43.0
(28) Information services, research, advertising	33 (2.1)	23 (2.6)	69.7
(29) Miscellaneous services	54 (3.4)	30 (3.3)	55.6
Total	1569 (100.0)	900 (100.0)	57.4

(Note) *Integrated chemicals refers to the manufacture of chemical fertilizers, inorganic chemicals, and chemical fibers.

* Parenthesized figures indicate the component ratio by industry

III. Overall Trends in Survey Results

Sections III ~ VII analyze the survey results for companies capitalized at ¥1 billion or more. Section VIII analyzes those for companies capitalized at less than ¥1 billion.

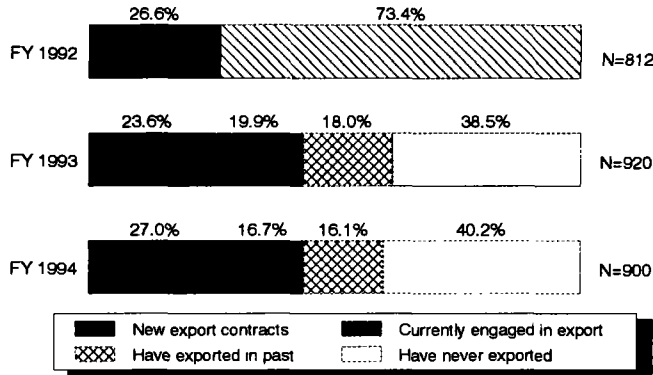
1. Overview of Conclusion of Technological Export Agreements

a. Companies Having Concluded Technological Export Agreements

A determination of the number of companies that concluded new contracts during FY 1994 was among the survey's goals. Of the 900 respondents, 27.0% replied in the affirmative, 16.7% said they had continuing or ongoing technology exports, 16.1% said they had carried out such contracts in the past, and 40.2% said they had never exported technology. Of the first group, those exporting technology for the first time, the figure represented a 3.4 percentage point increase over the prior fiscal year and was about equal to that of FY 1992. (See Figure 3-1)

A breakdown by capitalization for FY 1994 is shown in Fig. 3-2 and Table 3-1. It remains true that the higher the capitalization the greater the proportion of engagement in technology exports. The ability to finance R & D activities is a prerequisite to such exports.

Figure 3-1: Technology Export Contracts Concluded



* FY 1992 numbers are limited to new export contracts or their absence.

Fig. 3-2: Exporting/Non-exporting Companies By Capitalization

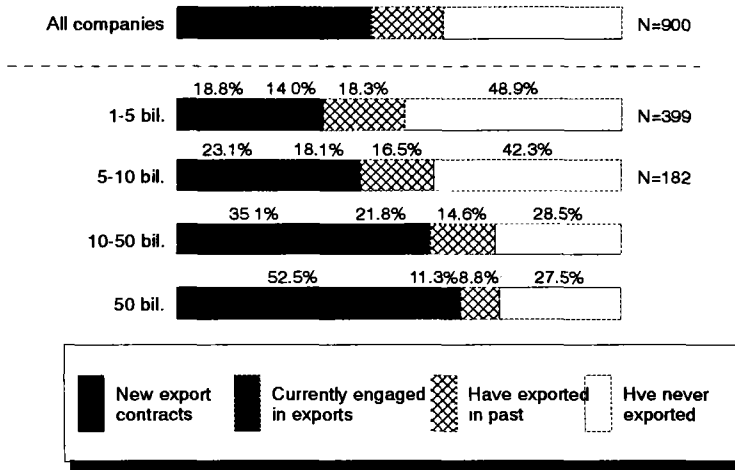


Table 3-1: Percentage Shares of Exporting/Non-exporting Companies s By Capitalization

	New contracts			Currently have exported			Exporting in past			Have never exported		
	FY 93	FY 94	% chg	FY 93	FY 94	% chg	FY 93	FY 94	% chg	FY 93	FY 94	% chg
All Co.'s	23.6%	27.0%	3.4%	19.9%	16.7%	-3.2%	18.0%	16.1%	-1.9%	38.5%	40.2%	1.7%
1 ~ 5 bn	14.3%	18.8%	4.5%	15.8%	14.0%	-1.8%	22.3%	18.3%	-4.0%	47.6%	48.9%	1.3%
5 ~ 10 bn	17.3%	23.1%	5.8%	24.5%	18.1%	-6.4%	18.9%	16.5%	-2.4%	39.3%	42.3%	3.0%
10 ~ 50 bn	34.4%	35.1%	0.7%	25.3%	21.8%	-3.5%	14.9%	14.6%	-0.3%	25.3%	28.5%	3.2%
50 bn ~	51.2%	52.5%	1.3%	13.1%	11.3%	-1.8%	4.8%	8.8%	4.0%	31.0%	27.5%	-3.5%

Narrowing the focus to manufacturing industries, Fig. 3-3 and Table 3-2 break down the 691 respondents in this sector. Of the 691 respondents, 32.7% entered into new agreements during the period, up 5.7 percentage points, while the 29.4% of all companies saying they had never exported technology represented a 10.8 point decline. Here too we see that the larger the capitalization the larger the percentage of those concluding new contracts: special note is made of the very high ratio (over 70%) for companies capitalized at ¥50 billion or more. On a year-earlier comparison, those capitalized at less than ¥10 billion showed a conspicuous gain, with the ratio for smaller companies (¥5 billion ~ less than ¥50 billion) in particular up 8.3 points.

Figure 3-3: Manufacturers' Technology Exports By Capitalization

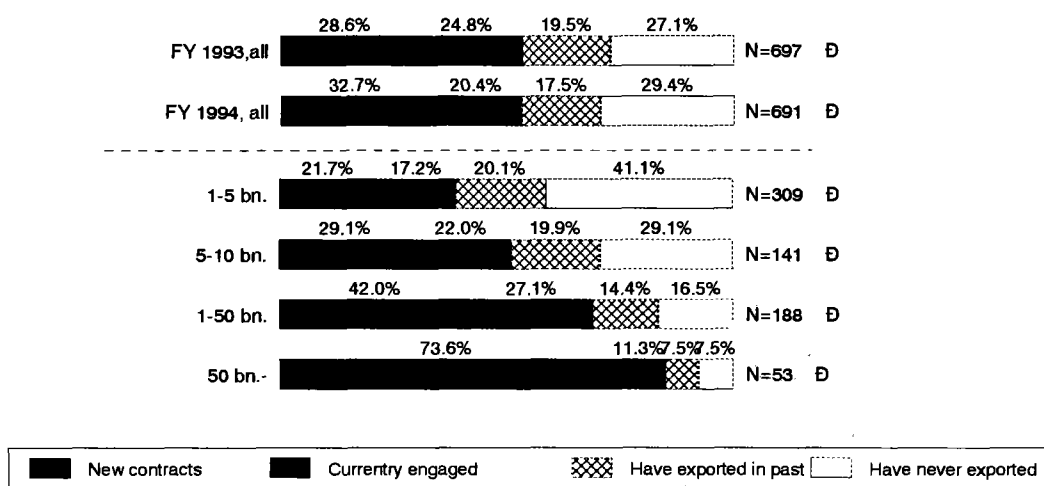


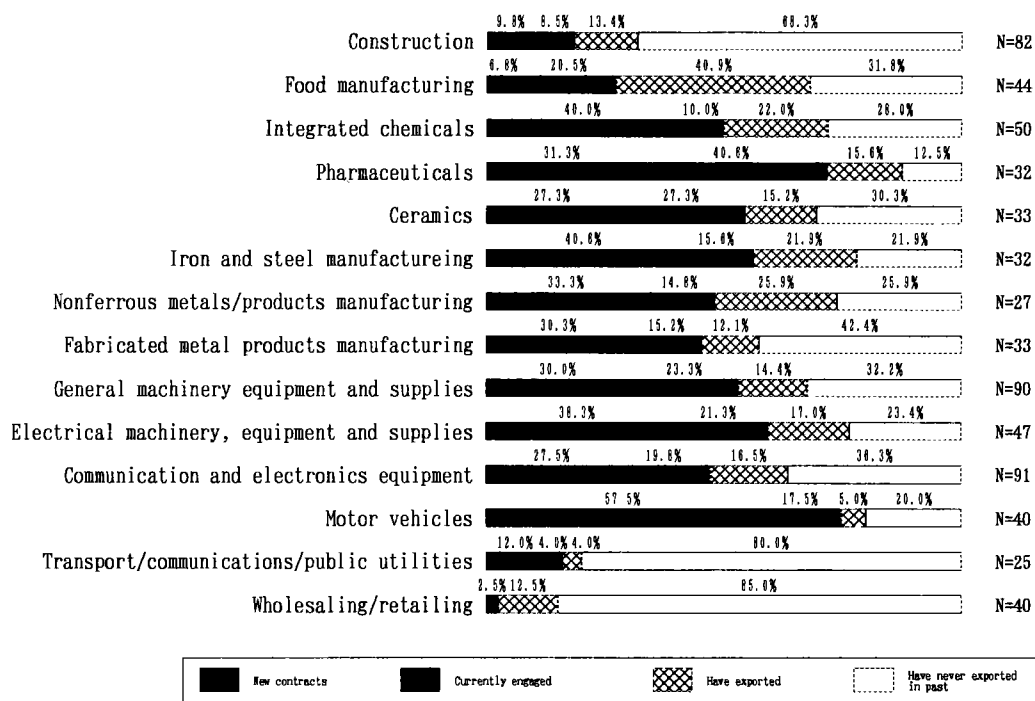
Table 3-2: Technology Exports By Manufacturers' Capitalization

	New contracts			Currently have exported			Exporting in past			Have never exported		
	FY 93	FY 94	% chg	FY 93	FY 94	% chg	FY 93	FY 94	% chg	FY 93	FY 94	% chg
All Co.'s	28.6%	32.7%	4.1%	24.8%	20.4%	-4.4%	19.5%	17.5%	-2.0%	27.1%	29.4%	2.3%
1 ~ 5 bn	17.0%	21.7%	4.7%	19.9%	17.2%	-2.7%	24.8%	20.1%	-4.7%	38.2%	41.1%	2.9%
5 ~ 10 bn	20.8%	29.1%	8.3%	28.9%	22.0%	-6.9%	20.8%	19.9%	-0.9%	29.6%	29.1%	-0.5%
10 ~ 50 bn	41.4%	42.0%	0.6%	30.9%	27.1%	-3.8%	14.9%	14.4%	-0.5%	12.7%	16.5%	3.8%
50 bn ~	76.5%	73.6%	-2.9%	19.6%	11.3%	-8.3%	0.0%	7.5%	7.5%	3.9%	7.5%	3.6%

2) Defined as excluding agriculture/forestry/fisheries, mining, construction, transport/communications/public utilities, wholesaling/retailing, etc., as noted in Study Materials No. 2.

Breaking down the respondents by industry, we note that in the "New Contracts" category the automobile sector led with 57.5%, followed by iron and steel with 40.6% and integrated chemicals with 40.0%, while non-manufacturers lagged with wholesaling/retailing at 2.5%, construction at 9.8%, and transport/communications/public utilities at 12.0%, and foods (6.8%). Apart from foods, more than 1 in 4 manufacturers concluded new export contracts during the period. Direct numerical year-to-year comparisons cannot be made because of differences in the number of respondents, but we note that major changes occurred in metal products (up 23.2 percentage points), automobiles (up 20.7 points), and foods (down 13.2 points). (See Fig. 3-4)

Figure 3-4: Technological Export Results (By Industry)



b. Numbers of Technological Export Agreements

The number of new technology export contracts declined by 12.1% year-to-year in FY 1993 to 626, but in the period under review rose 16.6% to 730, a three-year high, on the same comparative basis. Our survey could not cover all technology exports, so a closer look at the data, including the correlation between contract numbers and rates of change, was undertaken.

The Administrative Management Agency's statistics show the total of both new and ongoing export contracts trending up for three consecutive years, but new contracts alone declined by about 4% annually over the two years following FY 1991's 2,066 contracts, down to 1,896 in FY 1993, and then rebounding by 13.3% to 2,148 in FY 1994. Footnote 3) The following table (3-3) should make clear these and other differences with the Administrative Management Agency's statistics.

To avoid statistical misunderstandings based on methods of data collection, we have aggregated the numbers from technology-exporting respondents for the past 3 years; here too we see that FY 1993's 398 contracts represented a 13.9% decline from FY 1992's 462, and further that FY 1994's 463 contracts measured a year-to-year gain of 16.3%.

Table 3-3: Technology Export Contract Statistics

	Science & Technology Agency				Administrative Management Agency			
	All		3-year respondents		New & ongoing		New contracts only	
	No.	% chg	No.	% chg	No.	% chg	No.	% chg
FY 1991	—	—	—	—	8,063	12.6%	2,066	31.6%
FY 1992	712	—	462	—	8,201	1.7%	1,983	-4.0%
FY 1993	626	-12.1%	398	-13.9%	8,338	1.7%	1,896	-4.4%
FY 1994	730	16.6%	463	16.3%	9,099	9.1%	2,148	13.3%

3) Our survey concentrates on companies capitalized at ¥1 billion or more, whereas the Administrative Management Agency's had a lower limit of ¥50 million and includes special corporations, among other differences.

c. Export Agreements Per Company

A simple average of new contracts per company computes out to 3.0 for FY 1994, up about 10% year-to-year, or almost no change.

The distribution of new contracts among the universe of 243 respondents is as shown in Fig. 3-5 below. Those that reported 1 contract were 48.6% of the total, and 2~3 contracts 25.5%, so that those with 3 or less accounted for more than three-quarters. Those reporting 11 or more came to only 3.7%. Broken down by capitalization as in Table 3-4, we see that 3 or fewer contracts among companies capitalized at ¥1 billion ~ less than ¥5 billion accounted for 88.0%, for an average of 1.8 each, while 3 or less for those capitalized at ¥50 billion or more accounted for no more than 45.2% of the total. On the other hand, 11 or more came to 16.7%, for an average of 6.1 per company. As with last year, therefore, the average rises with capitalization.

Figure 3-5: New Export Contracts Per Company by Capitalization

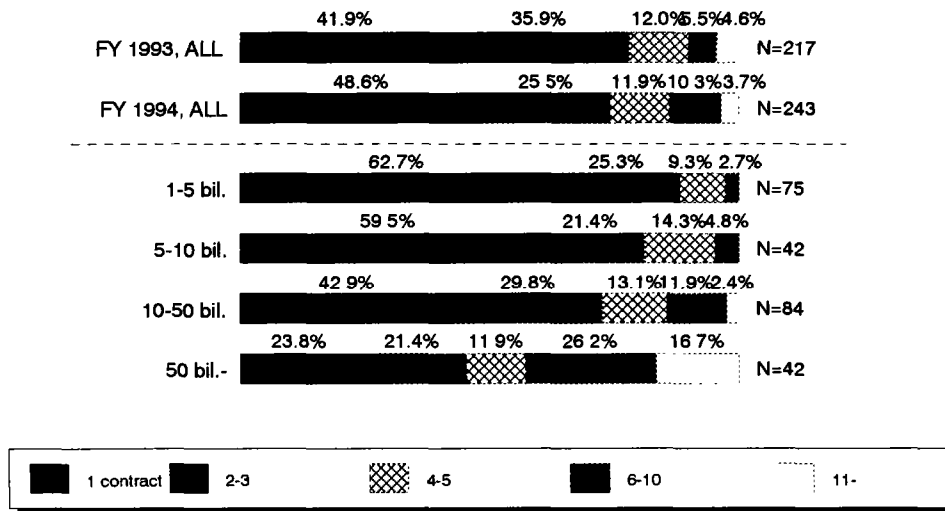


Table 3-4: Export Contract Numbers Per Company By Capitalization

	FY 1993			FY 1994		
	No. exporters	No. contracts	Per company	No. exporters	No. contracts	Per company
All	217	626	2.9	243	730	3.0
¥1 ~ 5 bn	57	108	1.9	75	134	1.8
¥5 ~ 10 bn	34	83	2.4	42	92	2.2
¥10 ~ 50 bn	83	214	2.6	84	246	2.9
¥50 bn ~	43	221	5.1	42	258	6.1

2. Regions and Countries/Areas of Contract Partners

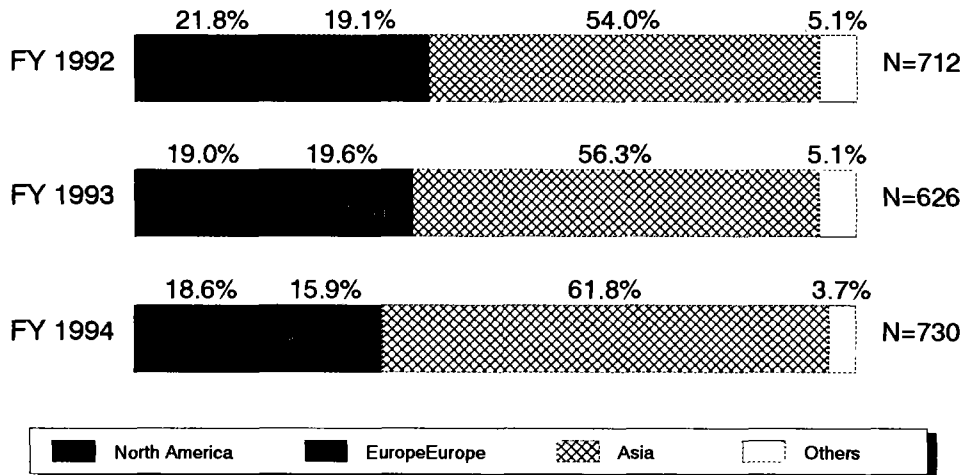
Breaking down the numbers of contracts by broad geographical area, it is seen that all showed declines last year, but in FY 1994 only Europe continued this trend; the other three were up sharply. (See Table 3-5)

Table 3-5: Export Contracts By Main Area

	North America		Europe		Asia		Others	
	No. contracts	% chg	No. contracts	% chg	No. contracts	% chg	No. Contracts	% chg
FY 1992	155	—	136	—	385	—	36	—
FY 1993	119	-23.2%	123	-9.6%	352	-8.6%	32	-11.1%
FY 1994	136	14.3%	116	-5.7%	451	28.1%	27	-15.6%

Fig. 3-6 graphs these data in percentages, with Asia at 61.7%, North America at 18.6%, Europe at 15.9% and others at 3.7%. Asia has always led since the inception of this survey.

Figure 3-6: Location of Foreign Contracting Parties



Breaking the data down yet further by country, we see that the U.S. remains by far the largest single contracting party, followed by Korea, China, Taiwan, and Thailand; there has been no change in the top five rankings over the past 3 years. And of the top 10, 7 are in Asia. Looking at 3-year changes, China's gains (from 56 in FY 1992 to 101 in FY 1994) and Britain's decline (from 35 to 15) stand out. And while the FY 1993 aggregate for Thailand, Malaysia and Indonesia declined sharply year-to-year (from 108 to 65), this year it rose to 99. Aside from these three, in Southeast Asia the figure for the Philippines, at 14 contracts, was up from a 2-year total of 11 (7 in FY 1992, 4 in FY 1993). Table 3-6 refers. (For additional details, see Table 2 of the aggregate tables in the appendix.)

Table 3-6: Export Contracting Parties By Country

	FY 1992			FY 1993			FY 1994		
	Country	No. contracts	%	Country	No. contracts	%	Country	No. contracts	%
1	USA	142	19.9%	Korea	104	16.6%	USA	122	16.7%
2	Korea	98	13.8%	USA	100	16.0%	Korea	101	13.8%
3	China	56	7.9%	China	80	12.8%	China	101	13.8%
4	Taiwan	53	7.4%	Taiwan	52	8.3%	Taiwan	73	10.0%
5	Thailand	51	7.2%	Thailand	32	5.1%	Thailand	49	6.7%
6	Britain	35	4.9%	Britain	29	4.6%	Germany	28	3.8%
7	Malaysia	34	4.8%	Germany	26	4.2%	Malaysia	26	3.6%
8	Germany	24	3.4%	Indonesia	19	3.0%	Indonesia	24	3.3%
9	Indonesia	23	3.2%	India	18	2.9%	India	23	3.2%
10	India	20	2.8%	France	15	2.4%	Britain	15	2.1%
11	Singapore	19	2.7%	Malaysia	14	2.2%	Italy	15	2.1%
12	France	16	2.2%	Hong Kong	14	2.2%	Singapore	14	1.9%
13	Italy	15	2.1%	Italy	12	1.9%	Philippines	14	1.9%
14	Hong Kong	12	1.7%	Singapore	11	1.8%	France	13	1.8%
15	Brazil	11	1.5%	Australia	10	1.6%	Spain	12	1.6%
	Others	103	14.5%	Others	90	14.4%	Others	100	13.7%
	Total	712	100.0%	Total	626	100.0%	Total	730	100.0%

3. Capital Relationships With Foreign Contracting Enterprises

We have reviewed the capital relationships involved in FY 1994's new technology export contracts. (Footnote 4) In 59.2% of the cases there is no capital relationship, followed by 25.1% for capital participations of more than half, and 15.7% for an interest of less than half. Japan's technology exports are still largely unrelated to financial interests, though the ratio of those involving some capital relationship did rise by 9.6 percentage points year-to-year.

Geographically, Asia still holds first place among those in which there is such a relationship, with 48.8%, followed at some distance by Europe with 20.7%. On a year-earlier comparison, the ratio for capital relationships was up, most noticeably for North America (up 10.8 points) and Asia (9.0 points). (See Fig. 3-7, Table 3-7)

By country, we note wide variations within Asia, where those with high ratios for no capital relationships (Korea, India) compare with high ratios for existing capital relationships (Malaysia, Thailand, China) and those of intermediate status (Taiwan, Indonesia). Also in Asia Japan's direct investments and the economic situation vary, leading to a mixed picture in relation to financial interests in the contracting parties. See Fig. 3-7, Table 3-7, and Fig. 3-8 . (This topic is analyzed in greater detail in Section VII.)

4) "Capital relationships" here refers to whether or not stock or some part of the foreign contracting party is owned by the Japanese technology exporter.

Figure 3-7: Capital Relationships With Foreign Partners

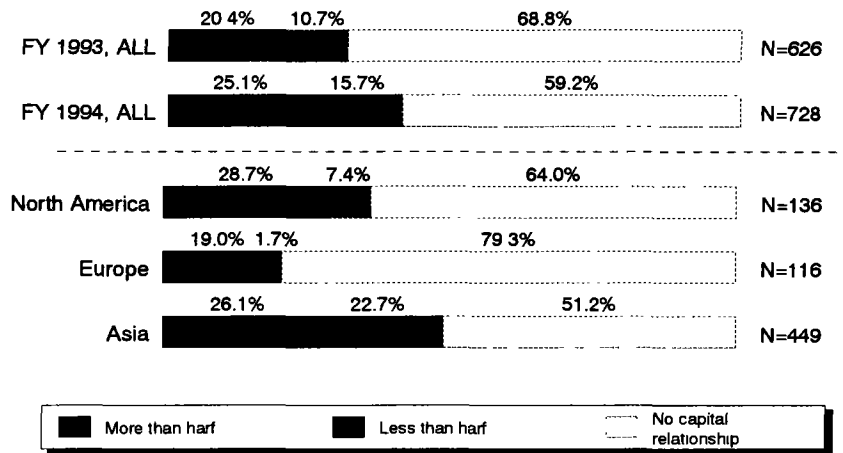
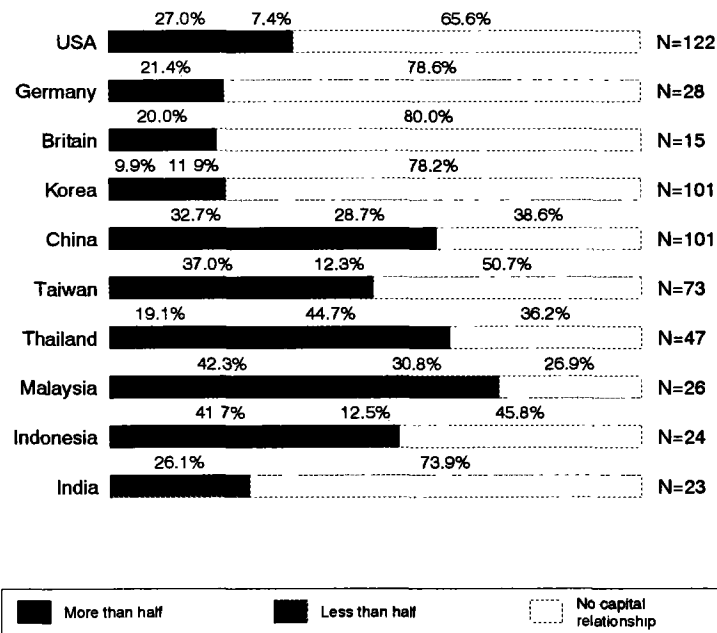


Table 3-7: Capital Relationships By Area

	More than half			Less than half			No relationship		
	FY 93	FY 94	% chg	FY 93	FY 94	% chg	FY 93	FY 94	% chg
All	20.4%	25.1%	4.7%	10.7%	15.7%	5.0%	68.8%	59.2%	-9.6%
North America	21.0%	28.7%	7.7%	4.2%	7.4%	3.2%	74.8%	64.0%	-10.8%
Europe	13.8%	19.0%	5.2%	2.4%	1.7%	-0.7%	83.7%	79.3%	-4.4%
Asia	23.9%	26.1%	2.2%	15.9%	22.7%	6.8%	60.2%	51.2%	-9.0%

Figure 3-8: Capital Relationships By Country



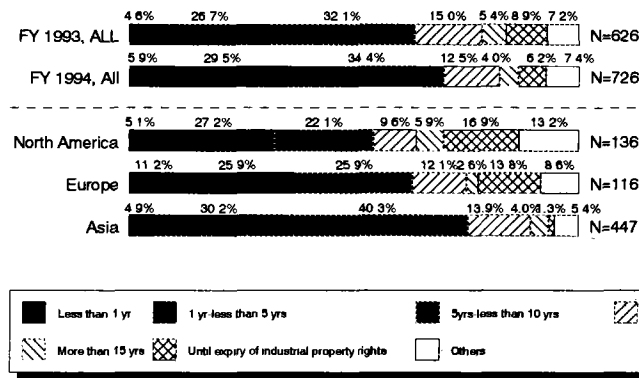
4. Contract terms

We examined the periods of the new contracts concluded in FY 1994. Of the total, 34.4% ran from 5 to less than 10 years, and 29.5% from 1 to less than 5 years--together these accounted for 63.9%. Those from 10 to less than 15 years were 12.5%, those for other periods (Footnote 5) were 7.4%, and those valid until the expiration of industrial property rights were 6.2%. At the extremes were 5.9% for those of less than 1 year and 4.0% for those exceeding 15 years. Year-to-year comparisons showed a 2.5 point drop in those of 10 ~ less than 15 years, a 1.4 point drop in the more than 15 years category, and a 2.7 point decline in those valid until the expiration of industrial property rights.

Geographically, North America and Europe showed high ratios of contracts valid until the expiration of industrial property rights: 16.9% and 13.8%, respectively. For Asia the same category registered a low 1.3 %, with contracts of less than 10 years accounting for 75.4% of the region's total. Year-earlier comparisons showed all regions' short-term ratios gaining, especially those of North America up, 8.7 points for contracts of 1 ~ less than 5 years and Europe, up 10.4 points for contracts of less than 1 year.

Generally, for Europe and the U.S. the ratios are high for longer-term contracts (to industrial rights expiry and for more than 10 years), while contracts with Asian partners tend to be of shorter duration (more than 80% for those of less than 10 years). But for China the ratio for 10 ~ less than 15 years is a rather high 29.0%. Breakdowns by period (Footnote 6), region, and country are shown in Fig. 3-9, Table 3-8, and Fig. 3-10, respectively.

Figure 3-9: Technology Export Contract terms By Region



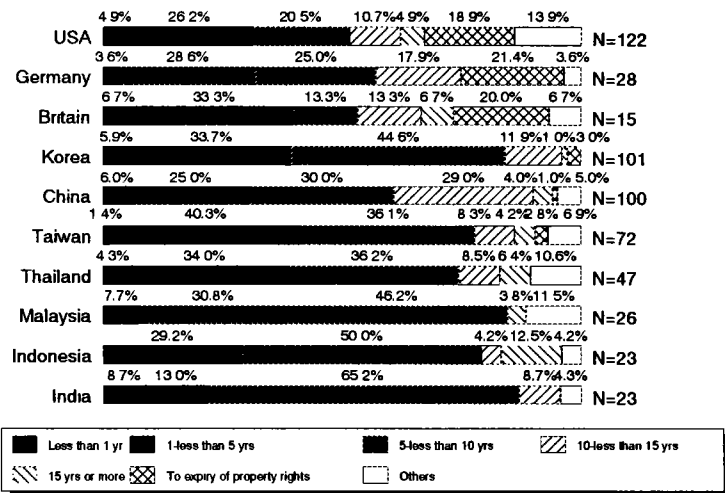
5 "Other periods" are here defined as contracts with no fixed expiry, those effective in perpetuity, those valid until nullified by another contract, etc.

Table 3-8: Contract terms By Geographical Area

	~ 1 year			1-less than 5 yrs			5-less than 10 yrs			10-less than 15 yrs		
	FY 93	FY 94	% chg	FY 93	FY 94	% chg	FY 93	FY 94	% chg	FY 93	FY 94	% chg
All	4.6%	5.9%	1.3%	26.7%	29.5%	2.8%	32.1%	34.4%	2.3%	0.15	12.5%	-2.5%
N. America	1.7%	5.1%	3.4%	18.5%	27.2%	8.7%	35.3%	22.1%	-13.2%	0.101	9.6%	-0.5%
Europe	0.8%	11.2%	10.4%	26.0%	25.9%	-0.1%	22.0%	25.9%	3.9%	0.171	12.1%	-5.0%
Asia	7.1%	4.9%	-2.2%	29.8%	30.2%	0.4%	34.4%	40.3%	5.9%	0.159	13.9%	-2.0%

	15 years ~			Property rights expiry			Others		
	FY 93	FY 94	% chg	FY 93	FY 94	% chg	FY 93	FY 94	% chg
All	5.4%	4.0%	-1.4%	8.9%	6.2%	-2.7%	7.2%	7.4%	0.2%
N. America	7.6%	5.9%	-1.7%	21.0%	16.9%	-4.1%	5.9%	13.2%	7.3%
Europe	5.7%	2.6%	-3.1%	19.5%	13.8%	-5.7%	8.9%	8.6%	-0.3%
Asia	4.5%	4.0%	-0.5%	2.0%	1.3%	-0.7%	6.3%	5.4%	-0.9%

Figure 3-10: Contract terms By Country/Area



5. Contract Formats

Looking at the type or format of the export contracts we see that 85.5% involved compensation or payment, 5.7% were cross-licensing contracts, and 8.9% were gratuitous and involved no payment. Cross-licenses were particularly noteworthy in North America, with 13.2% of the total.

On a year-earlier comparison, gratis and cross-license contracts declined in the aggregate. The ratio for North America sank by 5.3 points and that for Europe by 4.6 points. Asia's gained marginally (1.2 points). Fig. 3-11 and Table 3-9 provide details.

Figure 3-11: Contract Formats

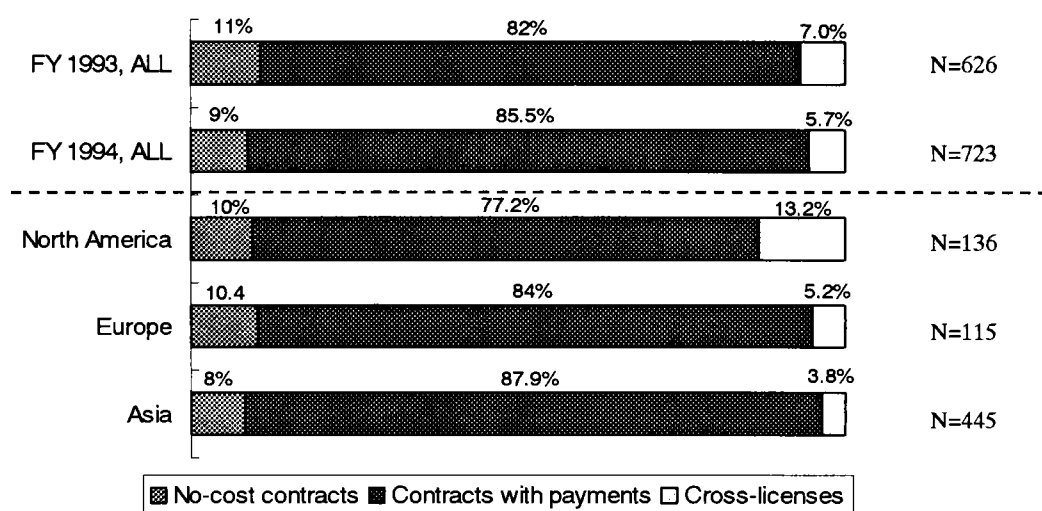


Table 3-9: Contract Formats By Region

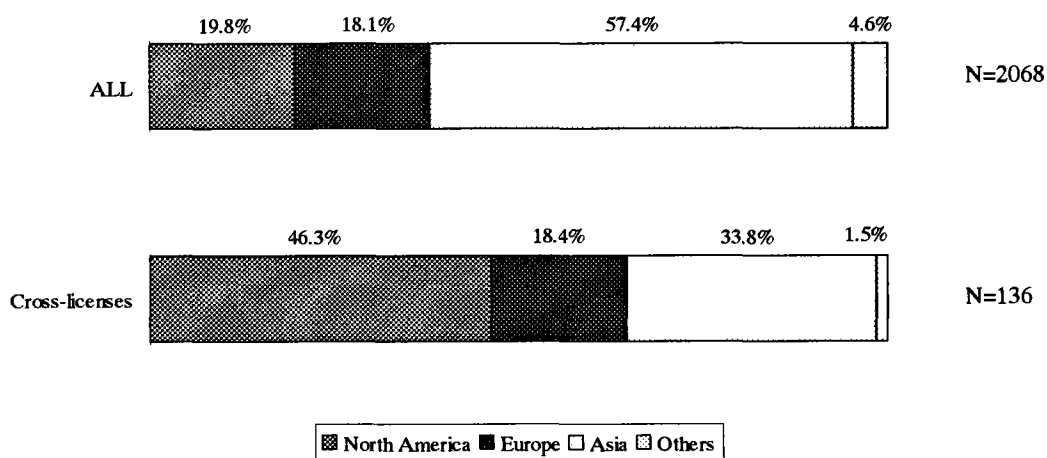
	No-cost (%)			Payment involved (%)			Cross-licenses (%)		
	FY 93	FY 94	% chg	FY 93	FY 94	% chg	FY 93	FY 94	% chg
All	10.9%	8.9%	-2.0%	82.1%	85.5%	3.4%	7.0%	5.7%	-1.3%
North America	10.9%	9.6%	-1.3%	70.6%	77.2%	6.6%	18.5%	13.2%	-5.3%
Europe	11.4%	10.4%	-1.0%	78.9%	84.3%	5.4%	9.8%	5.2%	-4.6%
Asia	8.5%	8.3%	-0.2%	88.9%	87.9%	-1.0%	2.6%	3.8%	1.2%

[Cross-license contracts]

In recent years, as the value of technology has come to be regarded more seriously, exporting companies have looked not only for cash but for exchanges of their partners' technology. And depending on the field, a single product may incorporate several hundred patents; to avoid problems with litigation over intellectual property rights and to reduce royalty payments, the cross-license contract has a very significant meaning. For this reason we have in this year's report examined cross-licensing contracts in detail. But because there are so few of them in a given fiscal year, we have aggregated data for the past 3 years.

By export region, North America accounts for the single largest share of cross-licenses, at 46.3%, while Asia's is lowest (at 33.8%) despite its high share of total technology export contracts (57.4%). Cross-licenses involve relatively complex rights and are used for high technology; sensitivity to intellectual property rights is high in North America, particularly the U.S. (See Fig. 3-12)

Figure 3-12: Cross-License Contracts By Region (3-Year Total)



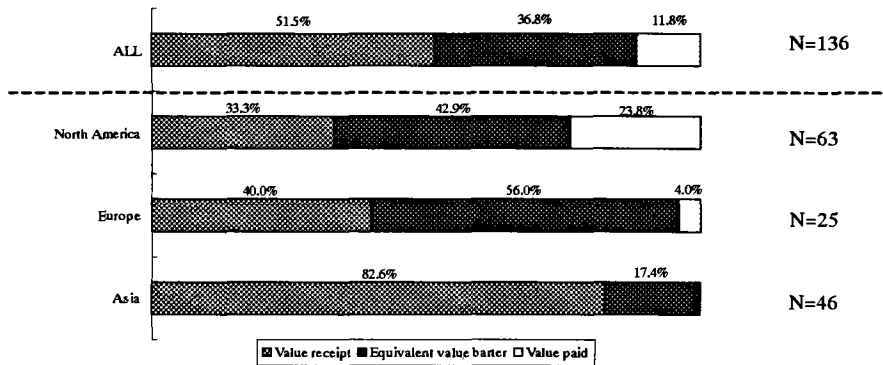
Our cross-license research covered all three contract subtypes: "Value receipt," "Equivalent value barter," and "Value paid." On a 3-year basis the first leads with a 51.5% share; the second and third follow with 36.8% and 11.8%, respectively.

Fig. 3-13 shows the 3-year regional breakdown by these subtypes. For the first Asia's share is an overwhelming 82.6%, while in North America and Europe the ratios for equivalent value barter exceed those for value receipt. Another noteworthy feature is that for North America the value paid subtype, at 23.8%, is much higher than for the other regions. (See Fig. 3-13)

By country, the U.S. has a very high cross-license share (43.4%). And looking at cross-licenses as a proportion of all export contracts, the U.S. is far and away the highest at 16.3%.

Within the cross-license category we see wide variations by country. Apart from the single value-paid contract for Germany, all are for the U.S. And for Korea and Thailand all are of the value-receipt subtype. The cross-license can be taken as a paradigm of Japan's technological power vis-a-vis other countries and areas.

Figure 3-13: Cross-License Contract Types By Region (3-Year Total)



Broken down by country, large divergences are apparent. Except for a single German contract, all "Value paid" types are U.S.-related. For Korea and Thailand all are "Value receipt." Cross-licenses are influencing the technological power of Japan vis-a-vis other countries. (See Table 3-10)

Table 3-10: Leading Cross-License Countries By Contract Numbers (3-Year Total)

	Cross-license contracts				Total export contracts	Ratio (%)
	Value rec'd	Barter	Value paid	Total		
1 USA		24	15	39 (59.1%)	363	10.7%
2 Korea		0	0	0 (0.0%)	301	0.0%
3 Taiwan		3	0	3 (4.5%)	177	1.7%
4 China		5	0	5 (7.6%)	235	2.1%
5 Thailand		0	0	0 (0.0%)	130	0.0%
6 Germany		3	1	4 (6.1%)	77	5.2%
Others		15	0	15 (22.7%)	776	1.9%
Totals		50	16	66 (100%)	2,059	3.2%

6. Value Receiving Method

Initial payments and running royalties (Footnote 6) are typical means of receiving payments in technology trade. In what percentage of FY 1994 new export contracts were these methods applied? We examined the value receipt methods used in the 637 cases listed by survey respondents as contracts with payment or as value-receipt cross-license contracts (618 of the former, 19 of the latter).

Contracts mandating initial payments accounted for 55.5% of the total, down 7.1 percentage points year-to-year. By region: Europe 58.0%, Asia 57.0%, and North America 48.6%. All areas were 6 ~ 8 points lower than last year.

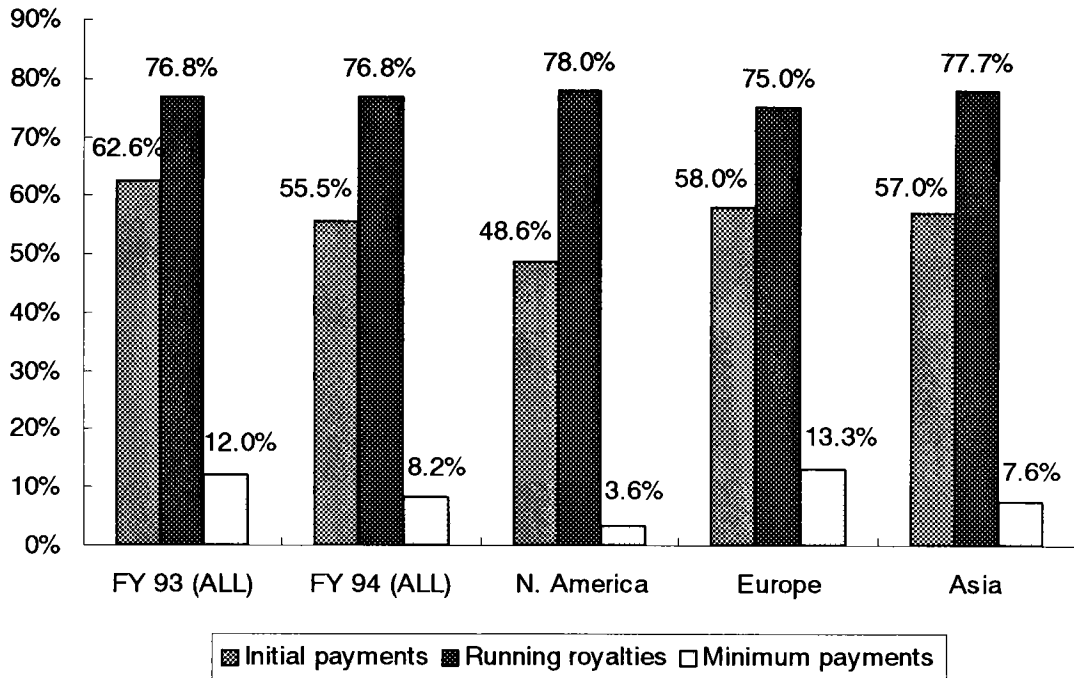
Contracts requiring running royalties constituted 76.8% of the total, about the same as last year. By region the ranking is North America (78.0%), Asia (77.7%), and Europe (75.0%), with little difference seen among them other than an 8.2-point year-to-year decline for Europe.

Were minimum payment terms established? In 8.2% of the 476 running royalty cases, this was true. (Footnote 7) Ranked by region, Europe led with 13.3%, and North America was at the low end with 3.6%. Year-earlier comparisons showed declines for all areas, especially North America (down by 9.1 points). Figure 3-14 and Table 3-11 show the major year-to-year changes.

6) In the calculation of average Contract terms, the validity ranges of "less than 1 year," "1 year to less than 5 years," "5 years to less than 10 years," "10 years to less than 15 years," "15 years or more," and "valid until the expiration of industrial property rights" were converted to 0.5 years, 3 years, 7.5 years, 12.5 years, 17.5 years, and 15 years, respectively.

7) Initial payments refer to the amount(s) paid independently upon effectuation of a contract or within a prescribed time frame, regardless of whether or not any execution payment obligations are incurred based on production, sale or use of the product(s) listed in the contract. Running royalties are fees paid based on the quantity of the product(s) in the contract and are also known as "piecework execution fees."

Figure 3-14: Value-Receipt Contracts By Region



[The minimum payments category is a percentage of the running royalties category.]

Table 3-11: Value Receipt Method By Region

	Initial payments			Running royalties			Minimum payments		
	FY 93	FY 94	%chg	FY 93	FY 94	%chg	FY 93	FY 94	%chg
ALL	62.6%	55.5%	-7.1%	76.8%	76.8%	0.0%	12.0%	8.2%	-3.8%
N. America	55.1%	48.6%	-6.5%	78.9%	78.0%	-0.9%	12.7%	3.6%	-9.1%
Europe	66.0%	58.0%	-8.0%	83.2%	75.0%	-8.2%	15.5%	13.3%	-2.2%
Asia	63.3%	57.0%	-6.3%	74.0%	77.7%	3.7%	10.2%	7.6%	-2.6%

Looking more closely at initial payments and running royalties by country, we see that for the former there are wide differences among the Asian countries: Against very high levels for Korea (69.9%) and India (75.0%), those for Thailand (43.2%) and Malaysia (41.7%) show a marked contrast. Fig. 3-15 refers. For running royalties, however, almost all countries are close to the overall norm, with only Malaysia a noteworthy standout at 91.7%. Fig. 3-16 refers.

Figure 3-15: Initial Payment Contracts By Country

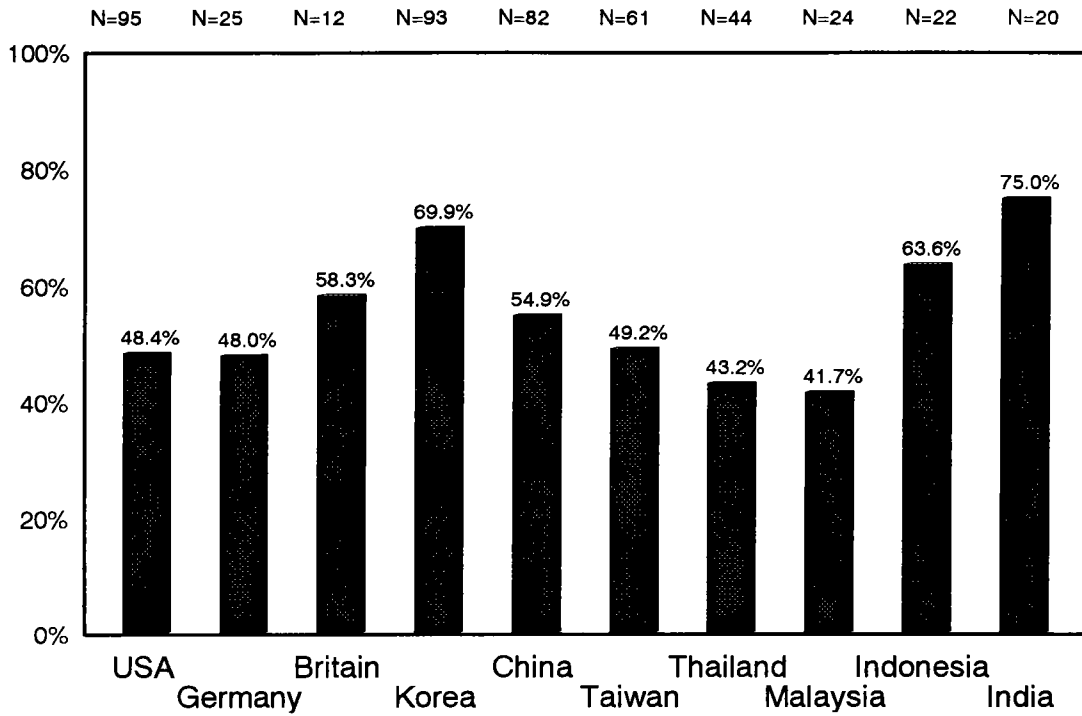
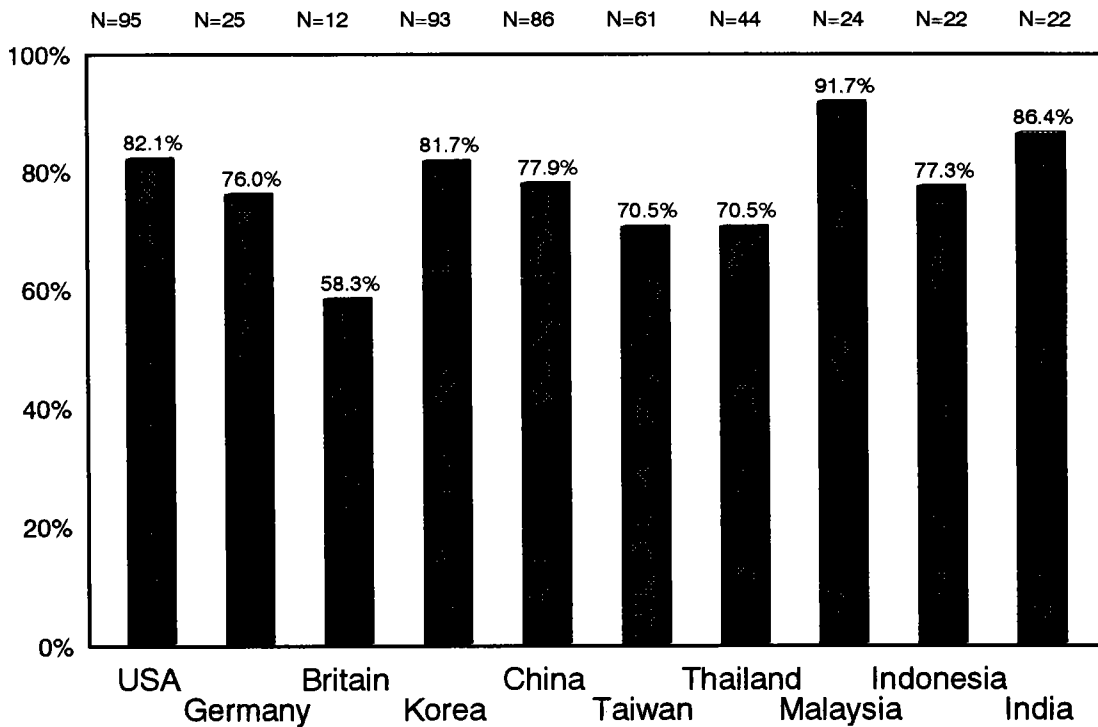


Figure 3-16: Running Royalty Contracts By Country



In terms of financial interest or capital participation in the partner companies, initial payments were required in 66.2% of the cases in which there was no such relationship, 57.7% of those with participation of less than half, and 27.8% of those with an interest of half or more. For running royalties, however, the proportions were 67.5%, 85.7%, and 93.4%, respectively. And where minimum payments were required, the figures were 11.8%, 6.6% and 2.8%. See figure 3-17.

Figure 3-17: Value-Receipt Export Contracts By Capital Participation

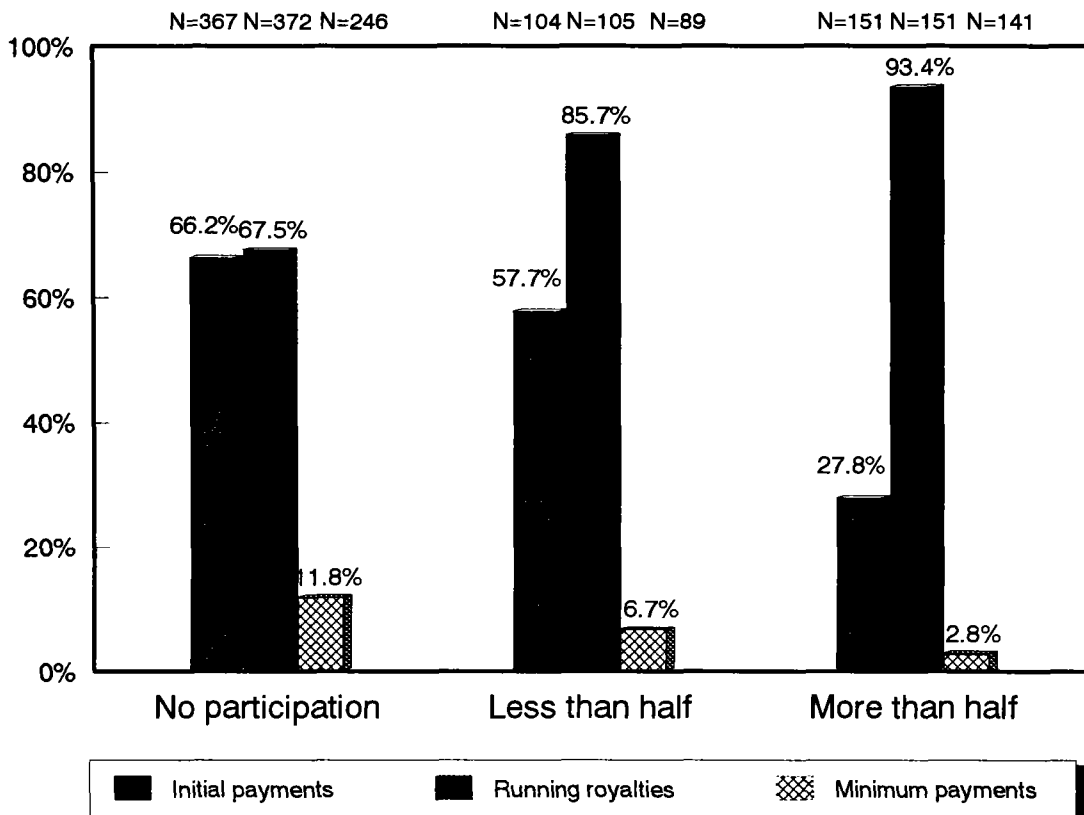
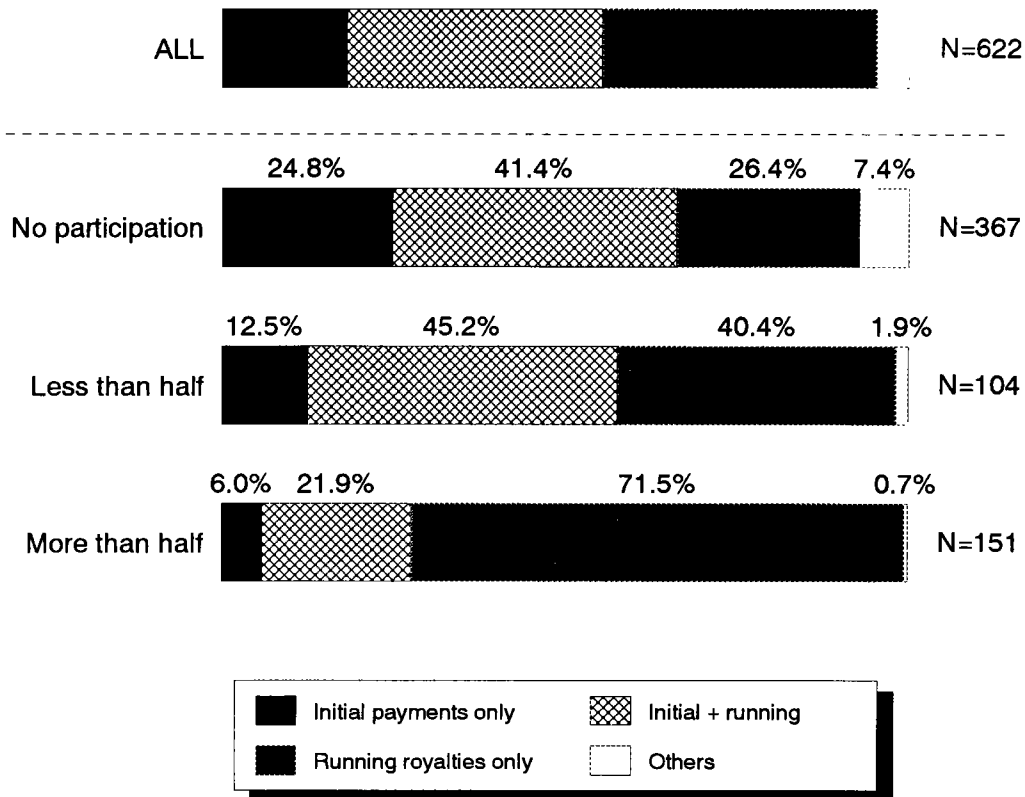


Fig. 3-18 aggregates the initial payments and running royalties data. Overall, 18.2% required initial payments only, 37.3% required both initial payments and running royalties, and 39.7% running royalties only. The 4.8% for "Others" (Footnote 8) refers to flat sum payments and miscellaneous payments. Where there was no capital participation the ratio for initial payments only was a high 24.8%, but with an interest of half or more this dropped to 6.0%. Running royalties only accounted for 71.5%. (Fig. 3-18 refers)

8) When within a contract period no running royalties are generated, or when payments fall below a set level, minimum payments for value may be established for exclusive rights, etc.

Figure 3-18: Contracts With Initial Payments and Running Royalties By Capital Participation



Initial payments as a method are intended to help reduce the risks of technological development and secure a specified value, while minimum payments secure minimum royalties. The existence or absence of a financial interest or capital participation is thought to be an important factor in these types of compensation. Therefore, in Asia, where there is a high ratio of technology exports to companies wherein a capital participation exists--as in such countries as Thailand and Malaysia--we see low proportions of initial payments. Conversely, where the ratio is high but there exists no capital participation--as in Korea and India--the proportion of initial payments is high. For the Asian recipients of technology exports there is a high correlation of 0.88 between the absence of capital participation and the existence of initial payments. (See Fig. 3-8 and Fig. 3-15)

7. Exclusive Rights and Sublicense Rights

Exclusive and sublicense rights are typical rights set out in technology trade contracts, apart from payment methods.

Contracts granting exclusive rights accounted for 34.3% of the total. By region, Asia led with 36.9%, followed by Europe (34.5%) and North America (25.2%). The overall proportion was almost unchanged from the prior year, but in the regional rankings Asia gained while the others declined.

Contracts granting sublicense rights were 8.8% of the total. Within this, the regional rankings were North America (16.3%), Europe (12.1%), and Asia (6.1%). Both the overall and the regional proportions declined year-to-year. (See Fig. 3-19 and Table 3-12)

By country/area, India and Korea had the largest exclusive-rights shares at 56.5% and 50.0%, respectively, while China was at the opposite end of the spectrum with 17.3%. (Fig. 3-20)

With regard to sublicensing rights countries with the highest shares were the U.S. and others in Europe and those with the lowest in Asia; within the latter, the leaders were India (21.7%) and Indonesia (13.0%). (Fig. 3-21)

Figure 3-19: Exclusive and Sublicense Rights Contracts By Region

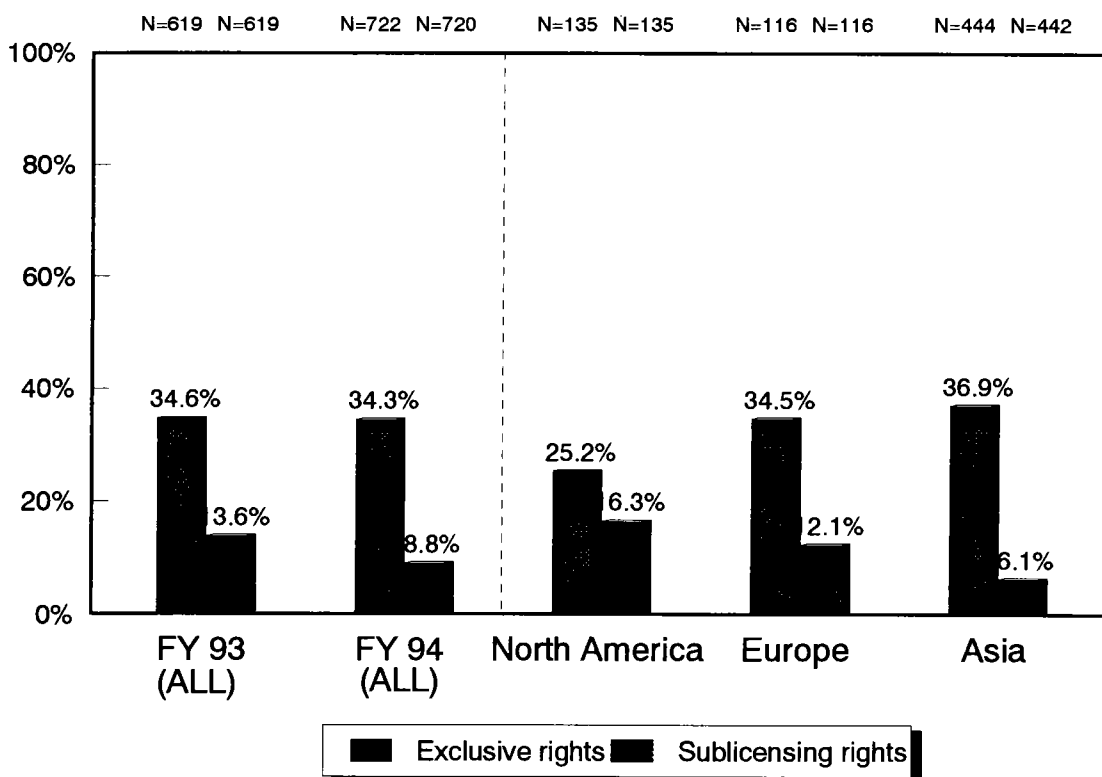
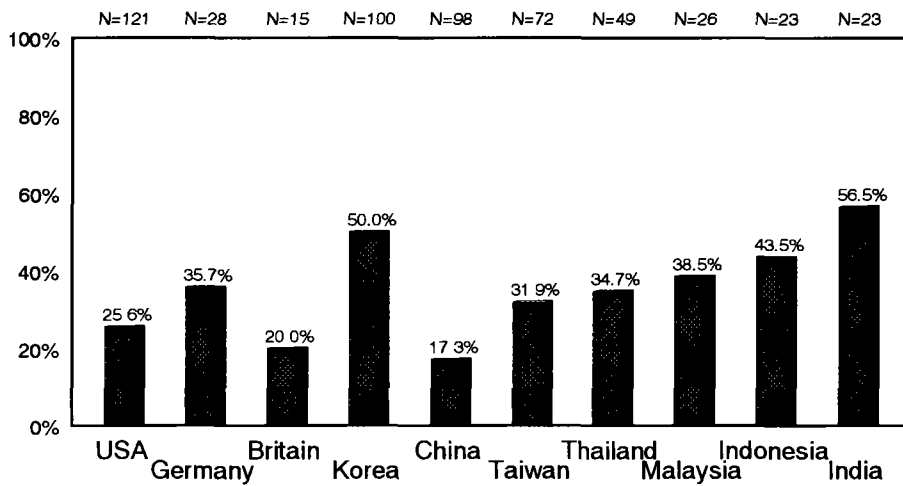


Table 3-12: Exclusive and Sublicense Rights Contracts By region

	Exclusive			Sublicensing		
	FY 93	FY 94	%chg	FY 93	FY 94	%chg
ALL	34.6%	34.3%	-0.3%	13.6%	8.8%	-4.8%
N. America	31.9%	25.2%	-6.7%	21.2%	16.3%	-4.9%
Europe	36.9%	34.5%	-2.4%	22.1%	12.1%	-10.0%
Asia	33.5%	36.9%	3.4%	8.0%	6.1%	-1.9%

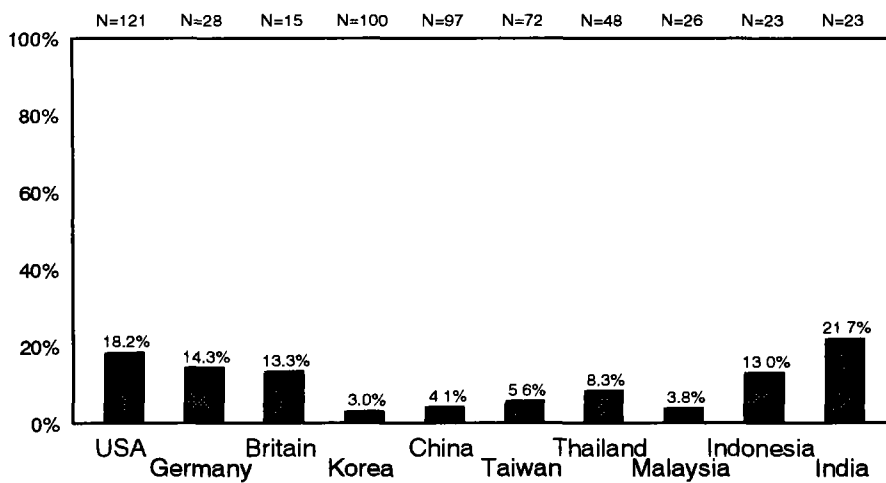
By country, we see that India and Korea had the highest proportions of exclusive rights (56.5% and 50.0%, respectively), while China trailed with 17.3%. (Fig. 3-20)

Figure 3-20: Exclusive Rights Contracts By Country



In respect of sublicensing rights, Fig. 3-21 shows the U.S. and European countries with relatively high ratios, while in Asia the only countries approaching them were India and Indonesia.

Figure 3-21: Sublicense Rights Contracts By Country



8. Forms of Technology

We analyzed the technology included in export contracts into the following classifications: patents, knowhow, trademarks, patents pending, utility models, and designs. All applicable answers were requested in cases where these classifications overlapped.

The proportions of contracts involving patents, knowhow and trademarks were 41.9%, 88.5% and 19.8%, respectively. Overall, there was no great year-to-year change.

By region, North America led in the patent area with 53.7%, followed by Europe with 53.1% and Asia a distant third. In respect of knowhow, Asia was ahead with 92.9%, followed by North America and Europe. North America trailed the pack in respect of trademarks. On a year-earlier comparison there were no major changes in relation to patents, knowhow and trademarks, but we would make note of the 10.4-point knowhow gain for North America while patents and trademarks declined by 5.1 and 6.4 points, respectively. Fig. 3-22 and Table 3-13 refer.

Figure 3-22: Patents, Knowhow and Trademark Contracts By Region

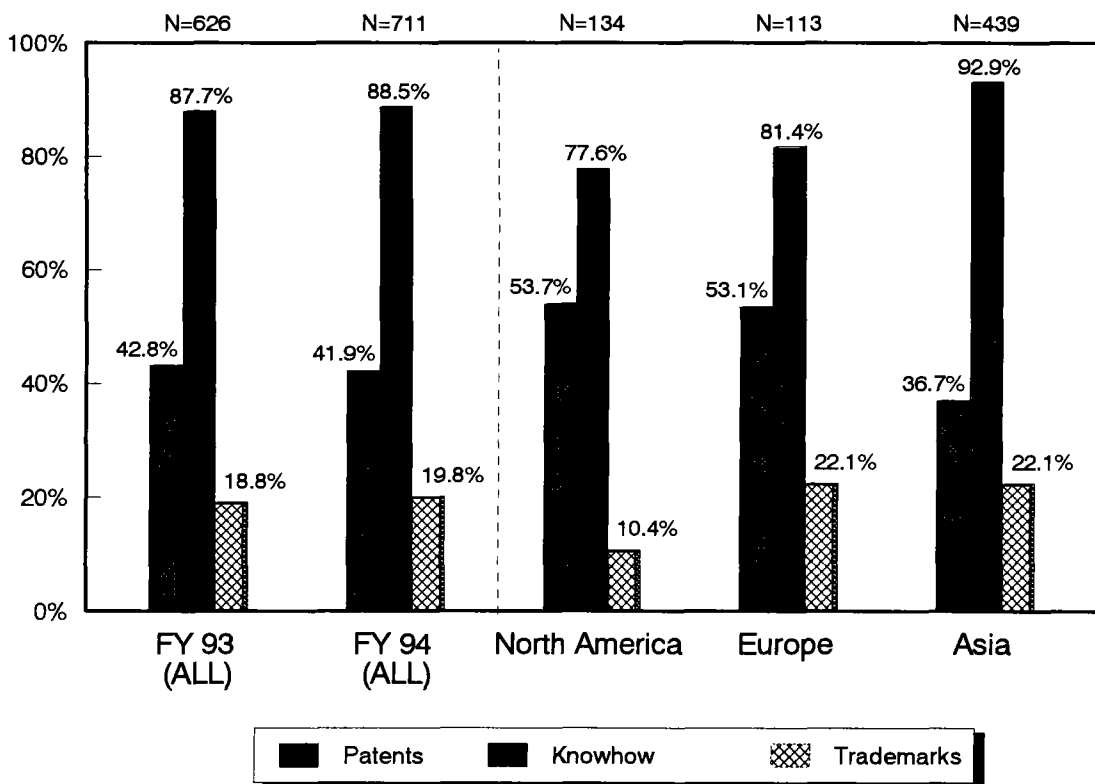


Table 3-13: Patents, Knowhow & Trademark Contracts By Region

	Patents			Knowhow			Trademarks		
	FY 93	FY 94	%chg	FY 93	FY 94	%chg	FY 93	FY 94	%chg
ALL	42.8%	41.9%	-0.9%	87.7%	88.5%	0.8%	18.8%	19.8%	1.0%
N. America	58.8%	53.7%	-5.1%	67.2%	77.6%	10.4%	16.8%	10.4%	-6.4%
Europe	49.6%	53.1%	3.5%	83.7%	81.4%	-2.3%	17.1%	22.1%	5.0%
Asia	35.8%	36.7%	0.9%	95.7%	92.9%	-2.8%	19.9%	22.1%	2.2%

Broken down by country and looking at patents alone, Figs. 3-23 and 3-24 show that the U.S. and Germany led with 56.7% and 55.6%, respectively, while wide variations were seen in Asia, where countries with high proportions for patents (Taiwan, Korea, China) contrasted with those with lower proportions (Thailand, Malaysia, Indonesia, India). For knowhow, Germany and the U.S. had lower shares (66.7% and 75.8%, respectively) than Asian countries. These results reflect in part the differing levels of the technological bases in these countries. (Figs. 3-23, 3-24) The numbers for trademarks (Fig. 3-25) show Indonesia and China leading, with 30.4% and 30.2%, respectively.

Figure 3-23: Patent Contracts By Country

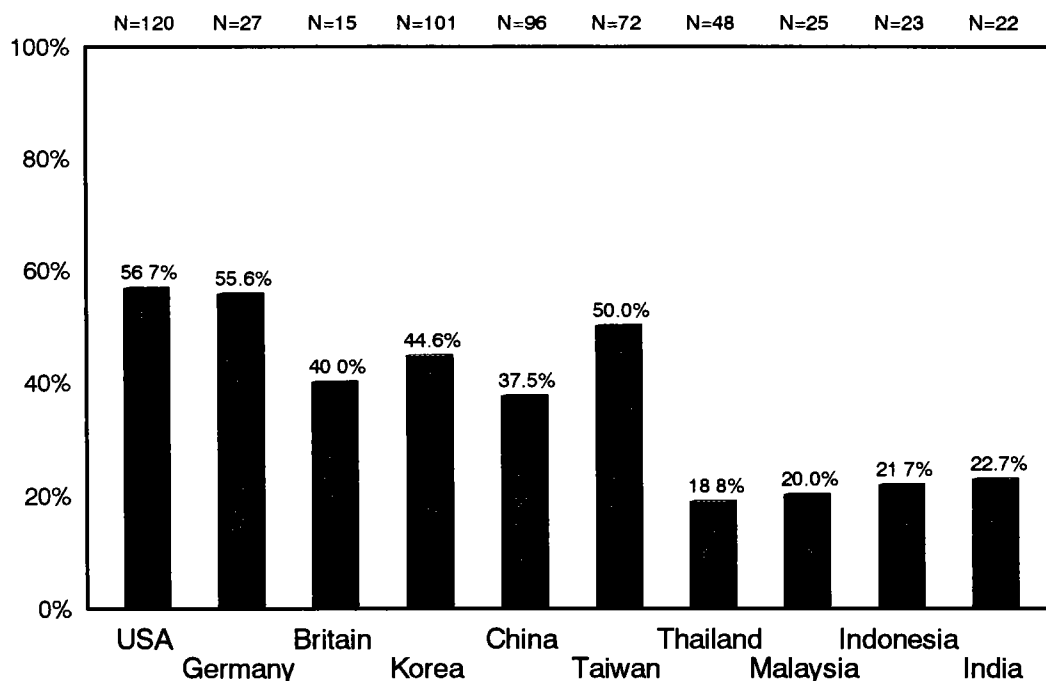


Figure 3-24: Knowhow Contracts By Country

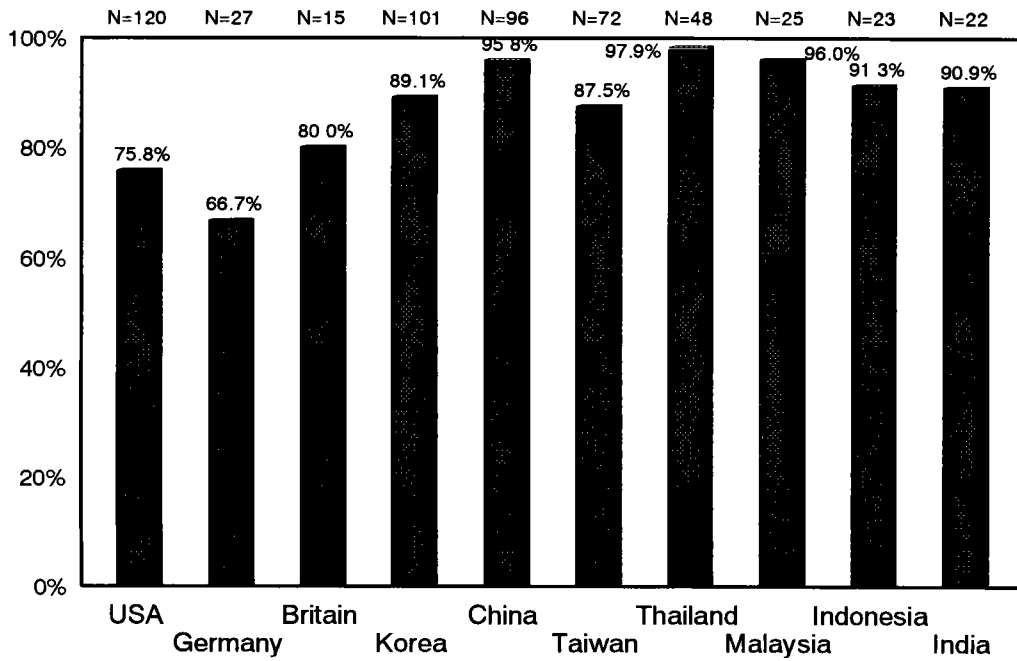
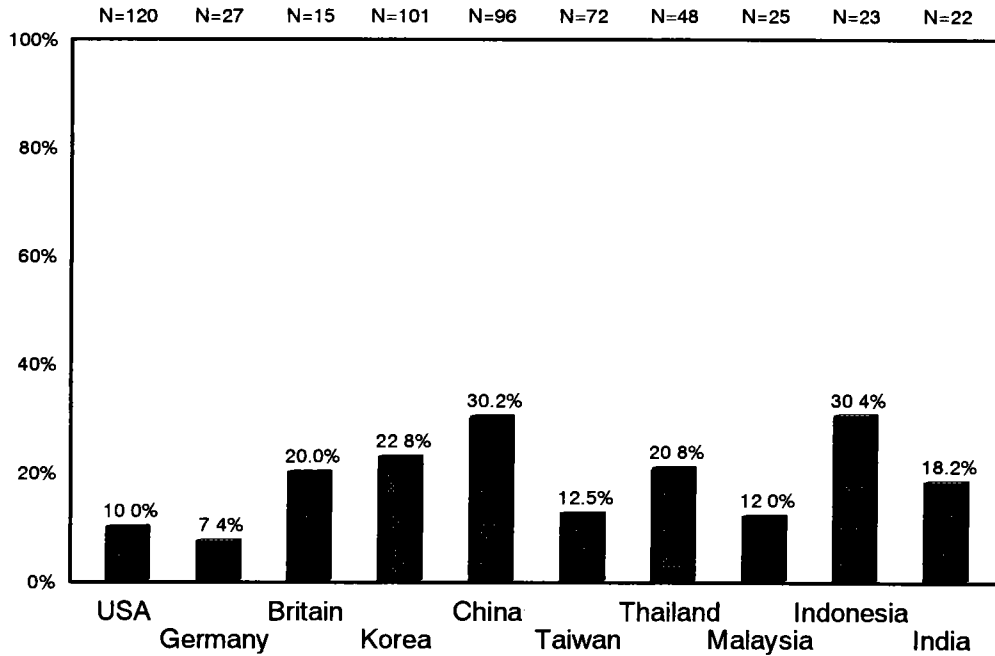


Figure 3-25: Trademark Contracts By Country



Turning to our other classifications, their ratios to the total were as follows: patents pending 20.0%, utility models 13.4%, and designs 8.0%. Fig. 3-26 and Table 3-14 show their breakdown by region. North America leads in patents pending with 29.1%, followed by Europe (26.5%) and Asia (16.2%): as with patents, the U.S. and Europe are high, Asia low. There is no wide regional variation for utility models.

Figure 3-26: Pending Patent, Utility Model and Design Contracts By Region

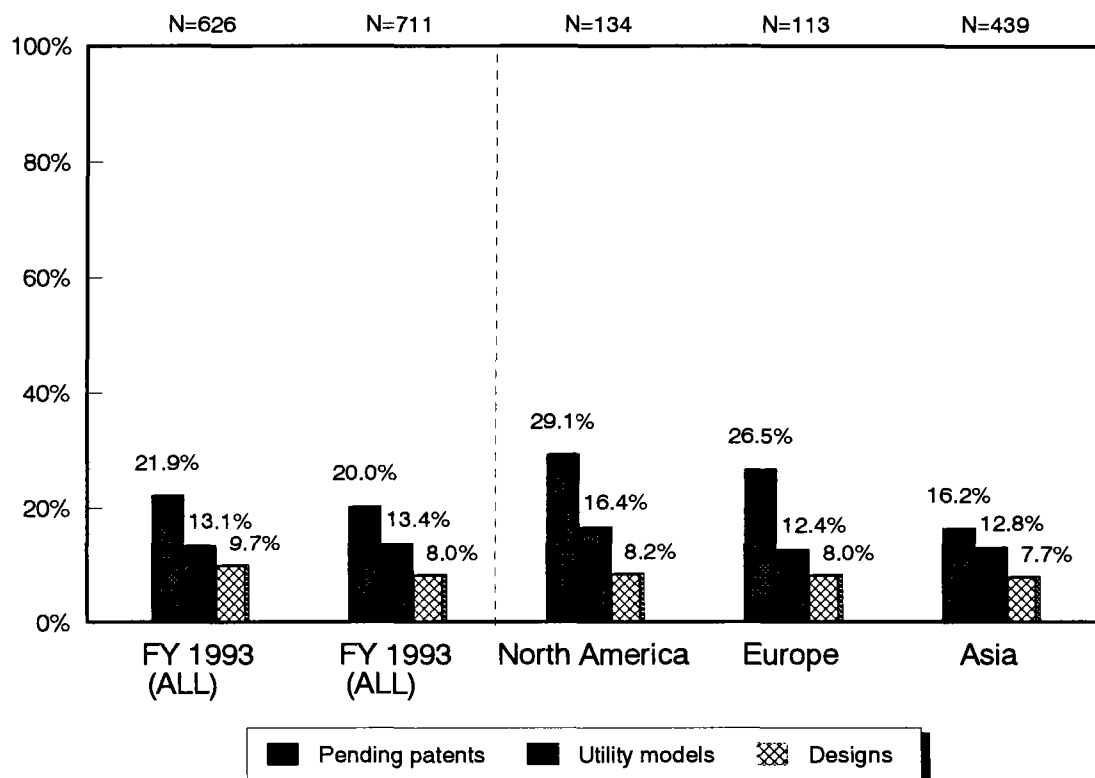


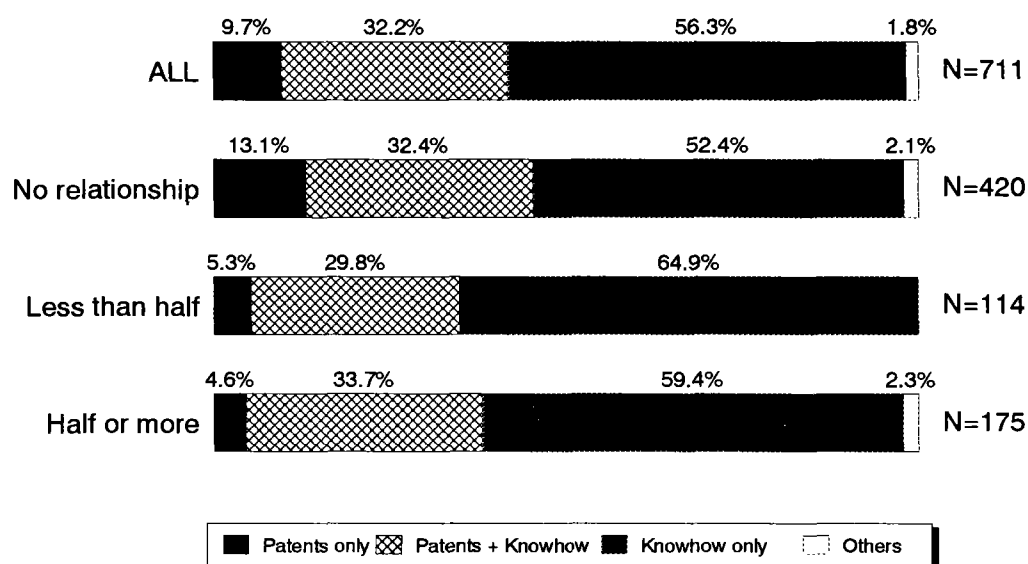
Table 3-14: Pending Patent, Utility Model and Design Contracts By Region

	Pending patents			Utility models			Designs		
	FY 93	FY 94	%chg	FY 93	FY 94	%chg	FY 93	FY 94	%chg
ALL	21.9%	20.0%	-1.9%	13.1%	13.4%	0.3%	9.7%	8.0%	-1.7%
N. America	31.1%	29.1%	-2.0%	11.8%	16.4%	4.6%	6.7%	8.2%	1.5%
Europe	28.5%	26.5%	-2.0%	6.5%	12.4%	5.9%	7.3%	8.0%	0.7%
Asia	17.6%	16.2%	-1.4%	16.5%	12.8%	-3.7%	11.4%	7.7%	-3.7%

We observe that of the total number of contracts, those involving knowhow only account for the majority, at 56.3%; knowhow-plus-patents have 32.2%; patents only have 9.7%, and others have 1.8%.

Looking now at the correlation between these classifications and capital participation or financial interest, we see that, as in the past 2 years, patents-only with no capital relationship accounts for 13.1%, with a less-than-half interest for 5.3%, and with a greater-than-half interest for 4.6%. In respect of knowhow only, there is a greater gap in the figures depending on the capital relationship. Fig. 3-27 refers.

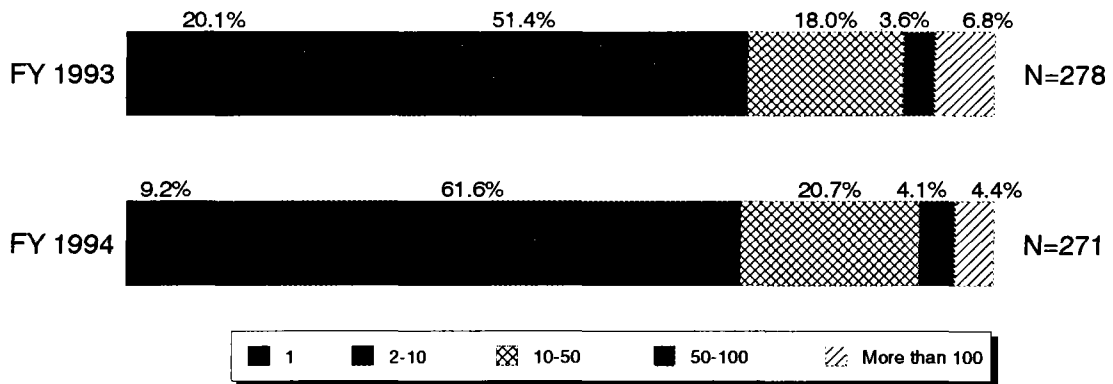
Figure 3-27: Export Contracts By Technology Classification and Capital Relationships



9. Numbers of Patents in Patent-inclusive Agreements

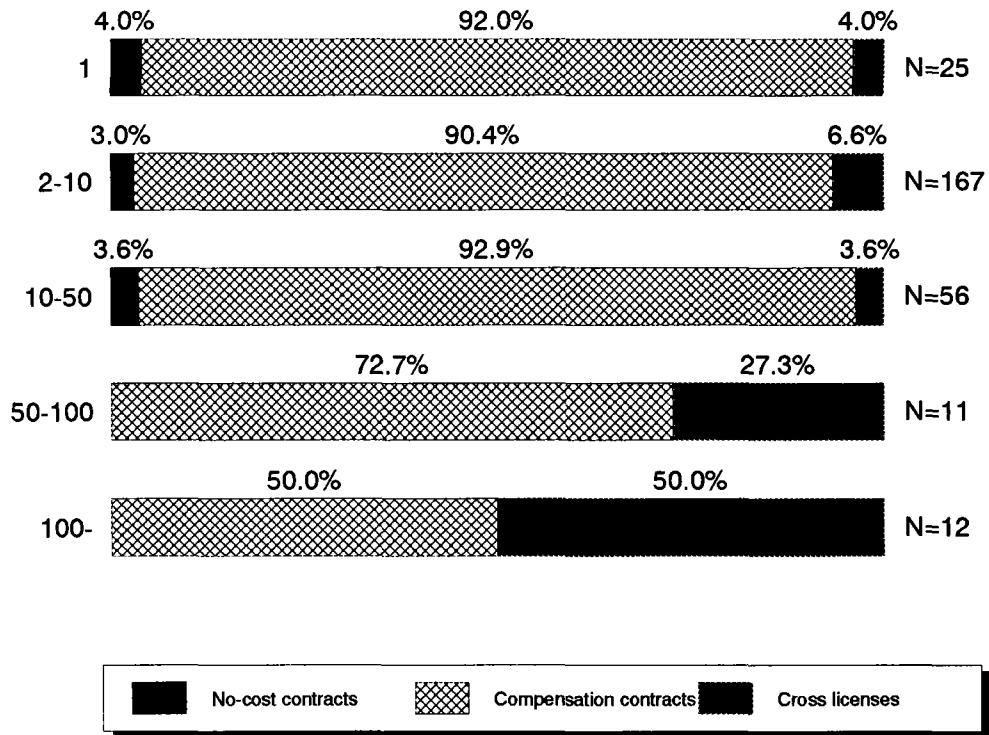
Our research included an examination of the numbers of patents and pending patents in the year's 271 new export contracts involving them. Fig. 3-28 illustrates the results. A noteworthy trend was that the numbers of patents per contract show substantial statistical gains.

Figure 3-28: Numbers of Patents in New Patent-inclusive Contracts



Looking at the number of patents/pending patents by contract format, we see that those involved in cross-licensing contracts rose (to a majority in cases of 100 or more patents) while those involved in no-cost contracts declined. Fig. 3-29 refers.

Figure 3-29: Numbers of Patents/Pending Patents By Contract Format



IV. Results of Analysis By Technology Classification

Previous sections examined the overall trends in technology exports. We now look in greater detail at the content of the technology itself.

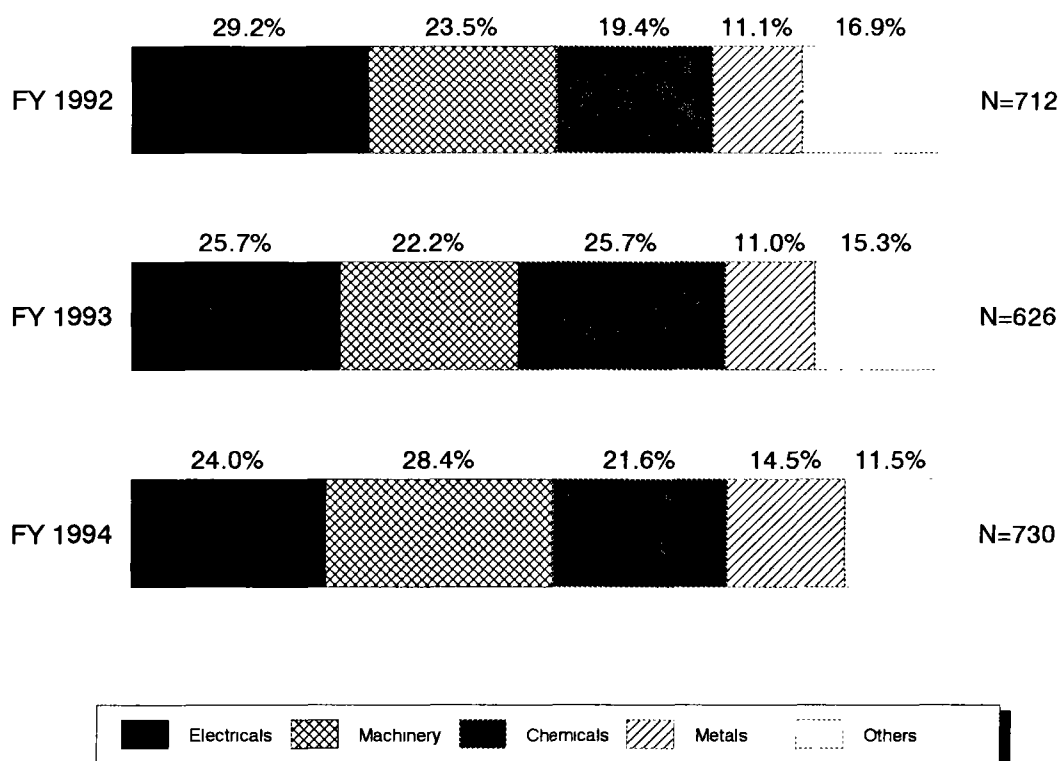
1. Technological Categories

We have used the 48 categories of "Technological Classification" prepared by this Institute and based on the "Japan Standard Industrial Classifications" in the course of compiling our "Trend Analysis of Foreign Technology Introduction." The 48 categories have been grouped into 5 broad areas: electrical, machinery, chemicals, metals, and others. (See Reference Material 3.)

2. Exports By Technological Categories

New technology export contracts concluded in FY 1994 may be broken down as follows: machinery 28.4%, electricals 24.0%, chemicals 21.6%, metals 14.5%, and others 11.5%. Of these, only the proportions of machinery and metals were up on a year-to-year comparison, with the former replacing electricals as the leader. (Fig. 4-1)

Figure 4-1: Export Contracts By Industrial Group



In more detailed categories, transportation equipment, at 15.1%, maintained a 3-year lead, followed by electronic computers (7.8%), iron and steel (6.2%), organic chemicals (6.0%), and electronic and communications parts (5.5%). The sector whose proportions shrank the previous year (transportation equipment) recovered in this, while the converse was true for pharmaceuticals and edible oils and paints. All 3 returned to FY 1992 levels. Further details on these and other sectors are shown in Table 4-1.

Table 4-1: Top Ten Technology Export Sectors

	FY 1992			FY 1993			FY 1994		
	Sector	No.	%	Sector	No.	%	Sector	No.	%
1	Transport Equip.	99	13.9%	Trans. Equip.	65	10.4%	Transport equip.	110	15.1%
2	Elec./comm parts	47	6.6%	Pharmaceutic.	50	8.0%	Computers	57	7.8%
3	Computers	45	6.3%	Oils, paints	41	6.5%	Iron & steel	45	6.2%
4	Pharmaceutics.	42	5.9%	Elec./comm parts	39	6.2%	Organic chems	44	6.0%
5	Metal products	33	4.6%	Computers	38	6.1%	Elec/comm parts	40	5.5%
6	Consumer electricals	32	4.5%	Metal products	34	5.4%	Metal products	33	4.5%
7	Organic chems	28	3.9%	Consumer elecs	30	4.8%	Pharmaceuticals	30	4.1%
8	Ceramics	26	3.7%	Organic chems	29	4.6%	Other chems	28	3.8%
9	Oils/paints	26	3.7%	Comm equip	23	3.7%	Nonferr metals	28	3.8%
10	TV/audio gear	25	3.5%	Ceramics	22	3.5%	Oils/paints	27	3.7%
	Others	309	43.4%	Others	255	40.7%	Others	288	39.5%
	Total	712	100.0%	Total	626	100.0%	Total	730	100.0%

3. Home Regions and Countries/areas of Agreement Partners

Looking at geographical characteristics, we note that the chemicals category for Asia declined below 60% in FY 1994, while for the others Asia recorded numbers exceeding that level. On a year-earlier comparison the categories wherein Asia's share was relatively low--chemicals, metals, others--each gained more than 10 points in FY 1994 and gave the region an overall majority, despite year-to-year declines in machinery and electricals. In the chemicals industry technology exports to Europe declined by 5.7 points but the overall proportion (24.7%) remained higher than those of other regions. (see Fig. 4-2 and Table 4-2.)

Figure 4-2: Contracts By Region

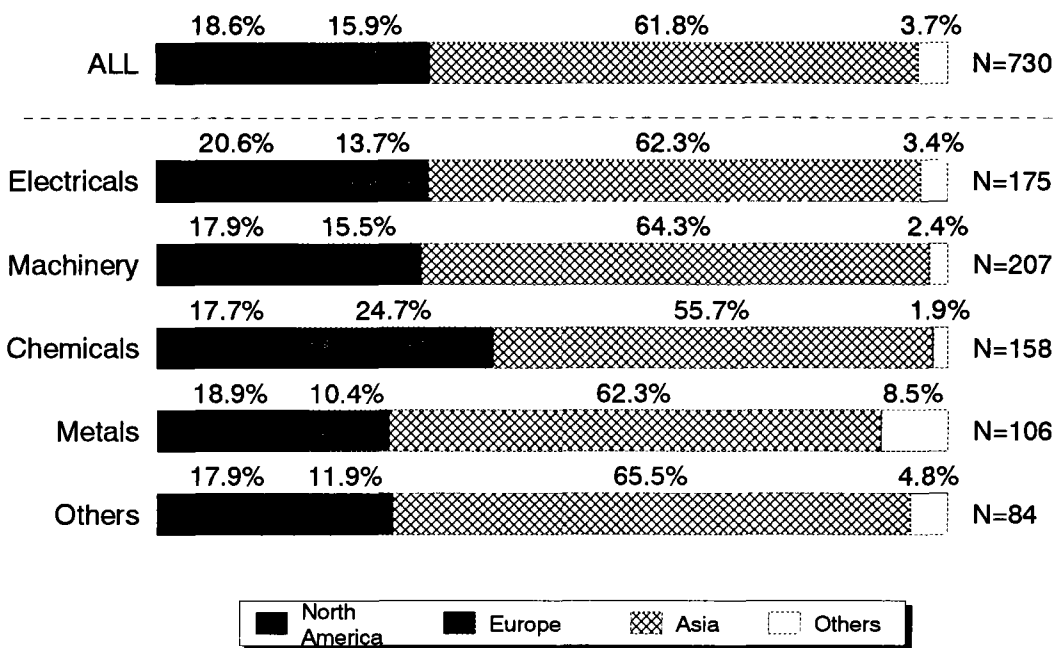
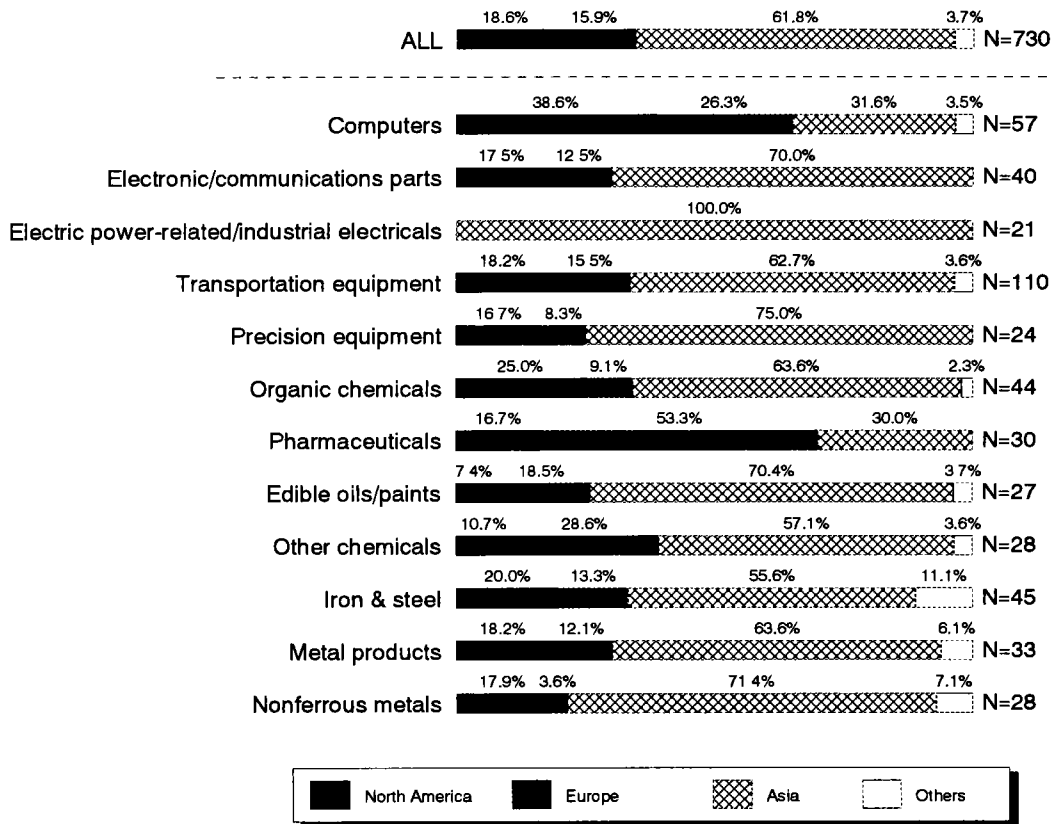


Table 4-2: Technology Exports By Group and Region

	North America			Europe			Asia			Other		
	FY 93	FY 94	%chg	FY 93	FY 94	%chg	FY 93	FY 94	%chg	FY 93	FY 94	%chg
ALL	19.0%	18.6%	-0.4%	19.6%	15.9%	-3.7%	56.2%	61.8%	5.6%	5.1%	3.7%	-1.4%
Electricals	18.0%	20.6%	2.6%	13.0%	13.7%	0.7%	67.7%	62.3%	-5.4%	1.2%	3.4%	2.2%
Machinery	17.3%	17.9%	0.6%	14.4%	15.5%	1.1%	66.2%	64.3%	-1.9%	2.2%	2.4%	0.2%
Chemicals	18.6%	17.7%	-0.9%	30.4%	24.7%	-5.7%	41.6%	55.7%	14.1%	9.3%	1.9%	-7.4%
Metals	18.8%	18.9%	0.1%	21.7%	10.4%	-11.3%	52.2%	62.3%	10.1%	7.2%	8.5%	1.3%
Others	24.0%	17.9%	-6.1%	18.8%	11.9%	-6.9%	50.0%	65.5%	15.5%	7.3%	4.8%	-2.5%

In a more detailed sectoral analysis, compared to the overall trend it is clear that the share of North America is high in computers, while for Europe pharmaceuticals lead; together these sectors/regions account for more than 60%--a tendency greatly contrary to the others. In other sectors Asia occupies the majority, with particularly high shares in electric power-related and industrial machinery (100.0%), precision equipment (75.0%), nonferrous metals (71.4%), edible oils/paints (70.4%), and electronic/communications parts (70.0%). There were wide geographical variations in sectors within the same industries. (See Fig. 4-3)

Figure 4-3: Contracts By Sector and Region



Broken down further by country, we see large variations within Asia, e.g., even where the number of export contracts is high, as in Korea and China, the former's share in machinery is high (47.5%) but low in nonferrous metals (2.0%), while the latter's is high in electricals (29.7%) but low in chemicals (13.9%). Fig. 4-4 refers.

Figure 4-4: Export Sectors By Country

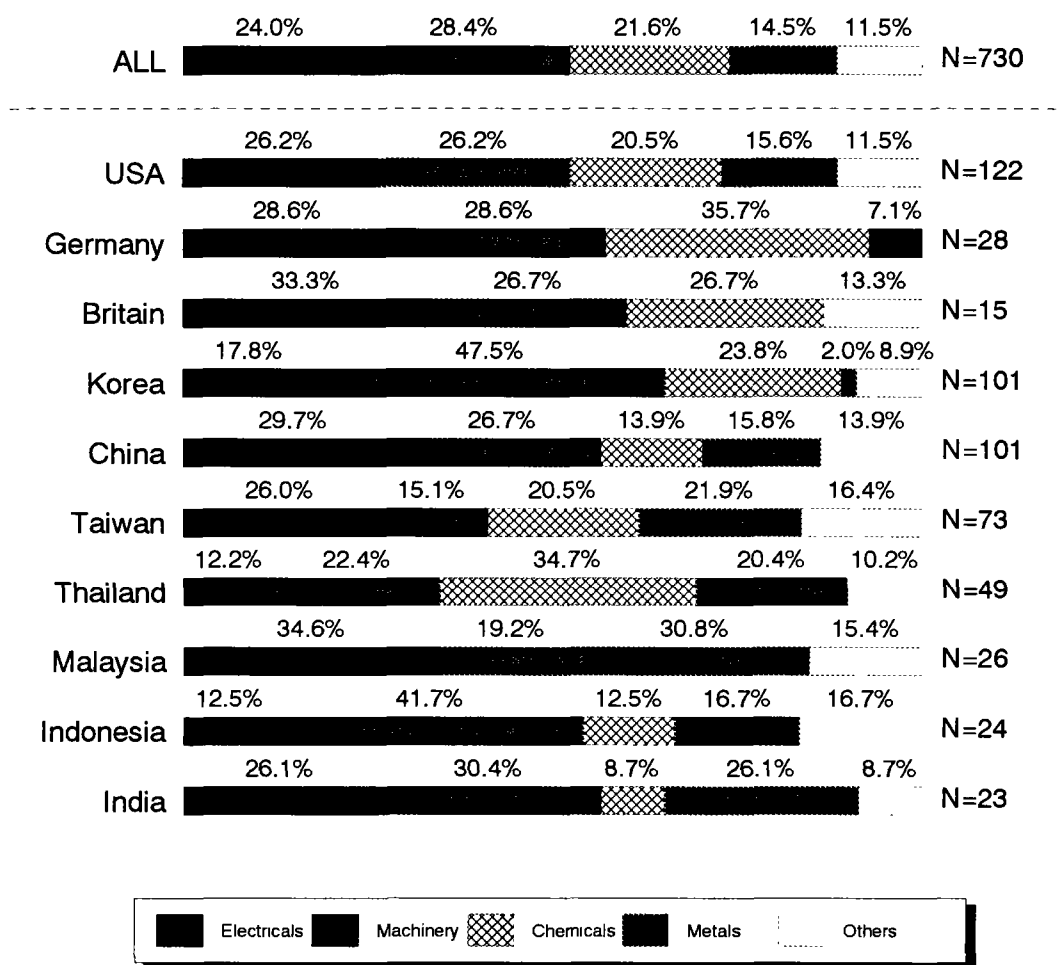


Table 4-3 is a still more detailed country breakdown of the numbers of export contracts by top-ten sector. Except for Taiwan, in all countries transport equipment leads. In FY 1994 this sector had a 15.1% share of all technology export contracts, and is particularly outstanding centering on Asia. Among electricals, the computer sector is noteworthy for the U.S. and Europe, with Asia showing a concentration in electronic/communications parts.

Table 4-3: Technology Sectors By Country

	USA		Germany		Britain	
	Sector	No.	Sector	No.	Sector	No.
1	Computers	18	Computers	6	Computers	4
2	Transport equip	16	Pharmaceutics	6	Transport equip	2
3	Organic chemicals	11	Transport equip	4	Other chemicals	2
4	Iron/steel	8	Oils/paints	2		
5	Elec/comm parts	7	Precisions	2		
6	Metal products	6				
7	Nonferr metals	5				
8	Pharmaceutics	4				
9	Precisions	4				
10	Other indus. machinery	4				
	Others	39	Others	8	Others	7
	Total	122	Total	28	Total	15

	Korea		China		Taiwan	
	Sector	No.	Sector	No.	Sector	No.
1	Transport equip	21	Transport equip	12	Nonferr metals	6
2	Organic chemicals	9	Iron/steel	10	Metal products	6
3	Elec pwr/ind. elects	8	Elec/comm parts	9	Elec/comm parts	5
4	Elec/comm parts	6	Home electronics	9	Precisions	5
5	Other machinery	6	Computers	6	Organic chemicals	5
6	Chemical equip	5	Metal fabric. equip	4	Other chemicals	5
7	Oils/paints	4	Other machinery	4	Home electronics	4
8	Precisions	4	Comm. equip	4	Elec pwr/industrial elects	4
9	Other ind. machin.	4	Ceramics	4	Iron/steel	4
10	Construction	4				
	Other	30	Other	39	Other	29
	Total	101	Total	101	Total	73

	Thailand		Malaysia		Indonesia		India	
	Sector	No.	Sector	No.	Sector	No.	Sector	No.
1	Transport equip	9	Nonferr metals	6	Transport equip	6	Transport equip	5
2	Organic chemicals	7	Transport equip	5	Organic chemicals	2	Metal products	4
3	Oils/paints	5	Elec pwr/ind. machin.	3	Nonferr metals	2	Elec pwr/ind. electricals	3
4	Other chemicals	5	Elec/comm parts	2			Oils/paints	2
5	Iron/steel	4		2			Iron/steel	2
6	Metal products	4		2				
7	Elec/comm parts	2		2				
8	Home electronics	2						
9	Nonferr metals	2						
10	Foods	2						
	Others	7	Others	4	Others	14	Others	7
	Total	49	Total	26	Total	24	Total	23

4. Financial Interest In Agreement Partner Companies

Fig. 4-5 shows the breakdown by industry group and capital relationships as we have defined them in earlier sections of this study. Electricals have the lion's share of 50.3% among those export partners with such a relationship; narrowing it to those with half or more, electricals still lead with 40.6%. On a year-to-year comparison, contracts with partners in which some degree of financial interest was held showed most growth in machinery (up 19.2 percentage points), metals (up 11.4 points), and others (up 11.3). Fig. 4-5 and Table 4-4 refer.

Figure 4-5: Contracts By Industrial Group and Capital Relationship

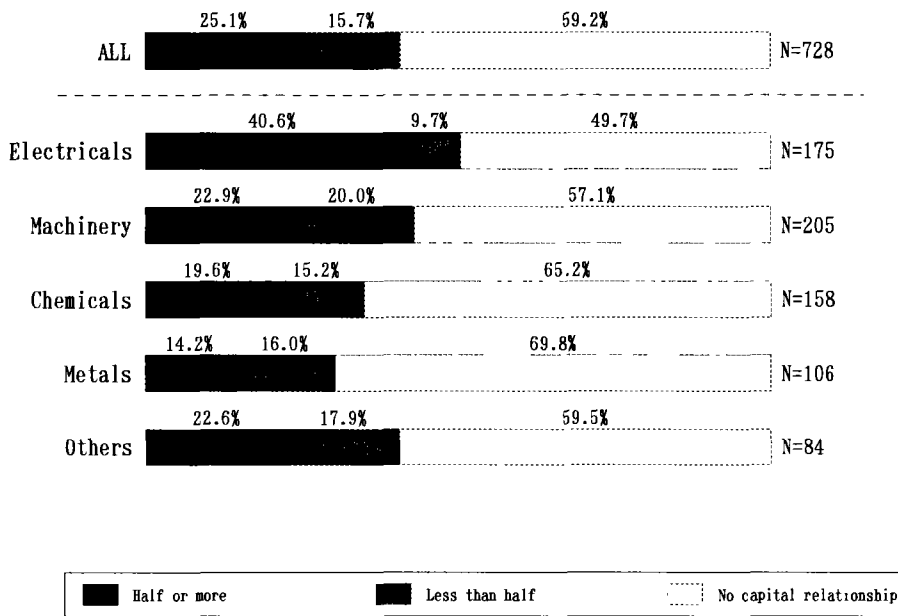
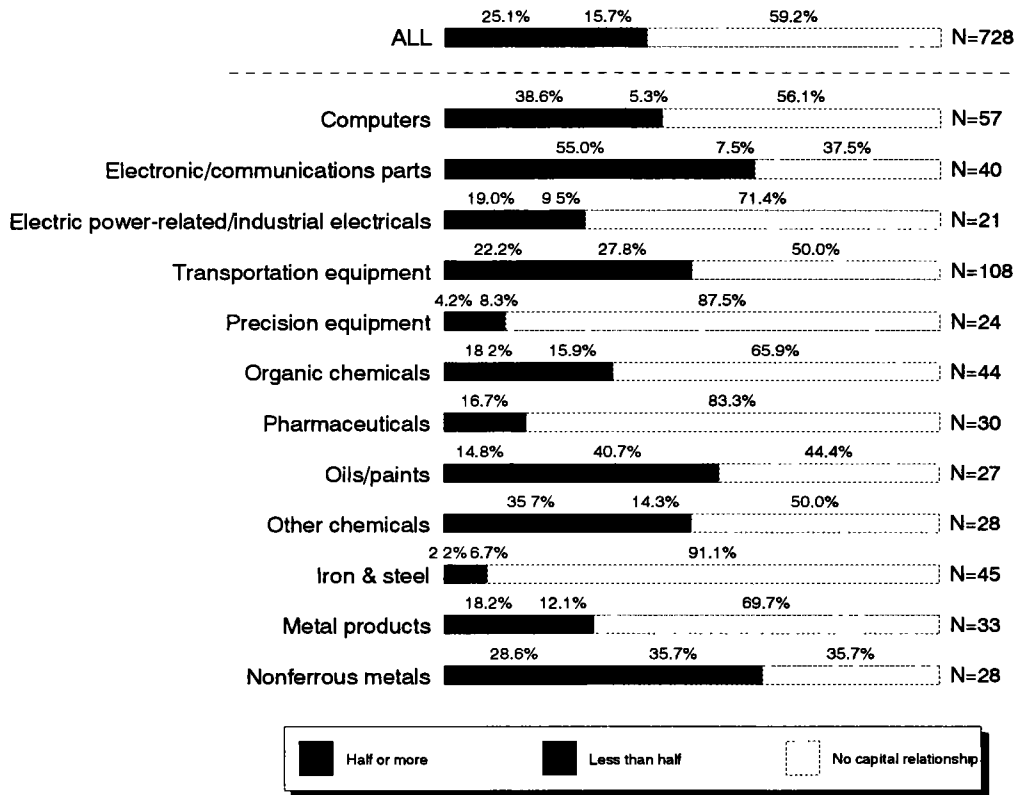


Table 4-4: Contracts By Industrial Group and Capital Relationship

	Half or more			Less than half			No financial interest		
	FY 93	FY 94	%chg	FY 93	FY 94	%chg	FY 93	FY 94	%chg
ALL	20.4%	25.1%	4.7%	10.7%	15.7%	5.0%	68.8%	59.2%	-9.6%
Electricals	38.5%	40.6%	2.1%	8.1%	9.7%	1.6%	53.4%	49.7%	-3.7%
Machinery	10.8%	22.9%	12.1%	12.9%	20.0%	7.1%	76.3%	57.1%	-19.2%
Chemicals	18.6%	19.6%	1.0%	9.9%	15.2%	5.3%	71.4%	65.2%	-6.2%
Metals	10.1%	14.2%	4.1%	8.7%	16.0%	7.3%	81.2%	69.8%	-11.4%
Others	14.6%	22.6%	8.0%	14.6%	17.9%	3.3%	70.8%	59.5%	-11.3%

Fig. 4-6 shows a more detailed breakdown by sector. Of those in which there is some capital relationship, three have majorities: nonferrous metals (64.3%), electronic/ communications parts (62.5%), and edible oils/paints (55.6%). Where the interest is half or more we see electronic/communications parts at the top with 55.0%. Where there is a capital relationship, at the low end we find iron & steel (8.9%), precision equipment (12.5%), and pharmaceuticals (16.7%).

Figure 4-6: Contracts By Sector and Capital Relationship



5. Contract terms

In this area the electrical group showed no outstanding characteristic, while machinery was largely concentrated in the 5 ~ less than 10 year time segment (41.0%). Chemicals tended to concentrate in the 10-years-or-more segment with 29.8%, while the reverse was true for metals (52.8% in contracts of less than 5 years' duration). See Fig. 4-7 and Table 4-5.

Figure 4-7: Export Contract terms By Industry

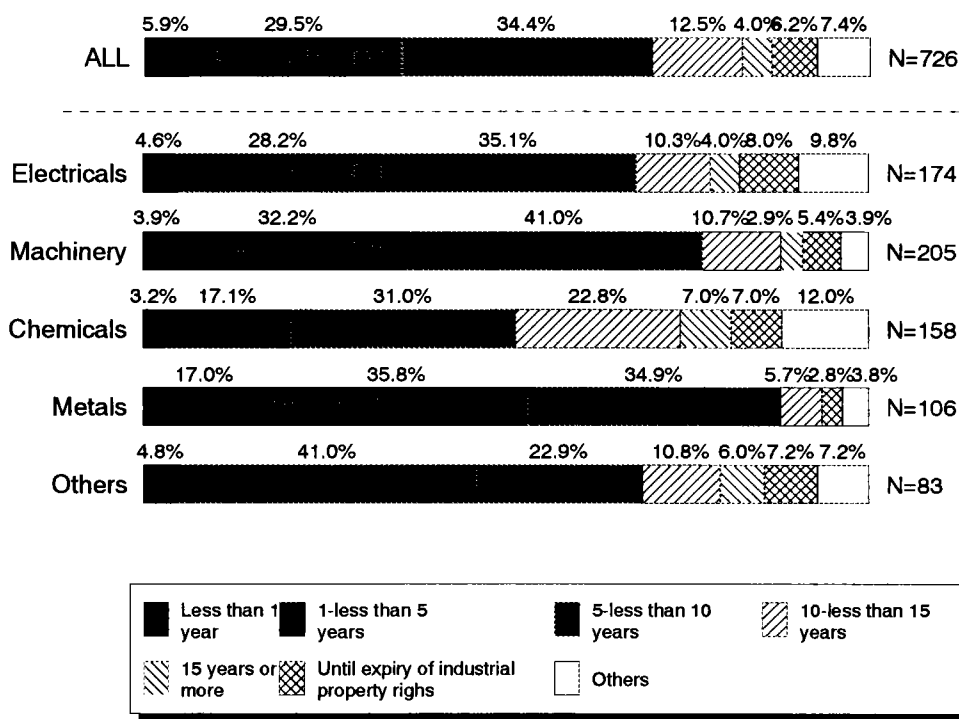


Table 4-5: Groups By Contract Period

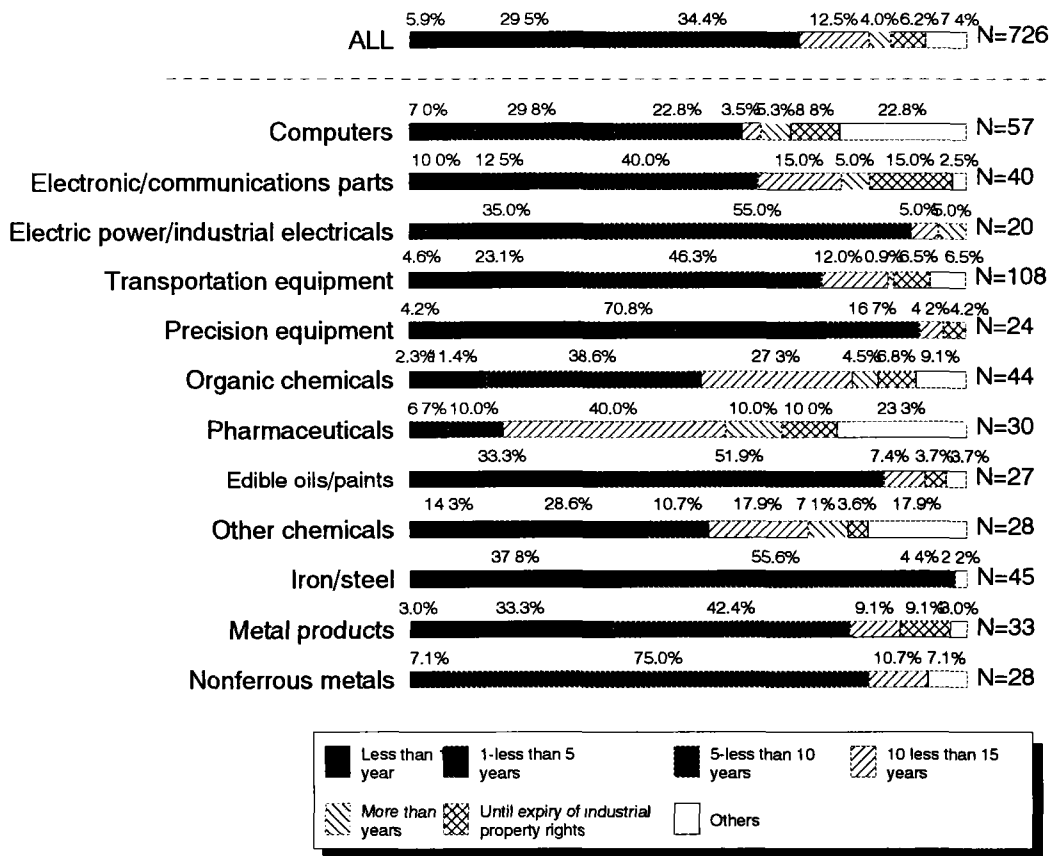
	Less than 1 year			1 ~ 5 years			5 ~ 10 years			10~15年		
	FY 93	FY 94	%chg	FY 93	FY 94	%chg	FY 93	FY 94	%chg	FY 93	FY 94	%chg
ALL	4.6%	5.9%	1.3%	26.7%	29.5%	2.8%	32.1%	34.4%	2.3%	15.0%	12.5%	-2.5%
Electricals	7.5%	4.6%	-2.9%	30.4%	28.2%	-2.2%	34.8%	35.1%	0.3%	11.8%	10.3%	-1.5%
Machinery	2.9%	3.9%	1.0%	24.5%	32.2%	7.7%	46.8%	41.0%	-5.8%	12.9%	10.7%	-2.2%
Chemicals	1.2%	3.2%	2.0%	18.0%	17.1%	-0.9%	23.6%	31.0%	7.4%	21.7%	22.8%	1.1%
Metals	4.3%	17.0%	12.7%	46.4%	35.8%	-10.6%	26.1%	34.9%	8.8%	10.1%	5.7%	-4.4%
Others	8.3%	4.8%	-3.5%	24.0%	41.0%	17.0%	25.0%	22.9%	-2.1%	15.6%	10.8%	-4.8%

	15 years ~			Property rights expiry			Others		
	FY 93	FY 94	%chg	FY 93	FY 94	%chg	FY 93	FY 94	%chg
ALL	5.4%	4.0%	-1.4%	8.9%	6.2%	-2.7%	7.2%	7.4%	0.2%
Electricals	3.7%	4.0%	0.3%	6.2%	8.0%	1.8%	5.6%	9.8%	4.2%
Machinery	2.9%	2.9%	0.0%	2.9%	5.4%	2.5%	7.2%	3.9%	-3.3%
Chemicals	9.9%	7.0%	-2.9%	16.8%	7.0%	-9.8%	8.7%	12.0%	3.3%
Metals	7.2%	0.0%	-7.2%	1.4%	2.8%	1.4%	4.3%	3.8%	-0.5%
Others	3.1%	6.0%	2.9%	14.6%	7.2%	-7.4%	9.4%	7.2%	-2.2%

We note that the shorter-term (less than 5 years) contracts are concentrated in the iron/steel and precision equipment sectors, with 93.4% and 75.0%, respectively, with 37.8% of the former's less than one year. For longer-term contracts of 10 years or more, pharmaceuticals and organic chemicals led with shares of 50.0% and 31.8%, respectively. Nonferrous metals dominated the medium term (5 ~ less than 10 years) with 75.0%, while electronic/ communications parts led with 15.0% the period until expiration of industrial property rights. The survey results showed substantial differences within the same industry depending on sector and contract period.

Looking at narrower industrial sectors, at the short end of the time scale we find iron & steel with 93.4% and precision equipment with 75.0% in contracts with less than 5 years to run. For those of 10 years or more duration, pharmaceuticals (50.0%) and organic chemicals (31.8%) can be cited. Even in the same sector large differences can be found depending on contract duration. See Fig. 4-8.

Figure 4-8: Export Contract terms By Sector



6. Value Receiving Methods

Are there any identifiable patterns in methods of receiving value in connection with our industrial groups and sectors? Initial payment ratios were high for chemicals (64.0%) and metals (60.6%), and low for the others. Machinery was far and away the leader for running royalties with a 92.6% ratio, while in respect of minimum payments those of chemicals and other were highest at 14.1% and 20.0%, respectively.

On a year-to-year comparison the initial payments ratios of machinery and others shrank drastically, while their running royalty counterparts rose sharply. See Fig. 4-9 and Table 4-6.

Figure 4-9: Contracts By Value Receiving Method and Industrial Group

*[proportion of minimum payments in running royalty category]

Table 4-6: Contracts By Value Receiving Method and Industrial Group

	Initial payment			Running royalty			Minimum payment		
	FY 93	FY 94	%chg	FY 93	FY 94	% chg	FY 93	FY 94	%chg
ALL	62.6%	55.5%	-7.1%	76.8%	76.8%	0.0%	12.0%	8.2%	-3.8%
Electricals	53.4%	51.1%	-2.3%	81.0%	74.1%	-6.9%	4.3%	4.1%	-0.2%
Machinery	71.1%	52.6%	-18.5%	83.6%	92.6%	9.0%	15.0%	4.6%	-10.4%
Chemicals	67.9%	64.0%	-3.9%	81.0%	73.5%	-7.5%	17.1%	14.1%	-3.0%
Metals	51.6%	60.6%	9.0%	64.1%	53.9%	-10.2%	2.4%	5.5%	3.1%
Others	62.5%	46.9%	-15.6%	63.5%	78.5%	15.0%	16.7%	20.0%	3.3%

By industrial sector wherein contracts called for initial payments, we find organic chemicals at the top with 85.7%, followed by pharmaceuticals with 78.3% and electric power/industrial electricals with 72.2%. The first-named has led for 3 consecutive years, while the others tend to fluctuate widely from year to year; the operative influences seems to be the extent of capital participation and other factors. (Figs 3-17 and 4-10 refer.)

Initial Payments Contracts By Industrial Sector

Computers products	El pwr/ind elec	Precisions	Drugs	Other chems	Metal
Elec/comm parts	Transport eqpmt	Organic chems	Oils/paints	Nonfer mtl	

Sectors with running royalty ratios over 90% were electric power/industrial electricals with 100%, other chemicals with 94.4%, edible oils/paints with 92.6%, and transportation equipment with 90.5%. These and those at the low end of the ratio scale have shown little change over the past 2 years. (See Fig. 4-11)

Figure 4-11: Running Royalty Contracts By Industrial Sector

Computers products	El pwr/ind elec	Precisions	Drugs	Other chems	Metal
Elec/comm parts	Transport eqpmt	Organic chems	Oils/paints	Nonfer mtl	

7. Exclusive/Sublicence Rights

There was a wide gap between industrial groups with high (machinery, chemicals, others) and low (electricals, metals) proportions of contracts granting exclusive rights. Chemicals led in the case of sublicensing rights. On a year-to-year comparison, however, for chemicals both ratios declined sharply (down by 11.0 and 18.3 points, respectively), while the exclusive-rights ratios for electricals and machinery rose by 7.7 and 9.5 points, respectively. See Fig. 4-12 and Table 4-7.

Figure 4-12: Exclusive and Sublicensing Contracts By Industrial Group

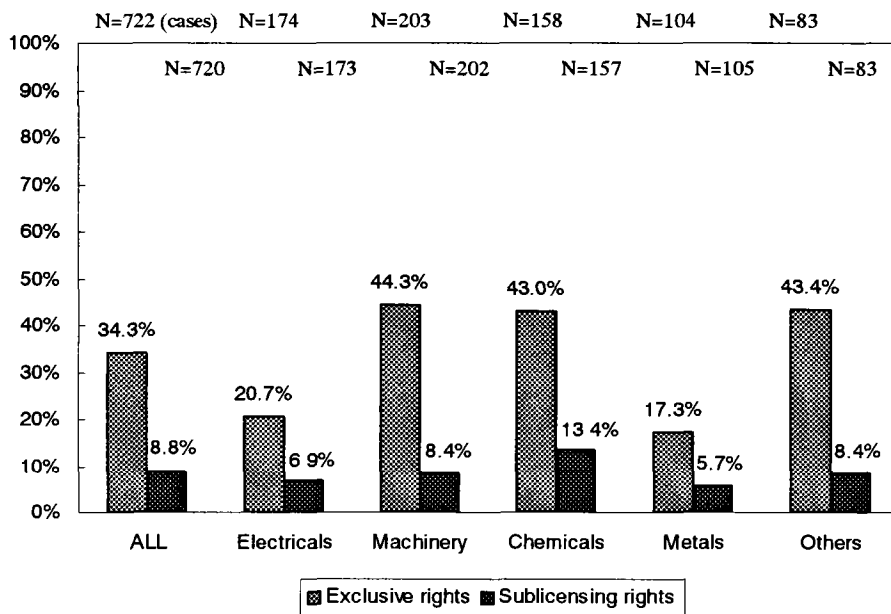


Table 4-7: Exclusive and Sublicensing Rights By Industrial Group

	Exclusive			Sublicensing		
	FY 93	FY 94	%chg	FY 93	FY 94	%chg
ALL	34.6%	34.3%	-0.3%	13.6%	8.8%	-4.8%
Electricals	13.0%	20.7%	7.7%	6.3%	6.9%	0.6%
Machinery	34.8%	44.3%	9.5%	2.2%	8.4%	6.2%
Chemicals	54.0%	43.0%	-11.0%	31.7%	13.4%	-18.3%
Metals	23.5%	17.3%	-6.2%	10.1%	5.7%	-4.4%
Others	46.2%	43.4%	-2.8%	14.3%	8.4%	-5.9%

Our more detailed sectoral breakdown shows pharmaceuticals, other chemicals, and edible oils/paints leading in the exclusive rights area, with iron and steel and computers at the low end. (See Fig. 4-13) Pharmaceuticals are also highlighted in respect of sublicensing rights. (See Fig. 4-14)

Figure 4-13: Exclusive Rights By Industrial Sector

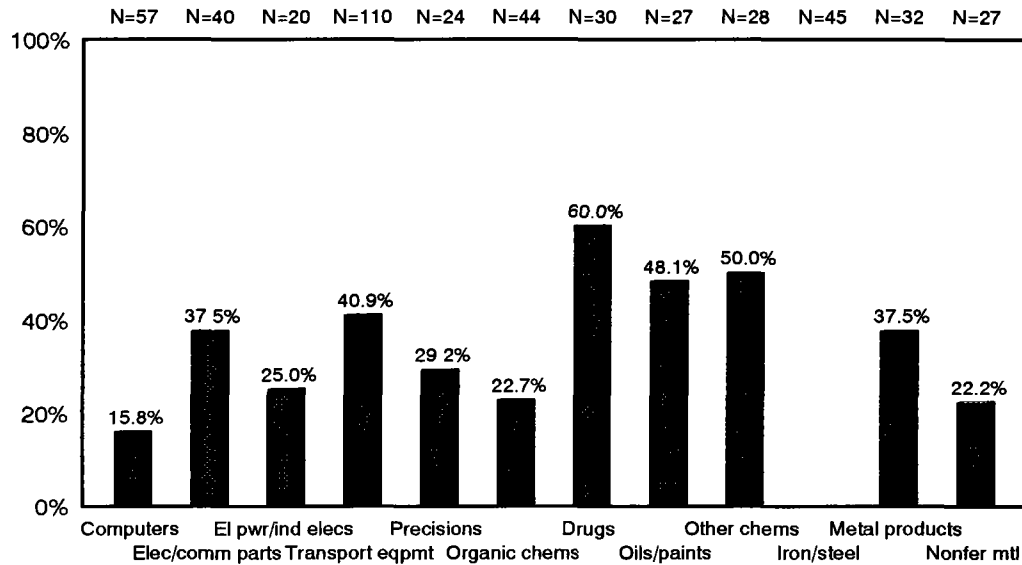
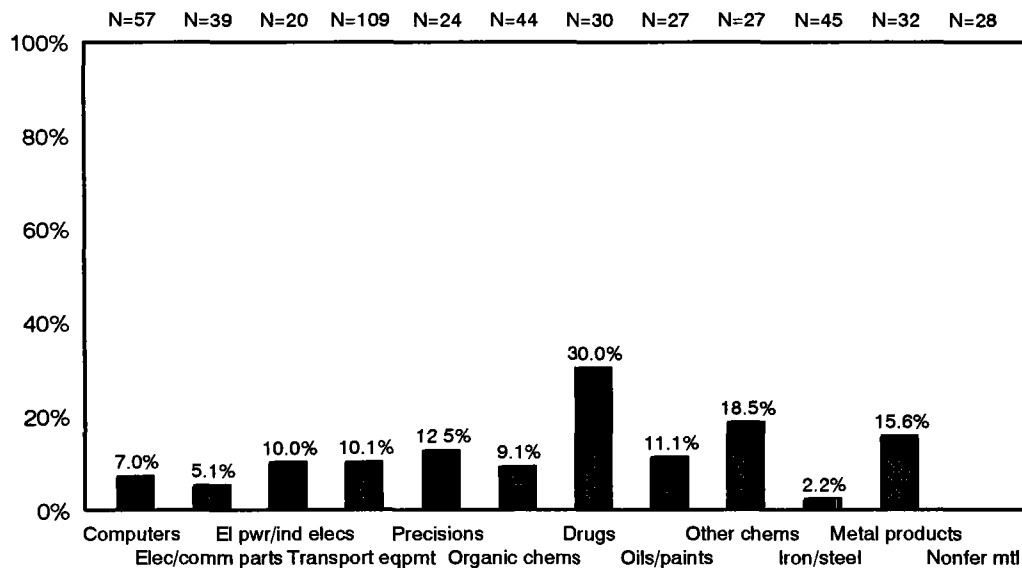


Figure 4-14: Sublicensing Rights By Industrial Sector



8. Forms of Technology

Examining the types of exported technology by industrial group, we see that electricals, machinery and chemicals have almost the same ratios in respect of patents. In practical terms the same is true for knowhow. Wider variations emerge only in connection with trademarks, where chemicals are high and metals low. Fig. 4-15 and Table 4-8 refer.

Figure 4-15: Patent, Knowhow and Trademark Contracts By Industrial Group

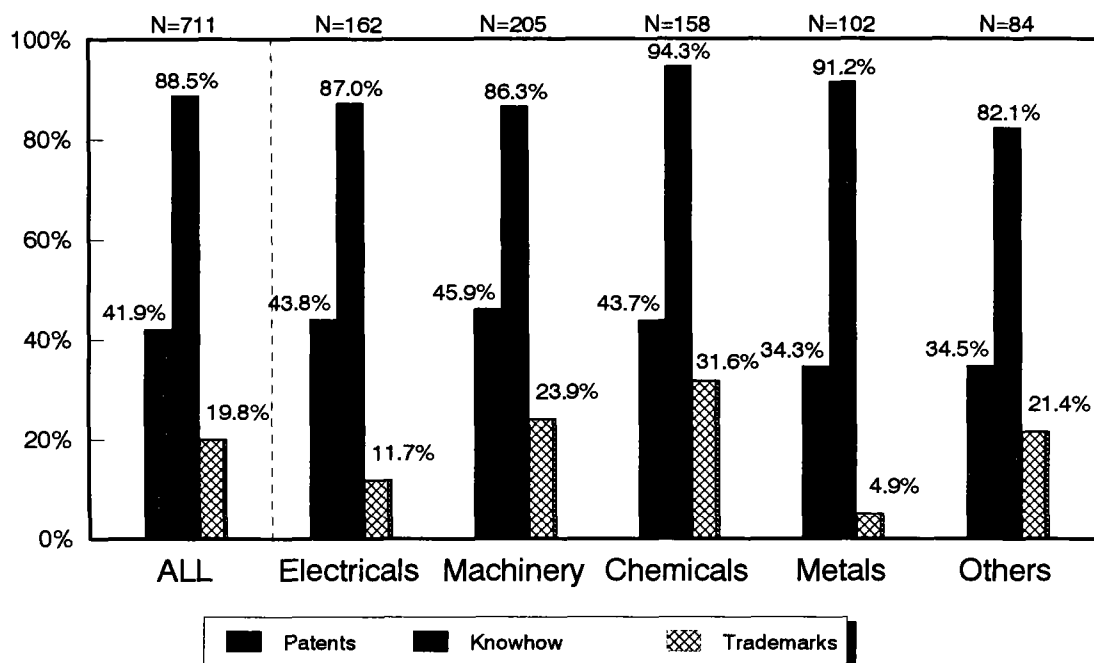


Table 4-8: Patent, Knowhow and Trademark Contracts By Industrial Group

	Patents			Knowhow			Trademarks		
	FY 93	FY 94	%chg	FY 93	FY 94	%chg	FY 93	FY 94	%chg
ALL	42.8%	41.9%	-0.9%	87.7%	88.5%	0.8%	18.8%	19.8%	1.0%
Electricals	41.6%	43.8%	2.2%	87.6%	87.0%	-0.6%	18.0%	11.7%	-6.3%
Machinery	36.0%	45.9%	9.9%	92.1%	86.3%	-5.8%	16.5%	23.9%	7.4%
Chemicals	52.2%	43.7%	-8.5%	84.5%	94.3%	9.8%	26.1%	31.6%	5.5%
Metals	44.9%	34.3%	-10.6%	88.4%	91.2%	2.8%	5.8%	4.9%	-0.9%
Others	37.5%	34.5%	-3.0%	86.5%	82.1%	-4.4%	20.8%	21.4%	0.6%

By industrial sector, we find that in four cases more than 60% of contracts involve patents: precision equipment, electric power/industrial electricals, electronic/communications parts, and pharmaceuticals, while edible oils/paints and computers have extremely low ratios. Wide variations exist even within the same technology type. (Fig. 4-16)

Figure 4-16: Contracts Involving Patents By Industrial Sector

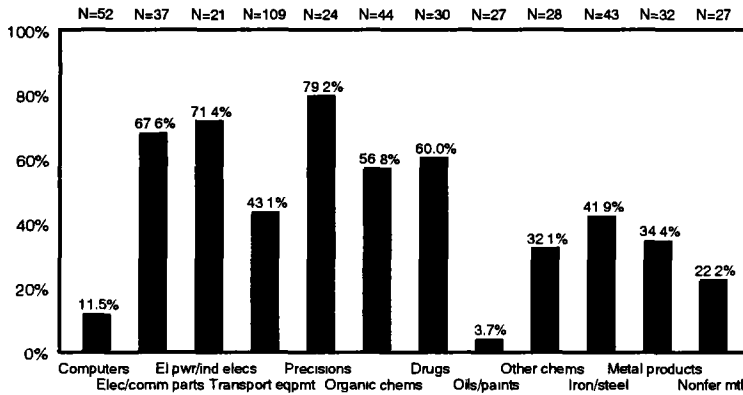


Fig. 4-17 illustrates the situation in respect of knowhow, where we find that, except for electronic/communications parts and metal products, all sectors showed ratios exceeding 80%, with that of electric power/industrial electricals being particularly noteworthy.

Figure 4-17: Contracts Involving Knowhow By industrial Sector

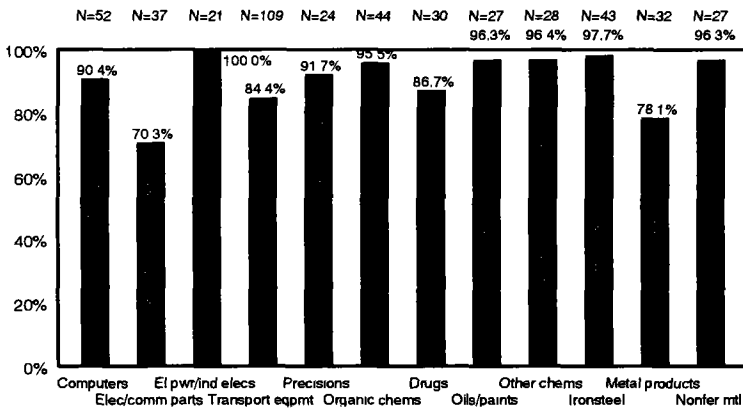
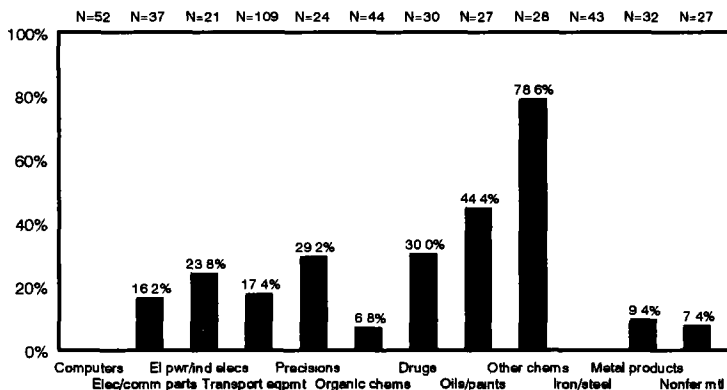


Fig. 4-18, covering trademarks, shows other chemicals a standout at 78.6%, followed by edible oils/paints and pharmaceuticals.

Figure 4-18: Contracts involving Trademarks By Industrial Sector



9. Specified Technological Areas

To this point we have looked primarily at technology groups and industries, but here we take a different approach and focus on eight specified technologies--computers (including hardware, software, and service [technical support for computer operation and management], see Footnote 9), semiconductors, nuclear power, aerospace, pharmaceuticals, and biotechnology--in our study of technology exports. In our survey, all applicable answers were requested where there was any overlap.

Table 4-9 shows 3-year comparative data. For FY 1994 ratios were high for software (7.1% of the total contracts), pharmaceuticals (3.7%), and semiconductors (2.4%) in terms of numbers of contracts. The software rose substantially over its level of 2 years prior, while that for pharmaceuticals sank by nearly half on a year-earlier comparison.

Pharmaceuticals have already been dealt with in detail. Looking more closely at software by export destination, we see that the share for Asia declined slightly in FY 1993 to 50.0% and more drastically to 36.6% in the year under review. (Fig. 4-19) And by capital relationship, the share for partners with a greater-than-half interest was still high. (Fig. 4-20) Finally, by contract content, the value-receipt method is noteworthy: Of the total, running royalties with 76.8% exceeded initial payments with 55.5%, but in the case of software the counterpart figures were 39.5% and 78.9%. (Fig. 4-21)

Table 4-9: Specified Technology By Numbers of Contracts

Specified Technology	FY 1992		FY 1993		FY 1994	
	No.	Ratio	No.	Ratio	No.	Ratio
Computers (hardware)	16	2.2%	11	1.8%	6	0.9%
Computers (software)	31	4.4%	30	4.8%	49	7.1%
Computers (service)	5	0.7%	6	1.0%	7	1.0%
Semiconductors	16	2.2%	22	3.5%	17	2.4%
Nuclear power	0	0.0%	1	0.2%	1	0.1%
Aerospace	3	0.4%	1	0.2%	2	0.3%
Pharmaceuticals	42	5.9%	50	8.0%	26	3.7%
Biotechnology	5	0.7%	2	0.3%	5	0.7%
Totals	712	100%	626	100%	694	100%

9). "Computer service" refers to the technological support for the operation, management, etc., of computers.

Figure 4-19: Software Technology Exports By Region

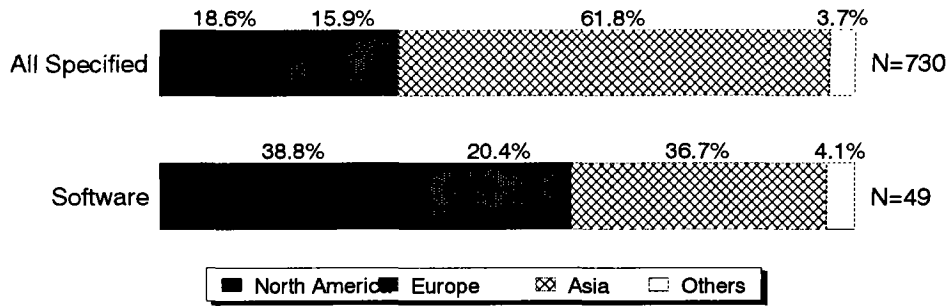


Figure 4-20: Software Technology Exports By Capital Participation

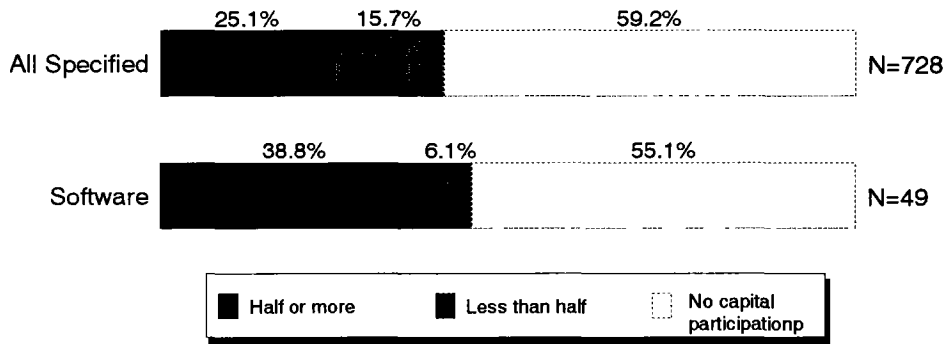
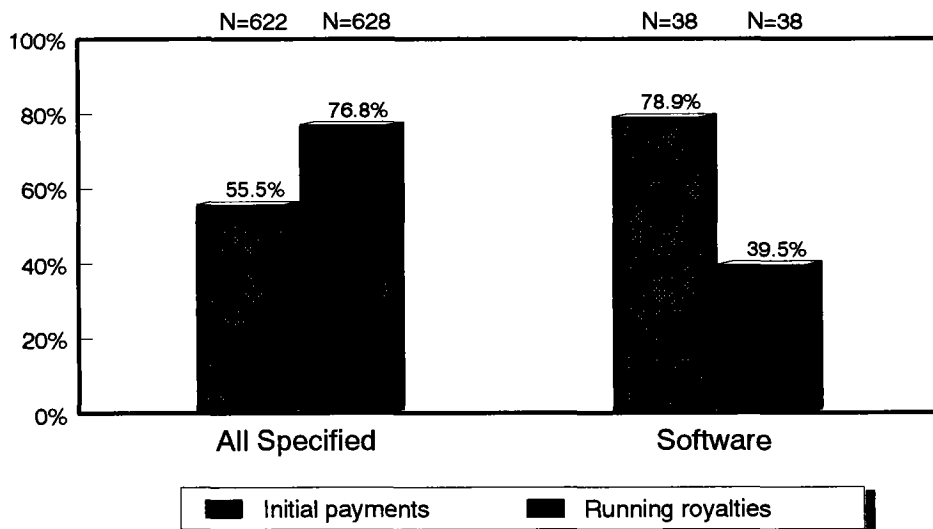


Figure 4-21: Software Technology Exports By Value-Receipt Method



10. Cross-licensing agreements

Finally, we analyze forms of agreement, in particular cross-licensing agreements. First, looking at forms of technological exports by technological field in FY 1994, we notice, a remarkable increase in the "electrical" field as in the previous fiscal year. In contrast, the proportion of cross-licensing agreements and onerous agreements in the "machinery" and "metal" fields is low with most agreements accounted for by gratuitous agreements. (see Fig. 4-22 and Table 4-10)

Fig. 4-22 Categories of technological export agreement (by technological field)

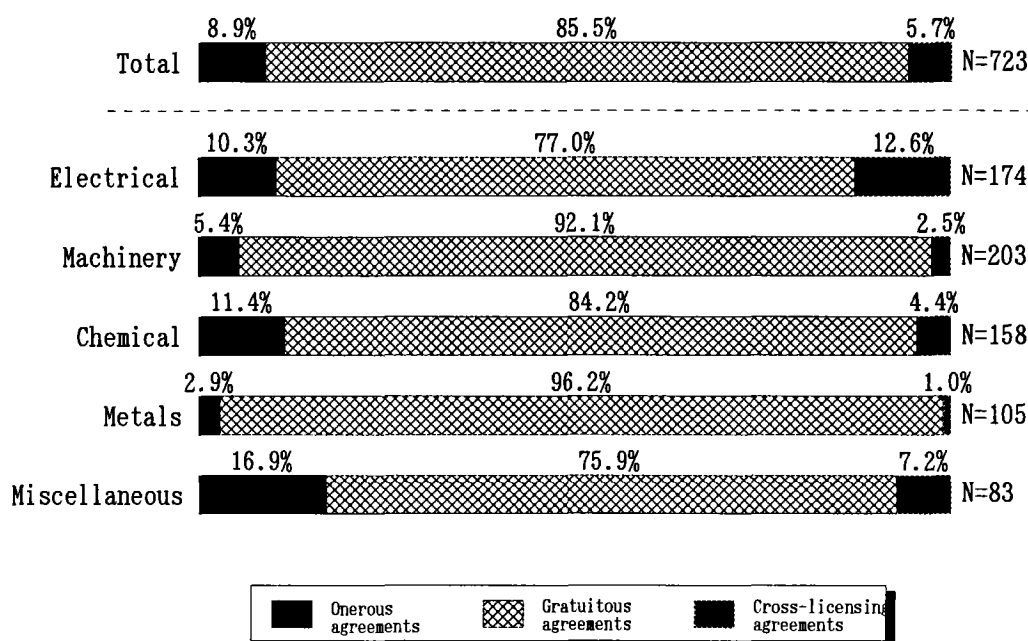


Table 4-10 Contracts by technological field

	Onerous agreements			Gratuitous agreements			Cross-licensing agreements		
	FY 93	FY 94	%chg	FY 93	FY 94	%chg	FY 93	FY 94	%chg
ALL	10.9%	8.9%	-2.0%	82.1%	85.5%	3.4%	7.0%	5.7%	-1.3%
Electricals	18.6%	10.3%	-8.3%	69.6%	77.0%	7.4%	11.8%	12.6%	0.8%
Machinery	7.9%	5.4%	-2.5%	90.6%	92.1%	1.5%	1.4%	2.5%	1.1%
Chemicals	11.2%	11.4%	0.2%	82.6%	84.2%	1.6%	6.2%	4.4%	-1.8%
Metals	1.4%	2.9%	1.5%	91.3%	96.2%	4.9%	7.2%	1.0%	-6.2%
Others	8.3%	16.9%	8.6%	83.3%	75.9%	-7.4%	8.3%	7.2%	-1.1%

Looking at the technological fields of cross-licensing agreements for the last three years, we notice that approximately half of the total is accounted for by the "electrical" category with its proportion being 48.5%. By contrast, the proportions accounted for by "machinery" (9.6%) and "metals" (5.9%) fields are reduced. (see Fig. 4-23)

Next, Looking at cross-licensing agreements by technological field, the proportions of "value received" in "machinery", "miscellaneous", and "chemical" fields account for the majority of these categories. Approximately 20% (19.7%) of the "electrical" field is accounted for by "value paid" while "value received" only accounts for 42.4%. The proportion of cross-licensing agreements and their forms depend largely on the technological field. (see Fig. 4-24)

Fig. 4-23 Technological fields of cross-licensing agreements (total of three years)

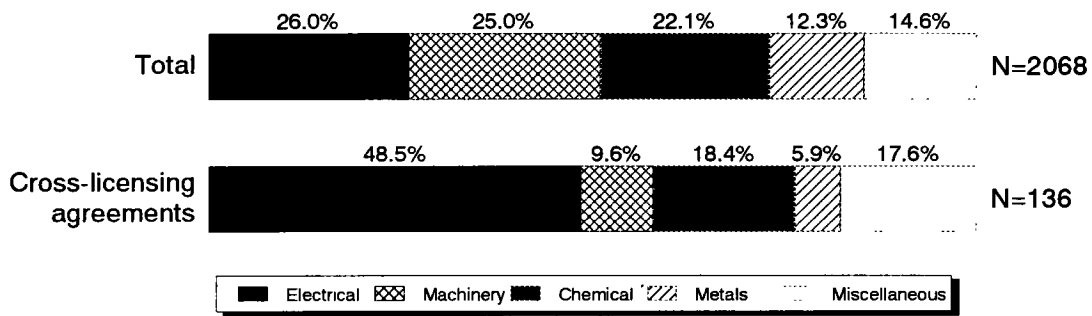
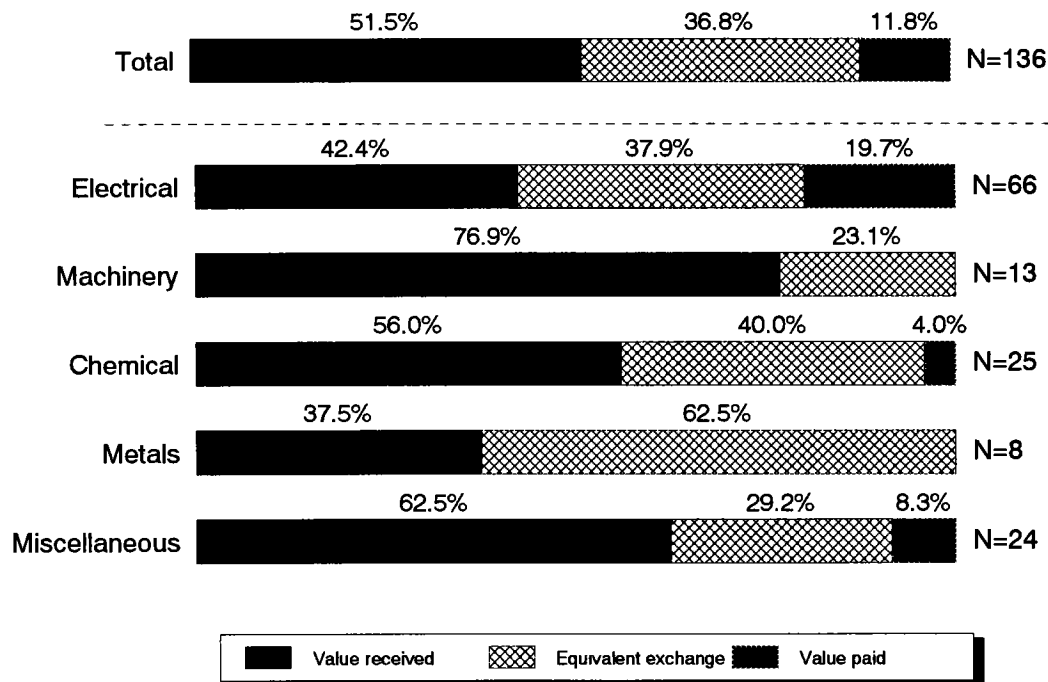


Fig. 4-24 Cross-licensing agreements by technological field (total of three years)



To pick technological categories in which more than 5 cross-licensing agreements were made over the last three years, "electrical/communications parts" accounts for approximately a quarter (26.5%) of the total. Other than "electrical/communications parts", "computers" account for 11.8% and "communications" for 3.7%, leading to an increase in the "electrical" field. The category of "transport machinery", which has the largest total number of technological exports, accounts for as little as 2.2% of total cross-agreements. Though categories of "petroleum/coal products", "textile" and "plastic products" do not have large technological exports, they occupy the top positions in terms of the number of cross-licensing agreements. Particularly, "petroleum/coal products" accounts for 13 out of a total of 22 cross-licensing agreements.

We notice a large difference between the top two items, "electrical/communications parts" and "computers" in the detailed items of cross-licensing agreements. While the category of "value received" accounts for the majority in "electrical/communications parts" with a quarter accounted for by "value paid", "computers" do not show the category "value paid" with "equivalent exchange" accounting for 60% of the total number of agreements. (see Table 4-11)

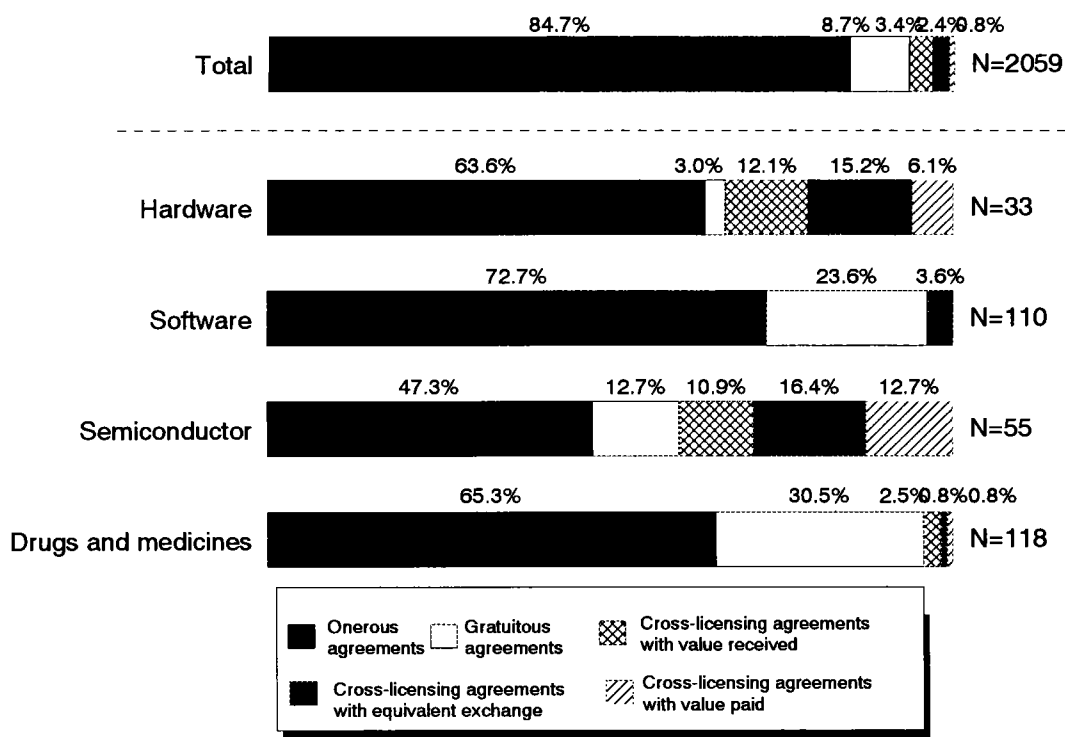
Table 4-11 Number of cross-licensing agreements in top ranked technological categories (total of three years)

	Cross-license agreement				Total number of agreements in technological exports	Proportion of cross-license
	Value received	Equivalent exchange	Value paid	Total		
1 Electrical/communications parts	19	8	9	36 (26.5%)	126	28.6%
2 Computers	5	10	1	16 (11.8%)	140	11.4%
3 Petroleum/coal products	5	8	0	13 (9.6%)	22	59.1%
4 Textile	5	3	0	8 (5.9%)	32	25.0%
5 Transport machinery	5	1	0	6 (4.4%)	272	2.2%
6 Communication machinery	1	3	1	5 (3.7%)	52	9.6%
7 Drugs and medicines	3	1	1	5 (3.7%)	122	4.1%
8 Plastic products	3	0	2	5 (3.7%)	46	10.9%
Miscellaneous	24	16	2	42 (30.9%)	1,247	3.4%
Total	70	50	16	136 (100%)	2,059	6.6%

Looking at contracts in specified technological areas, the proportion of cross-licensing agreements in software and drugs & medicines fields is low at approximately 4%. The proportions of semiconductors and hardware are, by contrast, very large at 40% and 33.3%, respectively. Technologies for semiconductor and hardware are diverse with a few hundreds of patents per product. Because of this diverse nature, as a means to reduce the amount of royalty to be paid and to prevent infringement of others' rights, cross-licensing agreements are made.

Of 16 "value paid" cross-licensing agreements, 7 are semiconductor-related technologies. Since basic patents associated with semiconductors are possessed by the United States, cross-licensing agreements seem to be signed to reduce large royalty payments. (see Fig. 4-25)

Fig. 4-25 Forms of agreements in specified technological fields (three years total)



V. Technological Import Comparisons

We have heretofore examined only technology exports, but in this section we will seek an overall view of the state of Japan's technology trade, drawing on the findings of NISTEP Report No. 46, "Trend Analysis of Foreign Technology Introduction" for FY 1994, also published by this Institute.

1. Introduction

Because of several differences between the data in the present survey and those in Report No. 46, it is necessary to bear the following points in mind when drawing comparisons. (Table 5-1 refers.)

First, in respect of the research method, note that this technology export study has used the survey method while that for technology imports used reports and other documents required by law and could be based on all figures. There are also wide differences in the companies targeted for investigation: this survey concentrated on those capitalized at ¥1 billion or more (Footnote 10), omitting those with less, while the import data set no lower limits in capital size. In order, therefore, to make possible meaningful comparisons on a consistent basis, for FY 1994 we have eliminated technology-importing companies capitalized at less than ¥1 billion (3,135 companies) (Footnote 11) and retained 2,098 in our database. (Fig. 5-1)

10) Though this study does look at companies capitalized at less than ¥1 billion, the research method differs from that for companies with greater capitalization and is not dealt with in the main text of this report.

11) Among those companies which in FY 1994 entered into new technology import contracts, importers capitalized at less than ¥1 billion accounted for 55.4% of all importers and for 33.1% of the total number of import contracts.

[Note: In our graphs and tables technology import-related figures are denoted with an asterisk (*) and drawn from "Trend Analysis of Foreign Technology Introduction" when it was in preparation.]

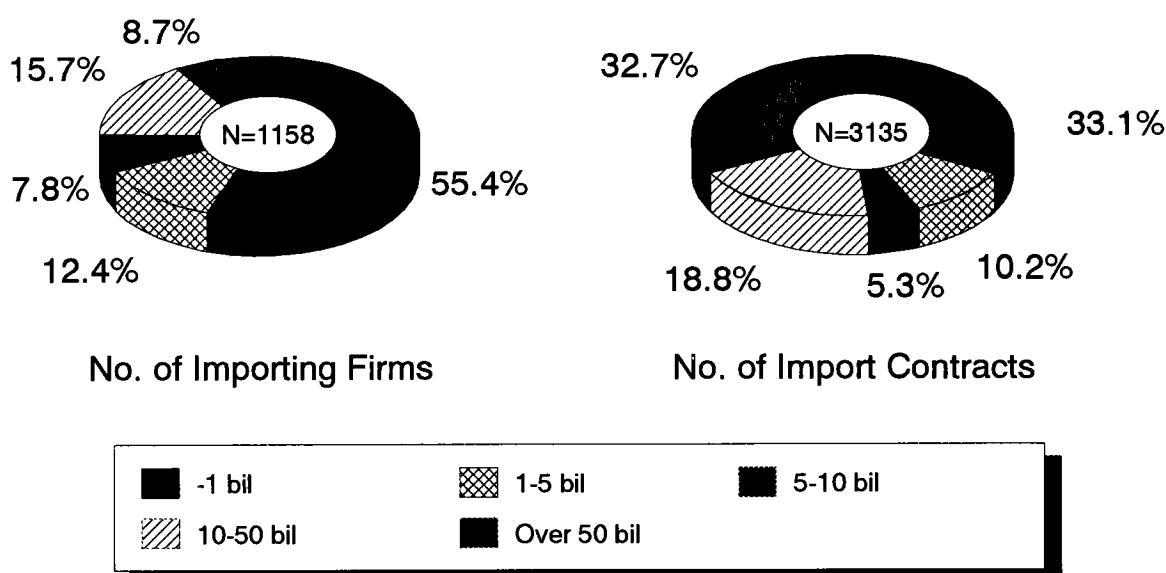
Table 5-1: Comparative Technology Export and Import Statistics

	Exports	Imports
Survey Report	This survey report	"Trend Analysis of Foreign Technology Introduction"
Survey Targets	Companies capitalized at 1 bil or more and engaged in R&D or involved in technology trade (1,569 companies)	All companies (for this comparison, only those capitalized at 1 bil or more have been selected)
Survey Method	Questionnaire by mail; 900 respondents, response rate 57.4%	Total sample survey using reports required by law*
Scope of Survey	Transfer or grant of usufructuary rights for patents, utility models, designs, trademarks, knowhow	Same as for exports
Contracts Covered	Contracts dated between in Survey 1 April 1994 and 31 March 1995	Same as for exports (required reports dated within same period)

* Data from NISTEP Report No. 46, incorporating technology import reports required by the Foreign Exchange and Foreign Trade Control Law.

Our export survey was a sampling using questionnaires, whereas the import survey used the total sample method based on legally-required reports. There are thus considerable differences in the companies surveyed. Companies capitalized at less than ¥1 billion were excluded from the export sample, whereas the study for imports included them. How many technology of the latter are involved? The FY 1994 raw data show a total of 3,135 new import contracts, of which 55.4% were concluded by smaller firms, accounting for 33.1% of total import contracts; eliminating those concluded by the smaller companies gives us 2,098 contracts. See Fig. 5-1.

Figure 5-1: Number of Companies and Import Contracts By Capitalization



2. Import/Export Contracts By Industrial Group and Sector

Fig. 5-2 illustrates import/export ratios by main group. For imports, electricals and metals occupy opposite ends of the spectrum with shares of 69.3% and 1.4%, respectively, while for exports the ratios are more evenly spaced among the groups.

Figure 5-2: Export/Import Agreements By Technological Field/Category

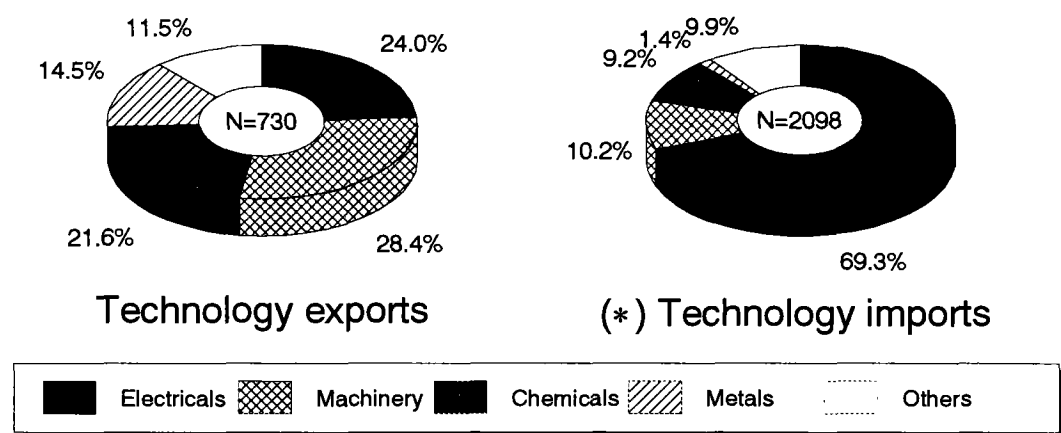


Table 5-2 gives a more detailed breakdown by industrial sector. We see that transportation equipment has led exports for three straight years, followed by computers and electronic/communications parts. Among imports, computers retain a high share of 54.6%; the export categories tend to be spread across a wide range. Fig. 5-2 refers.

Table 5-2: Import/Export Contracts By Industrial Sector

Exports			Imports*		
Sector	No.	%	Sector	No.	%
Transport equipment	110	15.1%	Computers	1,146	54.6%
Computers	57	7.8%	Electronic/communications	117	5.6%
Iron & steel	45	6.2%	Pharmaceuticals	82	3.9%
Organic chemicals	44	6.0%	Boilers/prime movers	73	3.5%
Electronic/communicatio	40	5.5%	Clothing	66	3.1%
Metal products	33	4.5%	Radio/TV/audio	65	3.1%
Pharmaceuticals	30	4.1%	Communications equipment	53	2.5%
Other chemical products	28	3.8%	Precision equipment	51	2.4%
Nonferrous metals	28	3.8%	Applied electronic instruments	50	2.4%
Edible oils/paints	27	3.7%	Chemical equipment	44	2.1%
Others	288	39.5%	Others	351	16.7%
Total	730	100.0%	Total	2,098	100.0%

3. Home Regions and Countries/Areas of Agreement Partners

Asia is the primary destination for technology exports with more than 60% this year, whereas North America and Europe split the remainder about evenly. But for imports North America is by far the leader with 71.6%, followed by Europe with 25.6% and Asia a distant third with only 2.1%. See Fig. 5-3.

Looking at imports/exports by principal country/area of origin, we see that, whereas the U.S. accounts for 16.7% of exports, if we omit Asia from the import count the U.S. would take 69.3% of the remainder, followed by various European countries. (See Fig. 5-4)

Figure 5-3: Technology Import/Export Contracts By Region

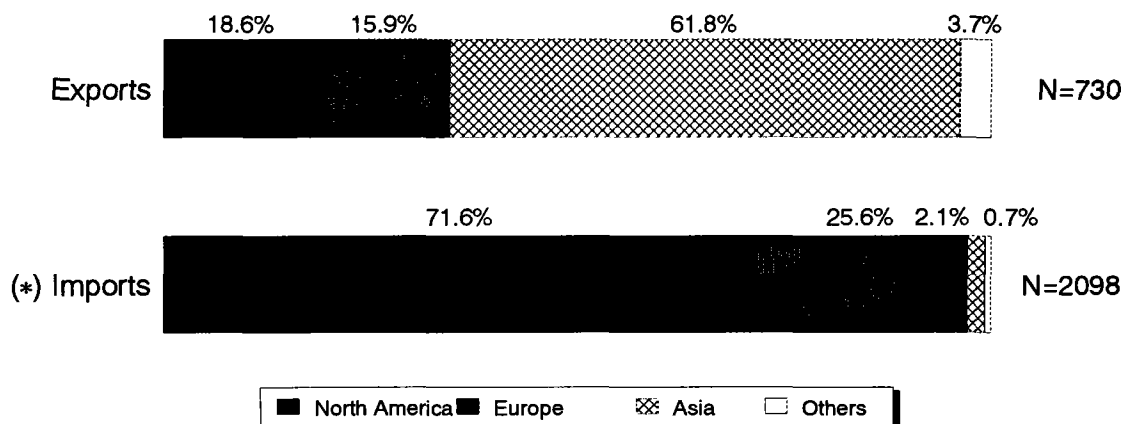
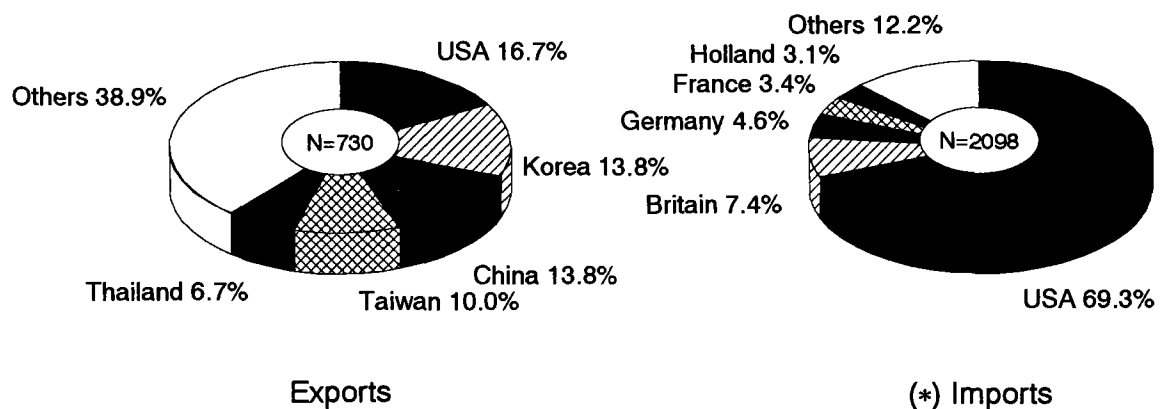
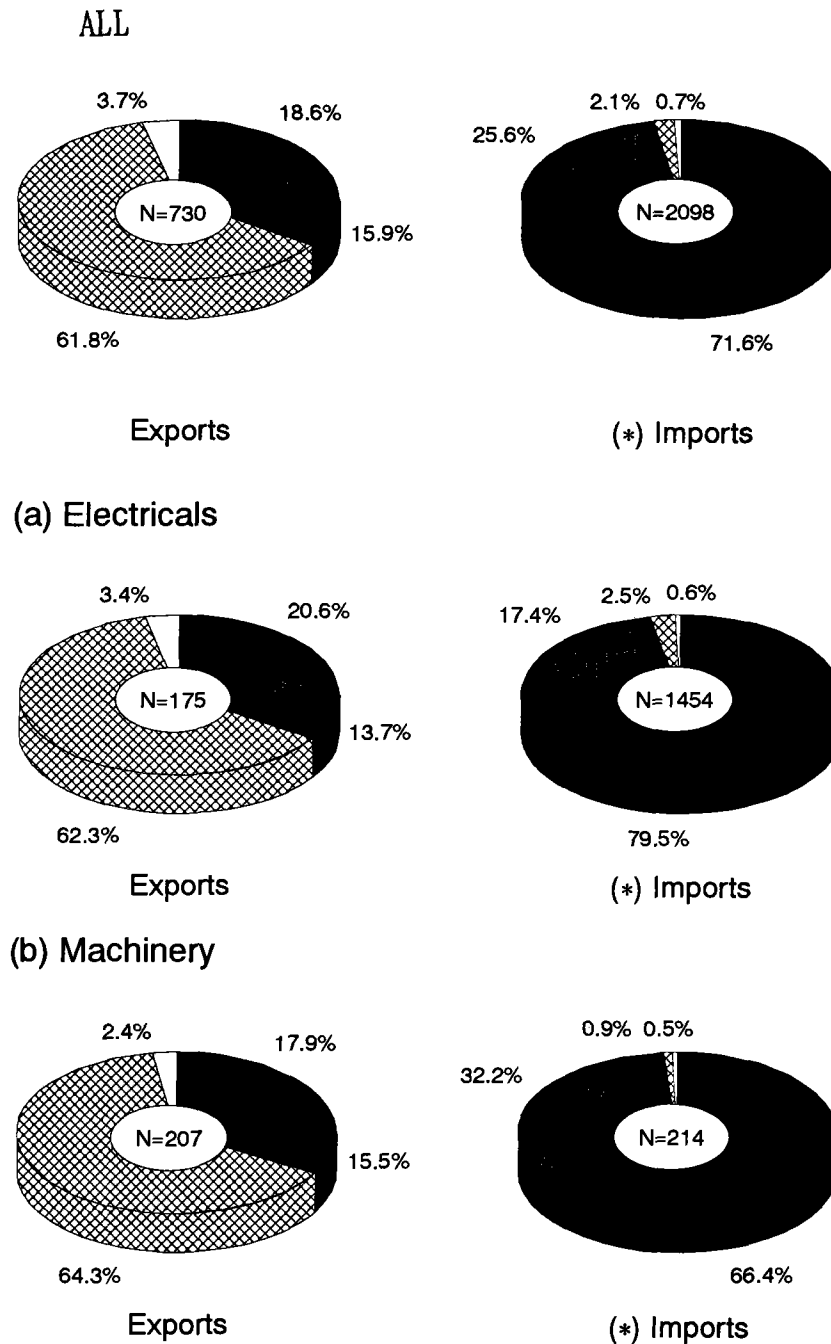


Figure 5-4: Import/Export Contracts By Country/Area

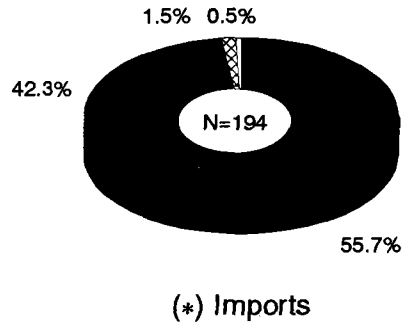
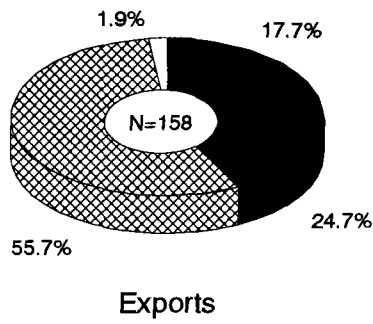


By industrial group, chemical export ratios to Europe are high and low to Asia, relatively speaking; most other groups show a preponderance (about 60%) for Asia. Imports show significant differences between North America and Europe, with the former's ratio about 80% for electricals, whereas Europe's ratio for other industries is higher (see Fig. 5-5).

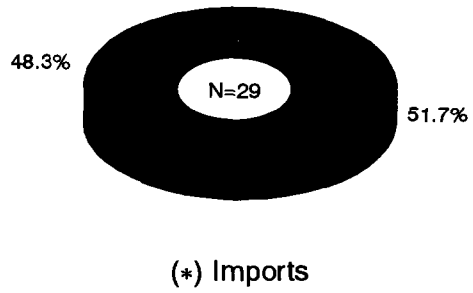
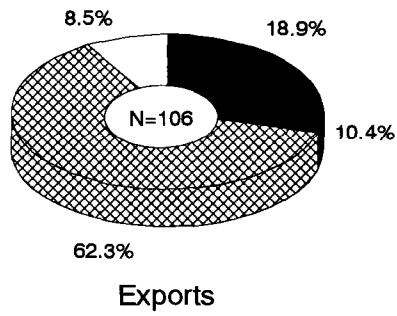
Figure 5-5: Import/Export Contracts By Industrial Group and Region



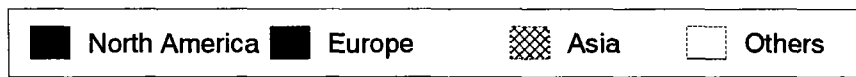
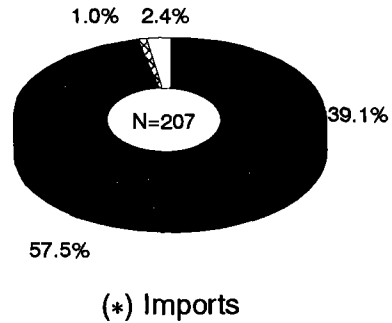
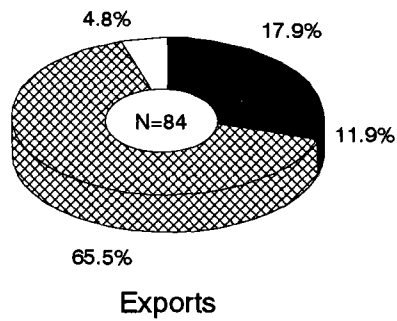
(c) Chemicals



(d) Metals



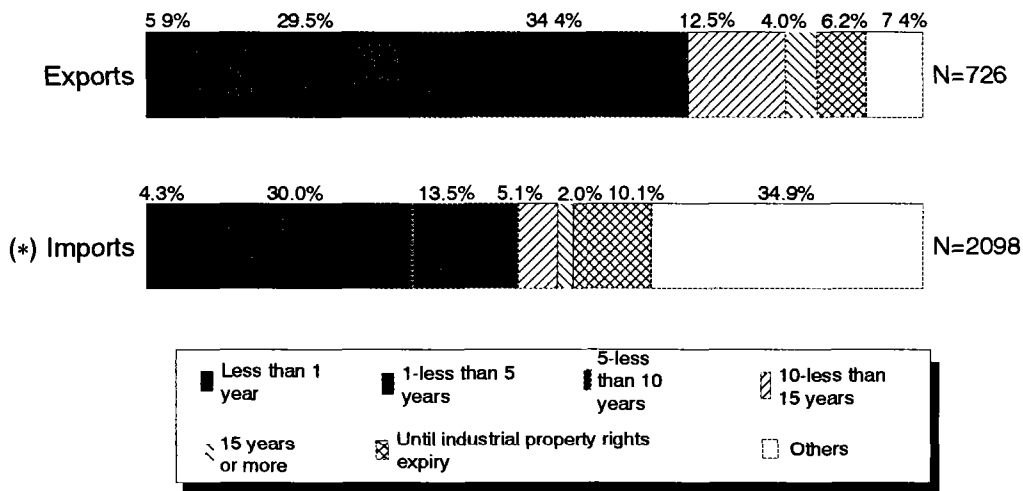
(e) Others



4. Contract terms

Are there any differences in export and import Contract terms? The share of export contracts in the range of 5 ~ less than 10 years is high, contrasting with a preponderance in "others" for import contracts. Other differences are not significant. (Fig. 5-6)

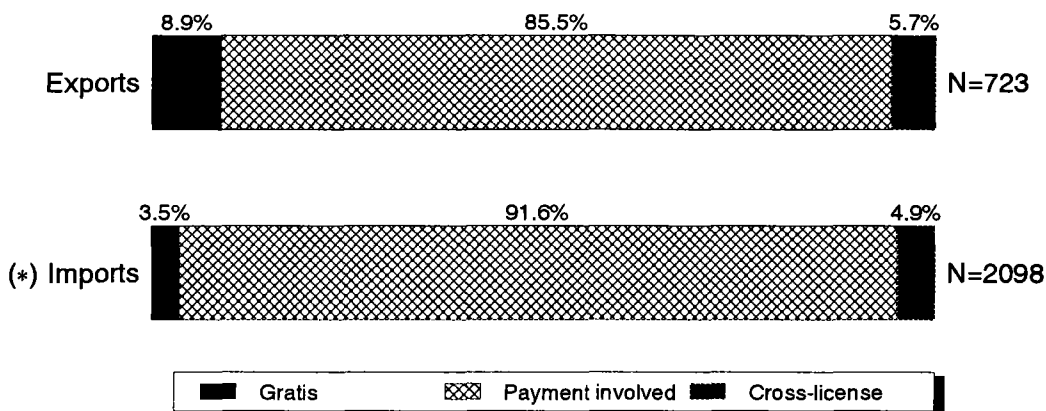
Figure 5-6: Import/Export Contract terms



5. Agreement Formats

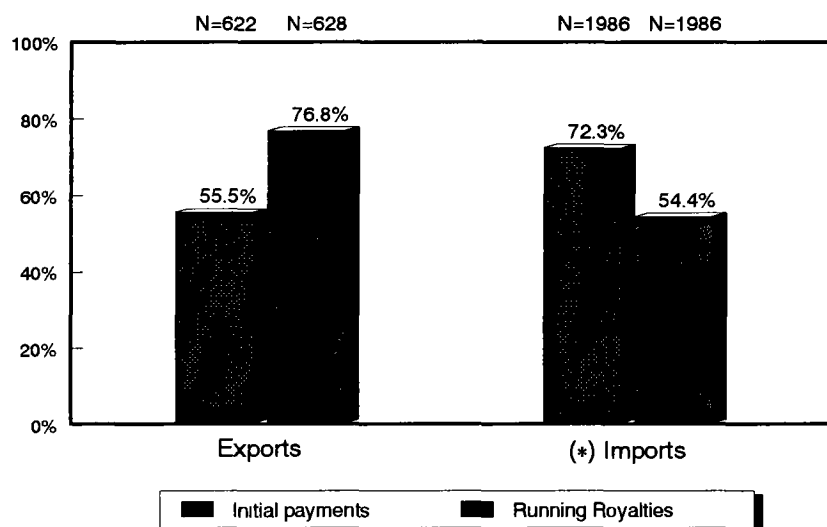
In both categories paid contracts are preponderant, with exports having a higher free or gratuitous ratio. (Fig. 5-7)

Figure 5-7: Export/Import Contracts By Format



With regard to the value-receipt method (Footnote 12), we observe that for exports the initial payment ratio is low and running royalties high. As we saw earlier, this disparity is due mainly to the weight of initial payments in software imports. (Fig. 5-8)

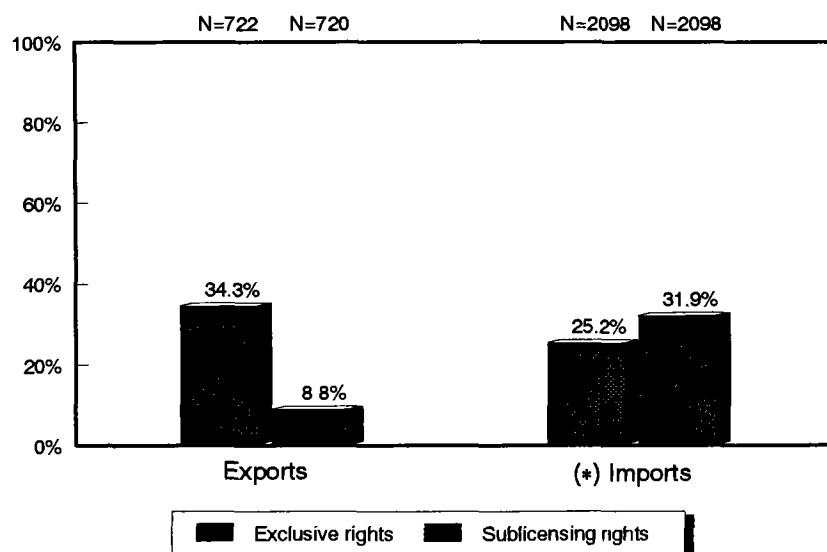
Figure 5-8: Initial Payment/Running Royalty Contracts



For exports, the exclusive rights ratio is slightly higher than for imports, and slightly lower in the case of sublicensing rights. (Fig. 5-9)

In respect of the value-paid method and contract terms (exclusive/sublicensing), there are no significant differences between export and import contracts, as was the case last year as well.

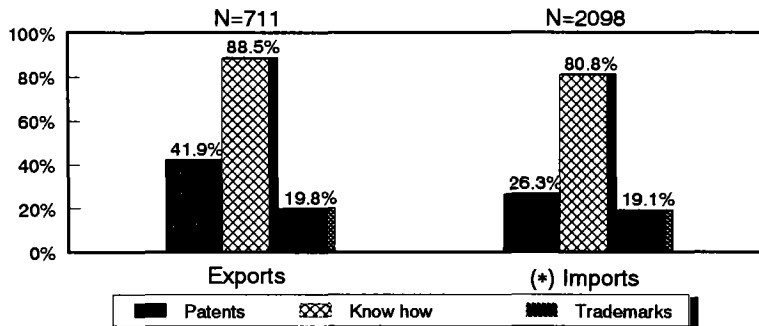
Figure 5-9: Exclusive and Sublicensing Rights Contracts



6. Forms of Technology

Knowhow (Footnote 13) is by far the largest category for both imports and exports, while for patents the export ratio is far higher than that for imports. (Fig. 5-10)

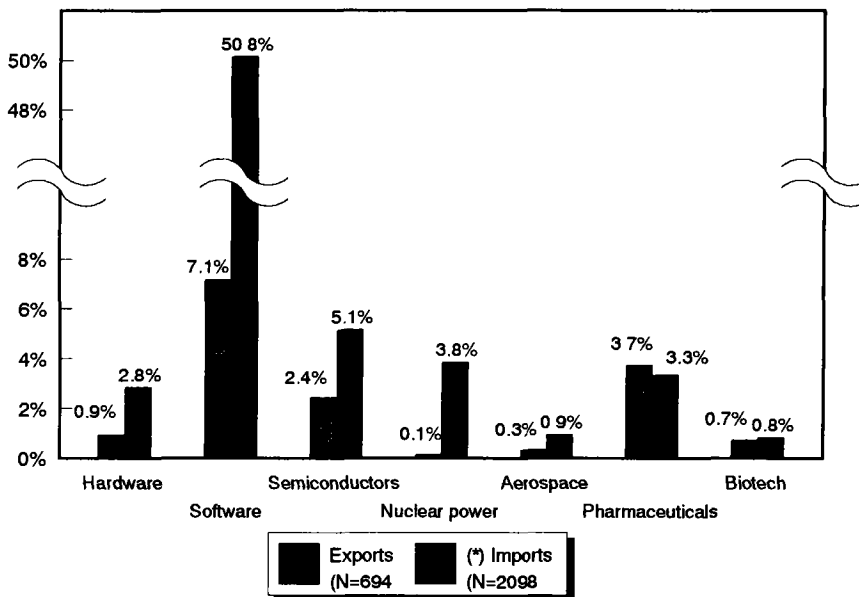
Figure 5-10: Patents/Knowhow/Trademark Export/Import Contracts



7. Specified Technological Areas

Taking into account differences in investigative method, the noteworthy point here is that software's share of total exports was 7.1%, and of total imports 50.8%. (Fig. 5-11)

Figure 5-11: Specified Technology Import/Export Contracts



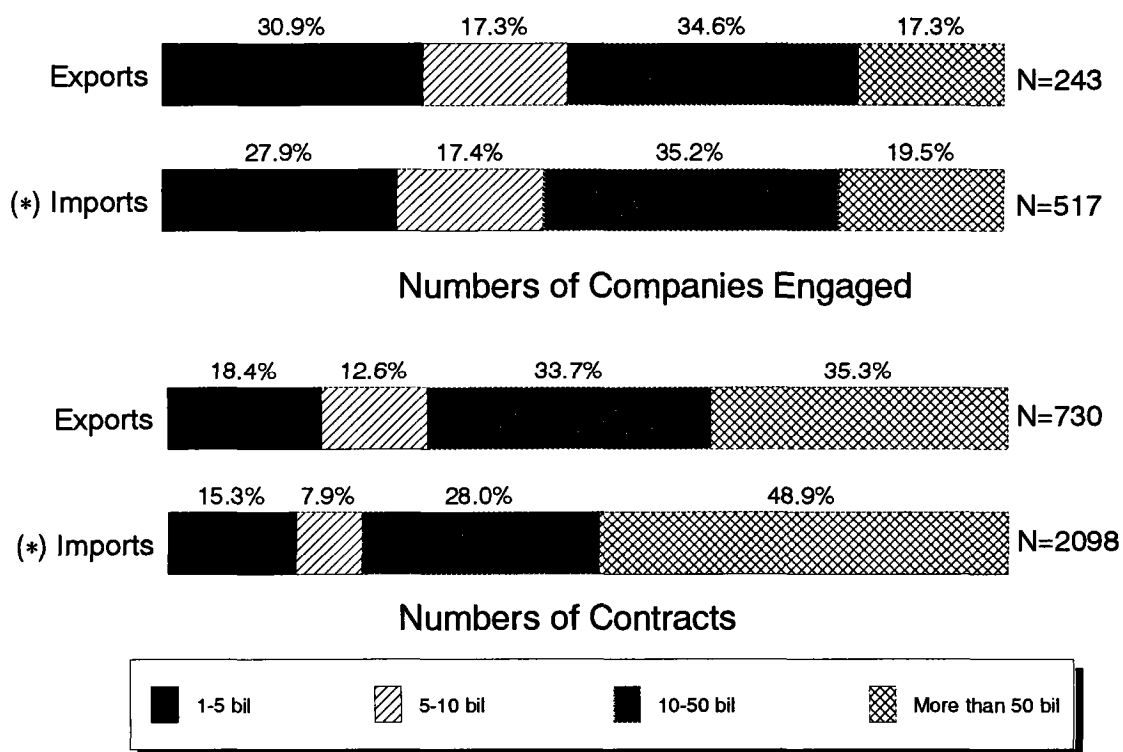
13. In export and import statistics, patents include utility models and knowhow includes patents pending.

8. Companies Engaged in Technological Importing/Exporting

(1) Export/Import Companies By Capitalization

The highest share of both import and export contracts goes to companies capitalized between ¥10 billion and ¥50 billion, while in terms of the number of contracts those capitalized at more than ¥50 billion are the leaders; with ratios of 35.3% for exports and 48.9% for imports, the latter are higher by nearly half. (Fig. 5-12)

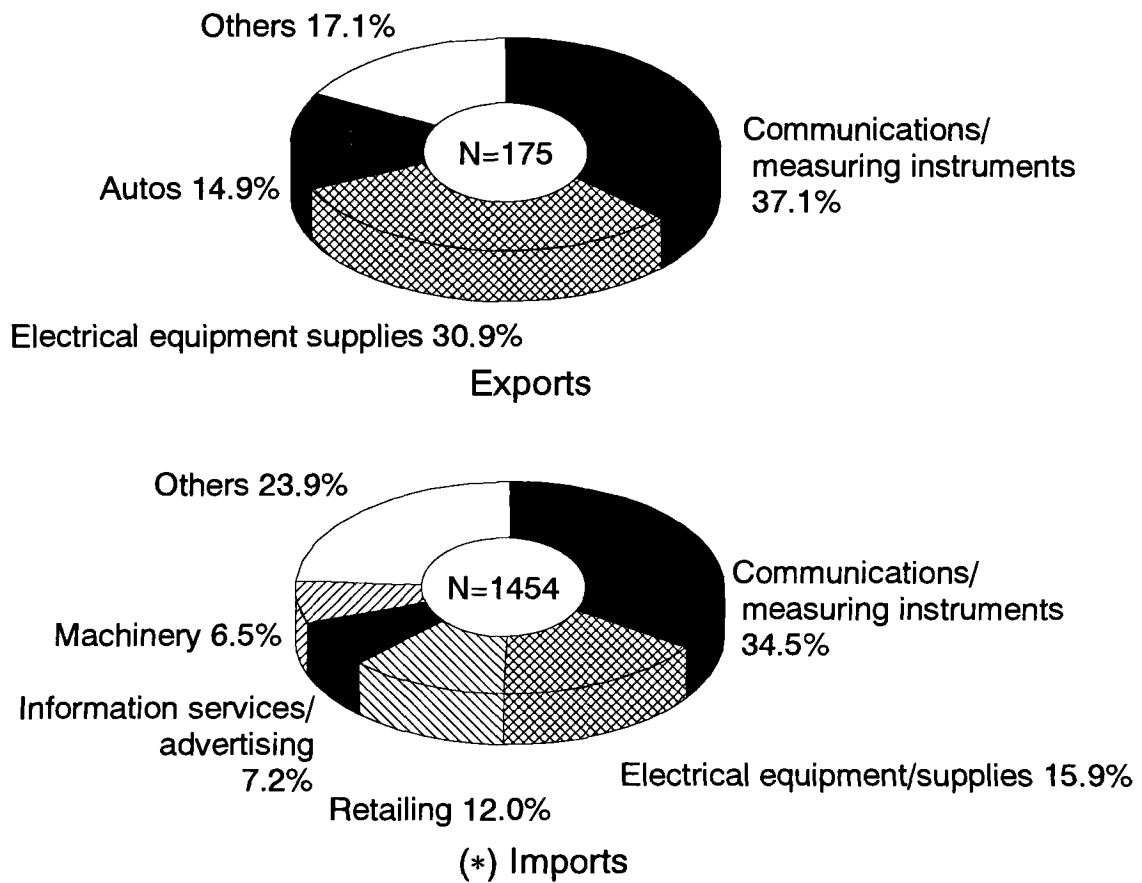
Figure 5-12: Import/Export By No. of Contracts and Capitalization



(2) Importing/Exporting Companies By Industrial Group and Sector

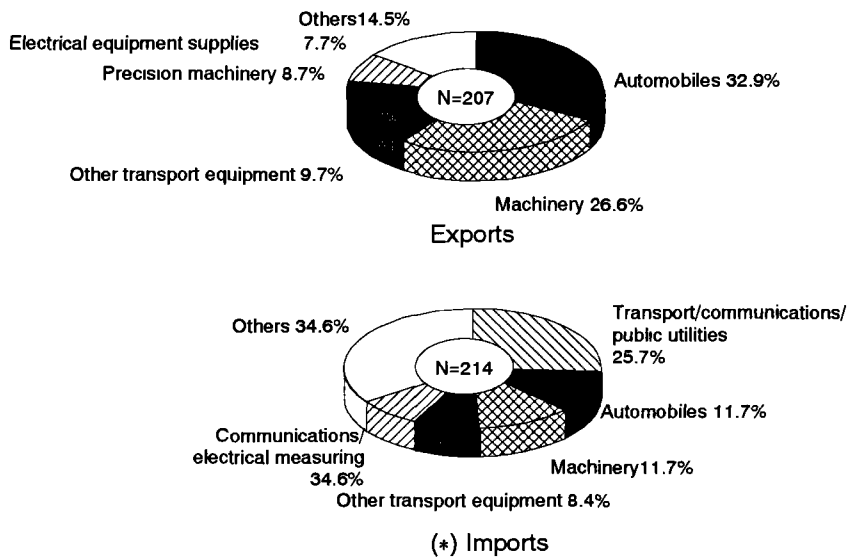
We broke down all import and export contracts by group and sector, and analyzed the top five in each. In the electricals group, communications/measuring instruments and electrical equipment supplies were at the top of both import and export rankings. In exports alone autos led, in imports alone retailing led. (Fig. 5-13)

Figure 5-13: Contract Numbers for Electrical-Related Sectors



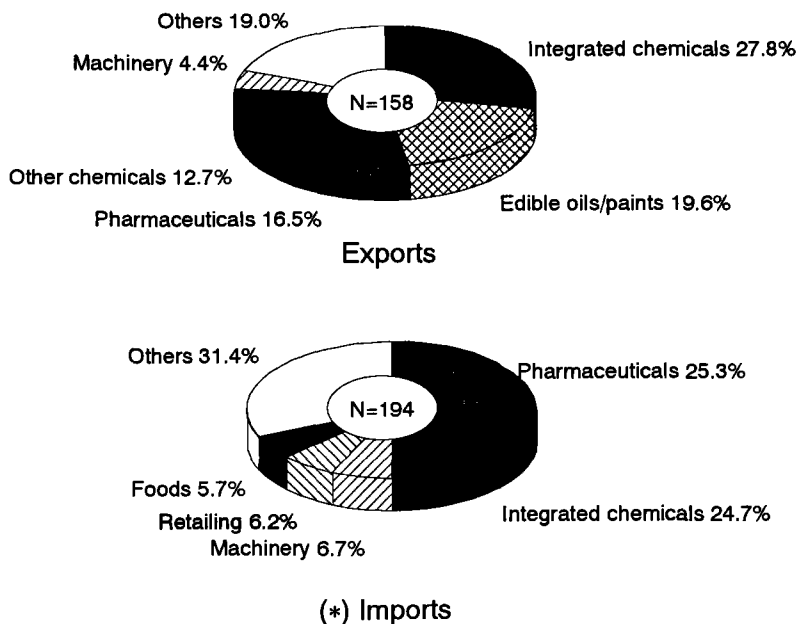
In Fig. 5-14, covering the machinery group, we see the expected export lead by autos, while the import lead is assumed by transport/communications/public utilities.

Figure 5-14: Contract Numbers for Machinery-Related Sectors



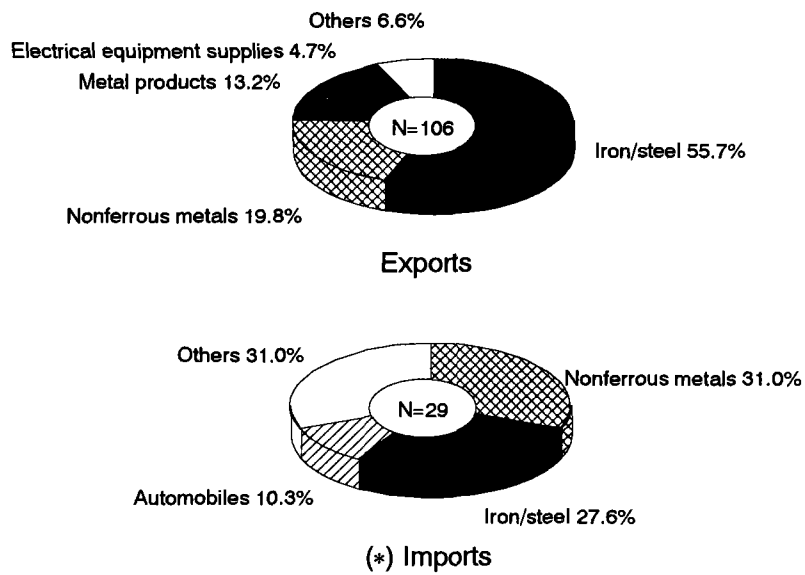
In the chemicals group, integrated chemicals and pharmaceuticals led in both imports and exports. In exports alone, edible oils/paints and other chemicals had high ratios, while for imports these were in machinery and retailing. See Fig. 5-15.

Figure 5-15: Contract Numbers for Chemical-Related Sectors



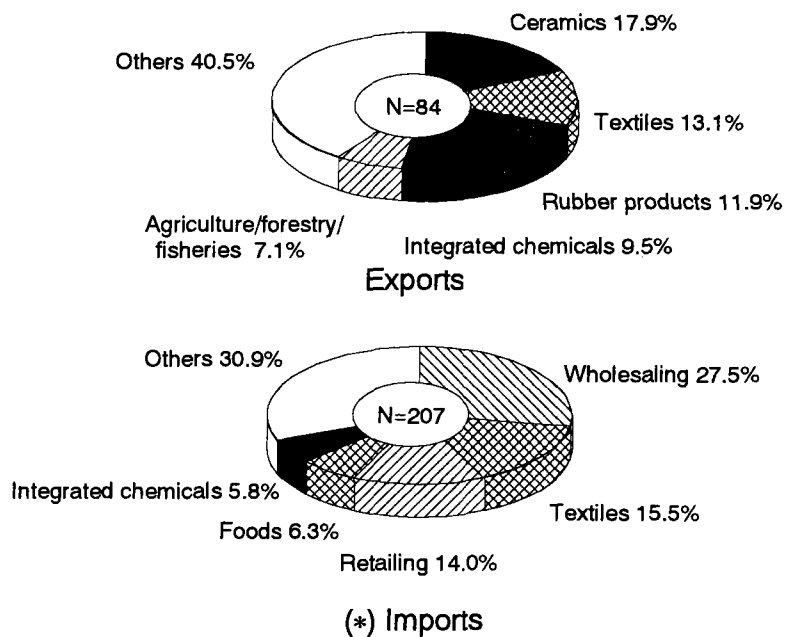
In the metals group, iron/steel and nonferrous metals had high shares of both imports and exports. See Fig. 5-16.

Figure 5-16: Contract Numbers for Metals-Related Sectors



In the others group, considerable variation was seen by import or export category. Export leadership tended to be scattered, while for imports such "tertiary industries" as wholesaling and retailing predominated. See Fig. 5-17.

Figure 5-17: Contract Numbers for Other Sectors



VI. Results of Analysis By Industrial Category

In sections IV and V we examined export technologies by content; in this section we will look at the relationship between various industries and the technology they export.

1. Exports

The major exporters in FY 1994 were the automobile, electrical equipment supplies, communications/measuring instruments, machinery, and iron/steel sectors, in that order. While the share for communications/measuring instruments declined for two straight years, that for automobiles rose sharply year-to-year to place the sector in the forefront of technology exporters. Other noteworthy changes were the significant decline in pharmaceuticals and the growth in machinery and iron/steel. Table 6-1 refers.

Table 6-1: Export Contracts By Industrial Sector

	FY 1992			FY 1993			FY 1994		
	Sector	No.	shr	Sector	No.	shr	Sector	No.	shr
1	Comm/measuring	110	15.4%	Comm/measuring	79	12.6%	Autos	97	13.3%
2	Autos	88	12.4%	Elec eqpmt supplies	61	9.7%	Elec eqpmt supplies	77	10.5%
3	Elec eqpmt supplies	70	9.8%	Integrated chems	56	8.9%	Comm/measuring	73	10.0%
4	Integrated chems	54	7.6%	Pharmaceuticals	51	8.1%	Machinery	67	9.2%
5	Machinery	50	7.0%	Autos	50	8.0%	Iron/steel	62	8.5%
6	Nonferr metals	38	5.3%	Machinery	49	7.8%	Integrated chems	52	7.1%
7	Iron/steel	36	5.1%	Iron/steel	42	6.7%	Oils/paints	33	4.5%
8	Pharmaceuticals	35	4.9%	Oils/paints	38	6.1%	Nonferr metals	33	4.5%
9	Oils/paints	28	3.9%	Nonferr metals	32	5.1%	Other transport eqpmt	27	3.7%
10	Ceramics	28	3.9%	Other transport eqpmt	28	4.5%	Pharmaceuticals	26	3.6%
11	Construction	25	3.5%	Ceramics	26	4.2%	Metal products	24	3.3%
12	Other transport eqpmt	25	3.5%	Foods	23	3.7%	Precisions	23	3.2%
13	Foods	19	2.7%	Construction	16	2.6%	Textiles	20	2.7%
14	Textiles	18	2.5%	Textiles	13	2.1%	Ceramics	20	2.7%
15	Metal products	16	2.2%				Other chems	20	2.7%
	Others	72	10.1%	Others	62	9.9%	Others	76	10.4%
	Totals	712	100.0%	Totals	626	100.0%	Totals	730	100.0%

2. Characteristics By Industry

Tables 6-2-1 ~ 15 show the numbers of export contracts and their content for the top 15 sectors with 20 or more contracts each for the year under review. The trends are seen in Table 6-3 and the region/area breakdown in Table 6-4. Individual characteristics are highlighted for the top 6 sectors with 50 or more export contracts each.

(1) Motor Vehicles

In this sector enterprises carrying out technology exports accounted for 57.5%, more than double the all-industry average. Its share of all-industry contracts advanced 5.3 percentage points year-to-year to 13.3% based on numbers of contracts.

By country, the ratios of the U.S. and Korea advanced, but the characteristic here is that a wide range of 29 countries/areas were involved. The ratio of exports to Asia, at 55.7%, was slightly down on an all-industry comparison.

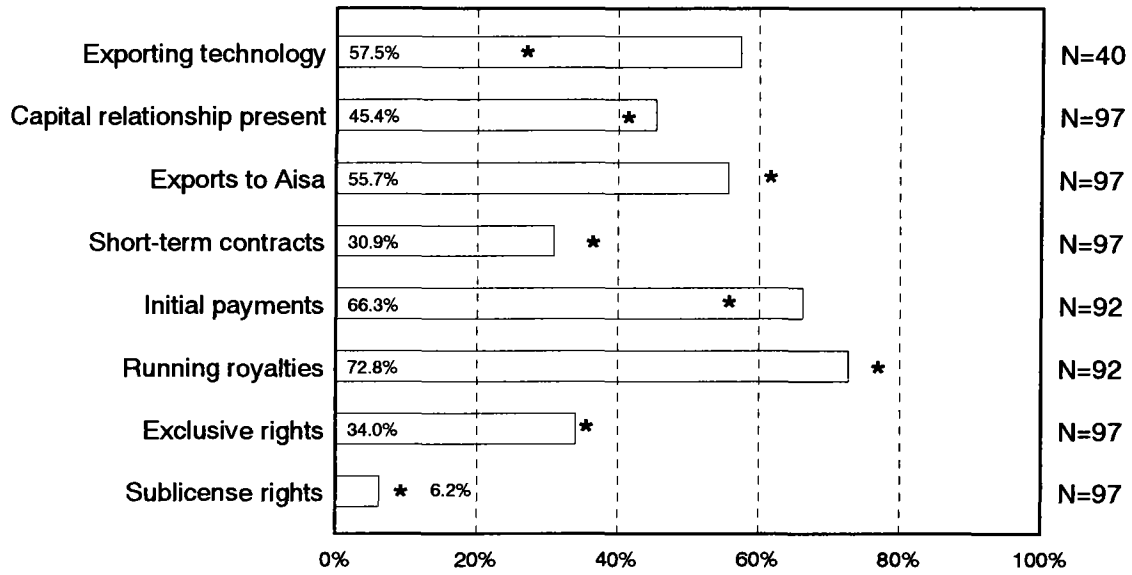
The trend in respect of contract content followed the all-industry average closely, though the initial payments ratio was higher and that of running royalties lower.

Machinery accounted for about 70% of technology export content, of which transportation equipment had a very high 64.9%, while in the electricals group (with slightly less than 30%) software had 24.7%. See Table 6-2-1 and Fig. 6-1.

Table 6-2-1: Content of Automobile Technology Exports

Sector (No. contracts)	Content (No. contracts)
Transportation equipment (63)	Automobile [body-related] (17), automobile [transmission-related] (10), automobile [engine-related] (9), automobile [control/ instrument-related] (4), automobile [heater/ airconditioning-related] (3), automobile [emission-related] (2), motorbike-related (9), truck-related (4), ship-related (3), bus-related (2)
Computers (24)	Software (24)
Other (10)	Industrial robots (3), environmental equipment (2), lighting supplies for autos (2), parking facilities (1), weight scales (1), others (1)

Figure 6-1: Trend of Automobile Export Contracts

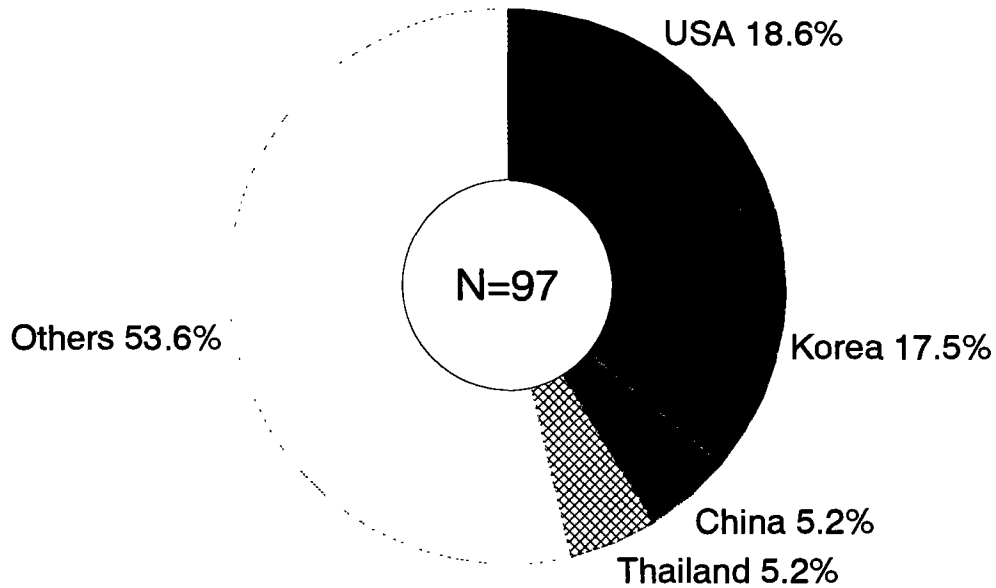


(a) Contract Content

* denotes all-industry average

[Note: "Short-term contracts" refers to those with less than 5 years to expiry.]

(b) Export Partners By Country/Area



(2) Electrical Machinery Fittings

Of the companies undertaking technology exports, 38.3% were active in this sector, or slightly over 10% of the all-industry average. Over the past 3 years there has been almost no change in its share of all-industry numbers of contracts.

By area, China leads with about 30%; except for the U.S., Asia accounts for 77.9%.

By contract content, the following predominate: capital participation exists, the running royalty ratio is high, and the share of exclusive rights is low.

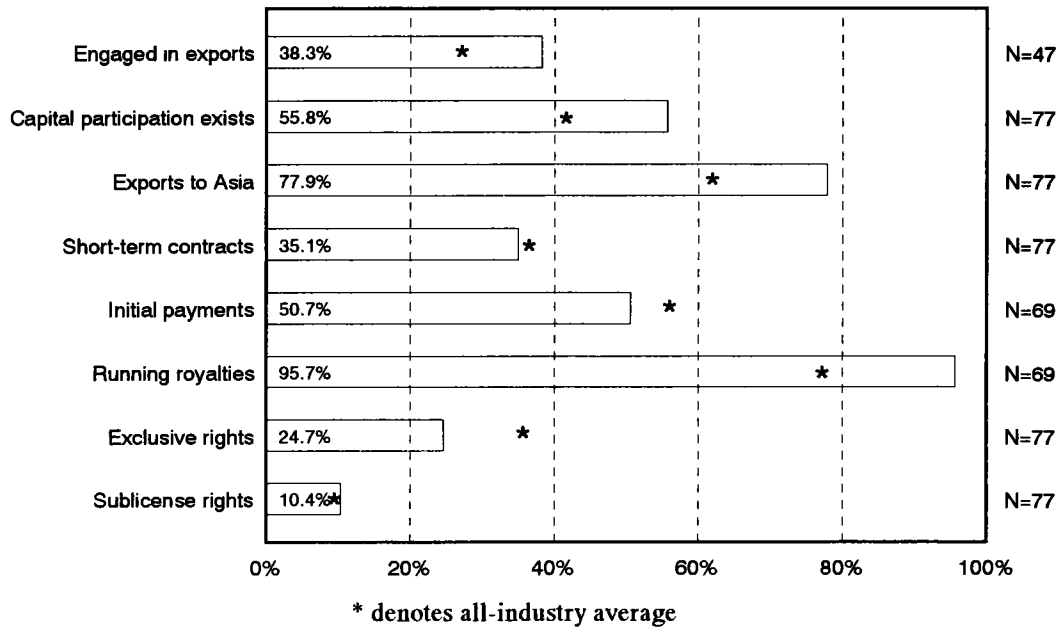
A look at the content of the technology exported shows the electrical group high at 70.1%, followed by machinery with 20.8%. Within the former the lead is held by the electric power/industrial electricals sector with 22.1%, while the combined share of home electronics and electronics/communications parts has declined. In the machinery group the metal processing equipment and transport equipment sectors show gains--especially for automobile electricals and car audio. Table 6-2-2 and Fig. 6-2 analyze 77 contracts related to this sector.

Table 6-2-2: Content of Electrical Machinery Fitting Contracts

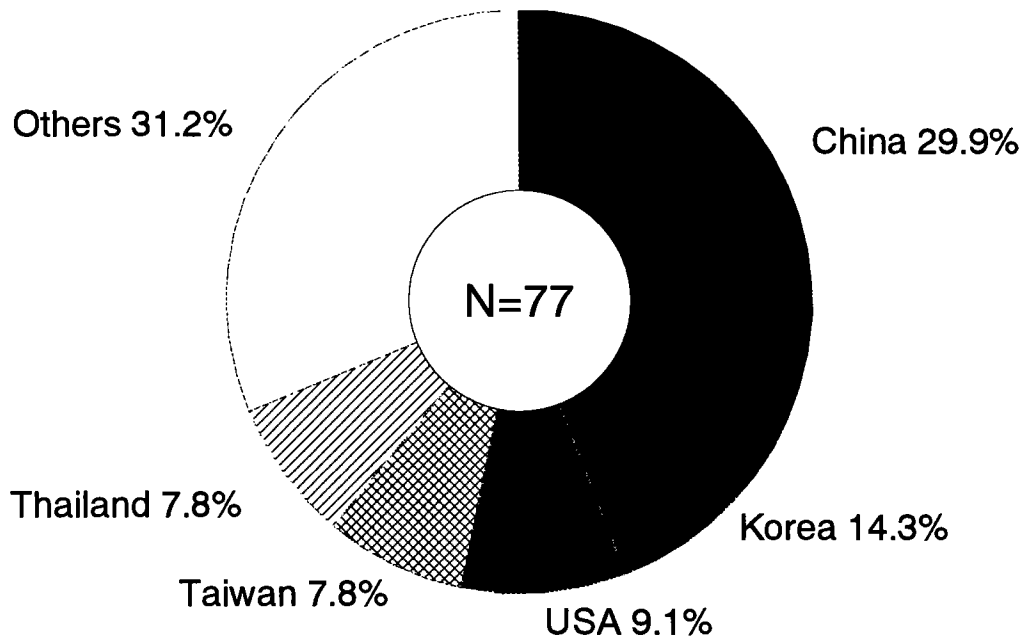
Sector	Content
Electric power/industrial electricals (17 contracts)	Auto electrical parts (10), electric power transformer devices (4), switching devices (1), others (2)
Home electricals (9)	Airconditioning (2), auto lighting (2), refrigeration (1), microwave ovens (1), electric cutters (1), others (2)
Other electricals (7)	Condensers (5), dry batteries (1), solar batteries (1)
Electronic/communications parts (6)	Electronic parts (5), semiconductors (1)
Others (38)	Motor fittings (6), car audio (4), automotive metal fittings (3), TV/audio (3), software (2), computer peripherals (2), organic chemicals (2), electric power meters (2), metals products for construction (2), fax machines (2), copiers (1), cordless telephones (1), auto parts (1), others (4)

Figure 6-2: Trends of Electrical Machinery Fittings Contracts

(1) Contract Content



(2) Exports By Country/Area



(3) Communications/Electrical Measuring Instruments

At 27.5%, the ratio of companies exporting this sector's technology is almost the same as the all-industry average. The number of contracts in relation to that average has declined for two years running--in FY 1994 by 5.4 percentage points to 10.0%.

By country, the U.S.'s share is highest at 17.8%, but to the Asian area as a whole it is about 70%.

Contracts in which there is a capital relationship with the partner lead, but those of short-term duration and those involving initial payments are at the low end.

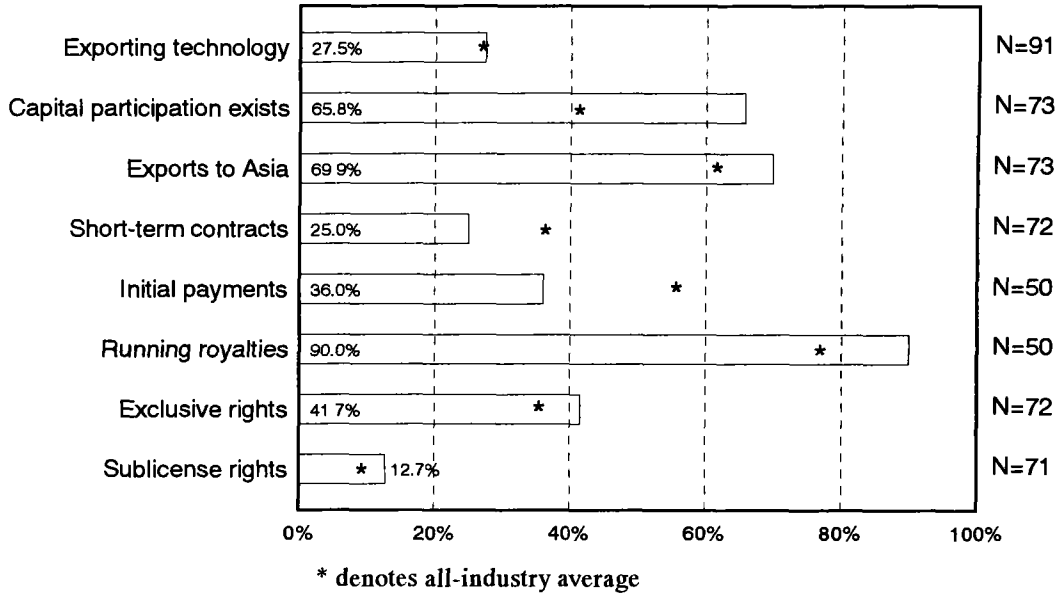
By technology content, we note that nearly 90% is accounted for by such sectors as electronic/communications parts, computers, wired/wireless communications equipment, home appliances, etc., in the electrical group--a great variance from the preceding sector. Table 6-2-3 and Fig. 6-3 analyze the 73 contracts relevant here.

Table 6-2-3: Technology Content of Communications/Electrical Measuring Instruments Sector

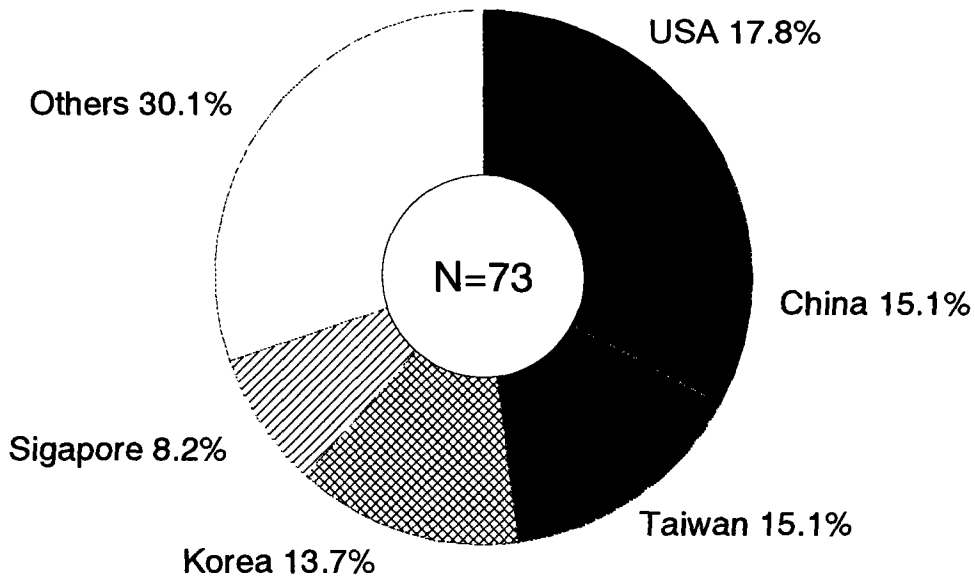
Technology Sector	Content
Electronic/communications parts (24)	Electronic parts (17), semiconductors (6), others (1)
Computers (15)	Software (9), floppy disks (3), magnetic tape (1), others (2)
Wired/wireless communications gear (8)	Communications-related technology (8)
Home appliances (8)	Refrigerators (1), washing machines (1), dryers (1), microwave ovens (1), airconditioners (1), others (3)
Others (18)	TV/audio (3), printing equipment (3), ink ribbons (2), motors (2), car audio (1), railroad-related (1), gas devices (1), testing equipment (1), control devices (1), others (3)

Figure 6-3: Trends In Communications/Electrical Measuring Instruments

(1) Contract Content



(2) Exports By Country/Area



(4) Machinery

Some 30% of exporting companies are active in this group--about the same as the all-industry average. Numbers of all-industry contracts have risen for two straight years, up this year by 2.2 percentage points over FY 1992, to 9.2%.

By country/area, the U.S. and Korea lead with more than 20% each. Asia's 55.2% ratio is slightly lower.

By contract content, the shares of running royalties and exclusive rights are very high, with short-term contracts slightly on the low side.

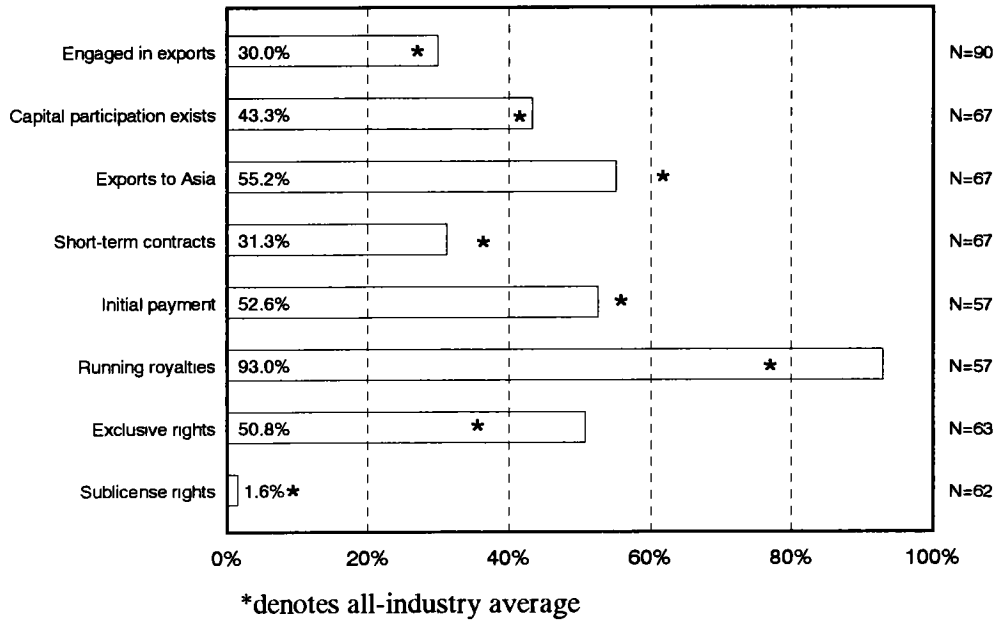
The content of the exported technology finds the machinery group exceeding 80%. Within this we see high quantities for the transport equipment and other machinery sectors. Table 6-2-4 and Fig. 6-4 analyze the 67 relevant contracts.

Table 6-2-4: Content of Machinery Technology Exports

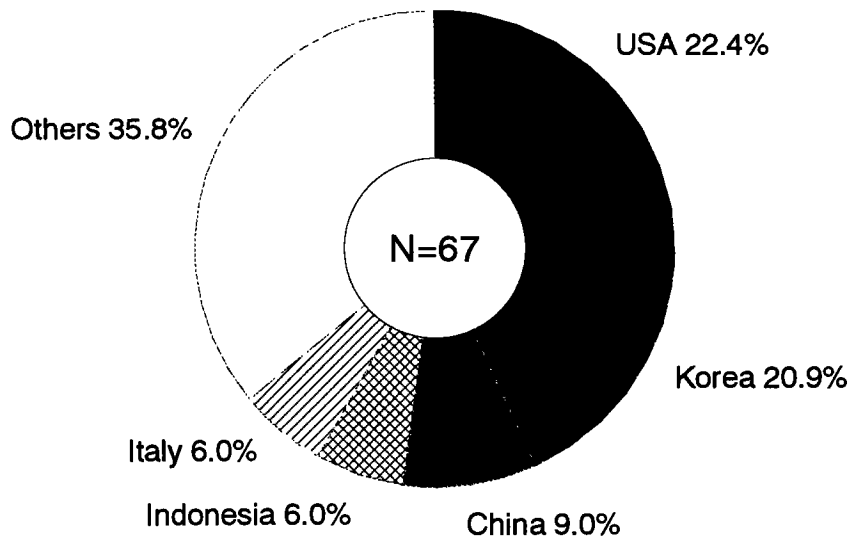
Sector	Content
Transport equipment (13)	Automobile parts (13)
Other machinery (13)	Sewing machines (5), industrial robots (2), bearings (2), office equipment (2), others (2)
Other industrial machinery (9)	Hydraulic equipment (6), sintering furnaces (1), carwash machinery (1), safety devices (1)
Metal processing machinery (6)	Machine tools (5), machinery fittings (1)
Chemical machinery (5)	Environmental facilities machinery (5)
Others (21)	Software (3), Diesel engines (2), construction machinery (2), weight scales (2), pumps/compressors (2), engines (1), boilers (1), printers (1), textile machinery (1), fax machines (1), cooling/refrigeration devices (1), pharmaceuticals (1), inorganic chemicals (1), others (2)

Figure 6-4: Trends In Machinery Export Contracts

(1) Contract Contents



(2) Contracts By Country/Area



(5) Iron and Steel

The ratio of companies engaged in exporting this group's technology was 40.6%, or about 10% greater than the all-industry average. The ratio based on the all-industry number of contracts rose for two straight years and was up 3.4 points to 8.5% compared to FY 1992.

By country/area, both the U.S. and China had shares of slightly below 20%. The aggregate for Asia, at 54.8%, was slightly lower than the all-industry average.

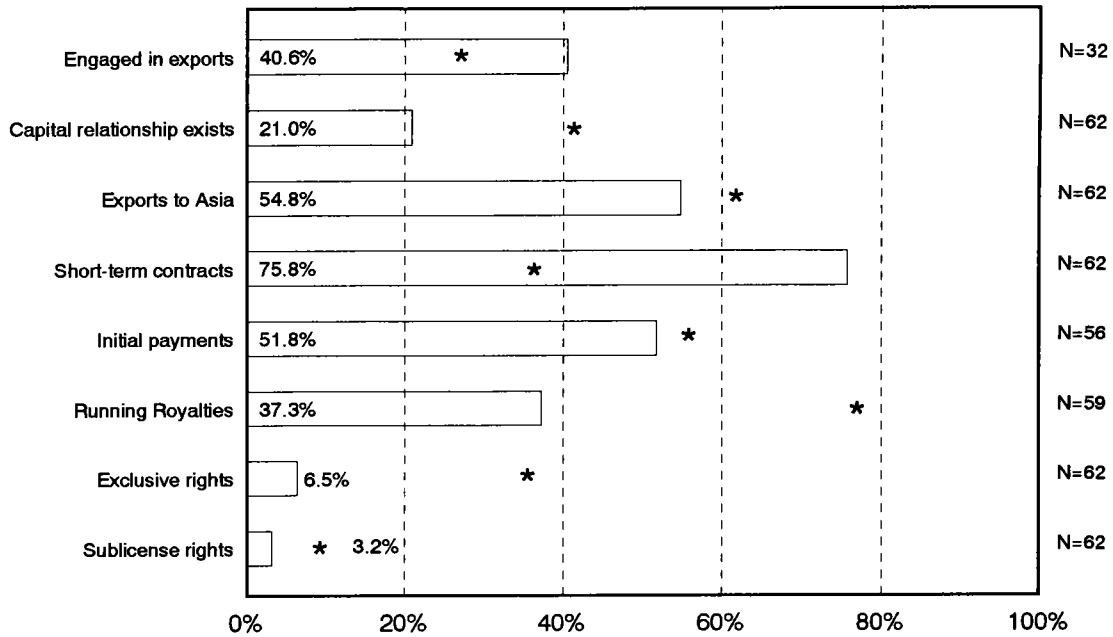
By contract content, we see that short-term contracts had a very high ratio, while the proportions for capital participation, running royalties and exclusive rights were extremely low; there were thus wide variations from the all-industry averages.

And by technology content the metals group was of course in the lead with 95.2%. In more detail, iron/steel retained an approximate 75% share. Table 6-2-5 and Fig. 6-5 analyze the 62 contracts relevant here.

Table 6-2-5: Content of Iron/Steel Technology Exports

Sector	Content
Iron/steel (45)	Production technology (42), fabrication technology (3)
Metal products (8)	Metal processing (3), joints (2), magnets (2), others (1)
Nonferrous metals (6)	Aluminum (5), others (1)
Others (3)	Auto parts (2), compressors (1)

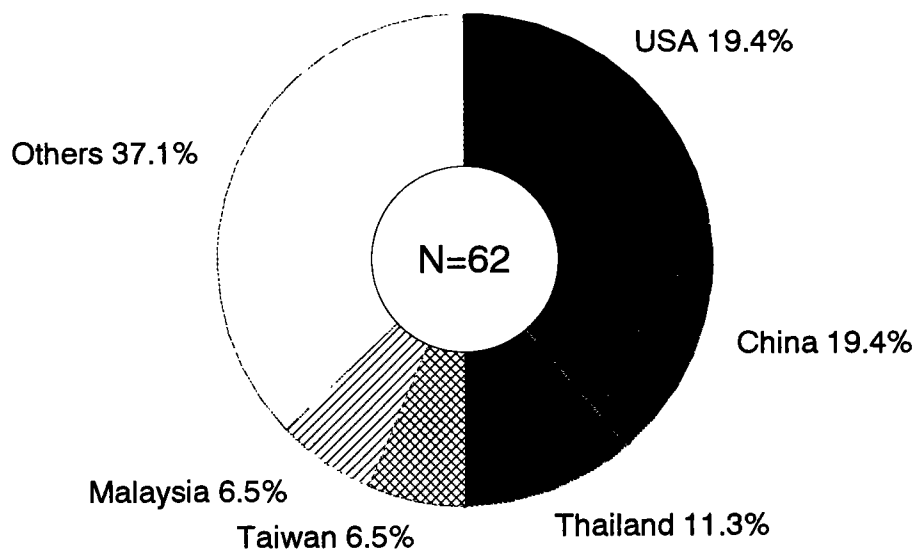
Figure 6-5: Trends in Iron/steel Export Contracts



(1) Contract Content

* denotes all-industry average

(2) Contracts By Country/region



(6) Integrated Chemicals

In this group technology exporting companies account for about 40%, or roughly 10% more than all-the industry average. As a proportion of the all-industry figure, the number of contracts shrank by 1.8 points to a 3-year low of 7.1%.

By export destination, the top 3 countries (USA, Korea, Taiwan) accounted for the majority of contracts. At 67.3% the share of Asia was slightly higher than the all-industry average.

In respect of contract content, the initial payments ratio was a very high 80%, while those for short-term contracts and exclusive rights were low.

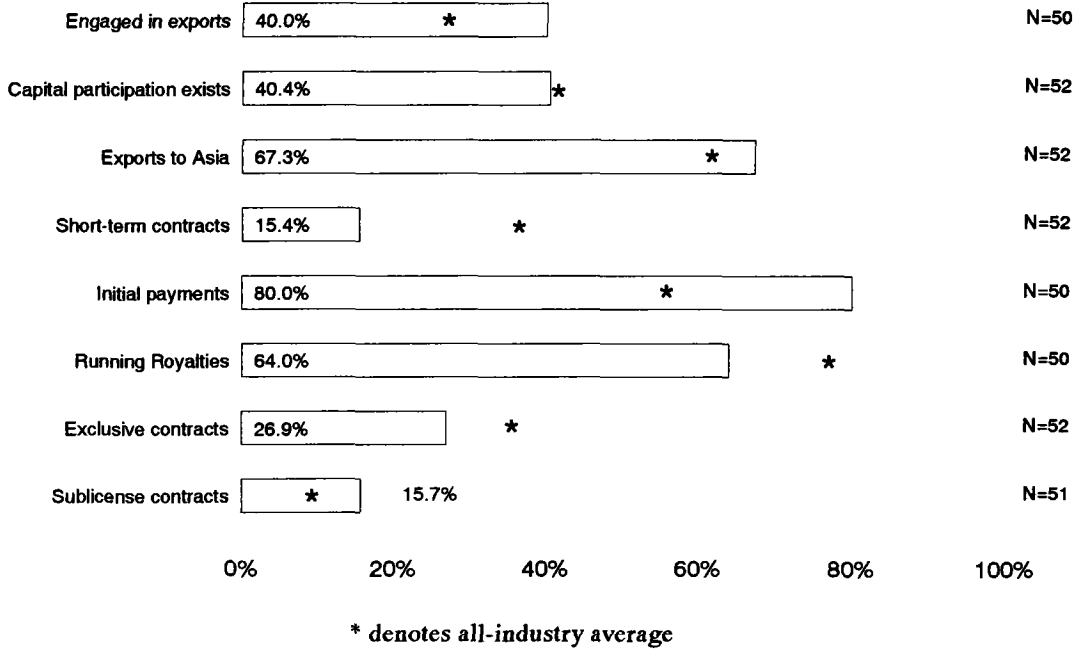
The numbers for contract content naturally showed a high reading (84.6%) for the chemicals group. Within it organic chemicals had nearly 60%. Table 6-2-6 and Fig. 6-6 analyze the 52 relevant contracts.

Table 6-2-6: Export Contracts of the Integrated Chemicals Group

Sector	Content
Organic chemicals (30)	Plastic/resin-related (21), raw/base
materials-related (6), others (3)	
Other chemicals products (6)	Natural resins (3), adhesives (2), others (1)
Pharmaceuticals (3)	Pharmaceuticals (3)
Others (13)	Environmental facility machinery (2), plastic products (2), textile products (2), foods (2), inorganic chemicals (1), chemical textiles (1), paper (1), petroleum products (1), construction (1)

Figure 6-6: Trend of Integrated Chemical Contracts

(1) Contract Content



(2) Contracts By Country/Area

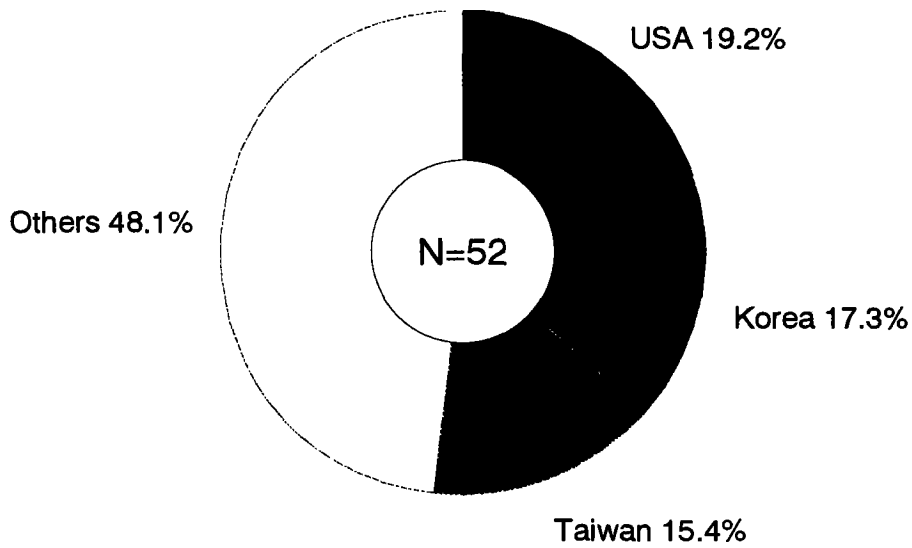


Table 6-2-7: Edible Oils/paint Contract Content

Sector	Content
Oils/paint (27)	Paint (21), inks (5), surface activating compounds (1)
Organic chemicals (4)	Resin-related (4)
Plastic products (2)	Plastic products (2)

Table 6-2-8: Nonferrous Metal Contract Content

Sector	Content
Nonferrous metals (19)	Wiring/cable (16), aluminum (1), others (2)
Transport equipment (6)	Auto parts (6)
Others (8)	Metal products (2), semiconductors (1), electronic parts (1), construction (1), plastic products (1), displays (1), others (1)

Table 6-2-9: Other Transport Equipment Contract Content

Sector	Content
Transport equipment (9)	Auto parts (2), aircraft (2), ships (2), railroads (1), automobiles (1), trucks (1)
Chemicals machinery/devices (4)	Environmental facility machinery (4)
Construction machinery (3)	Construction machinery (3)
Electric motors (3)	Parking facilities (2), others (1)
Others (8)	Electrical wiring for autos (2), metal processing, machinery (1), airconditioners (1), sintering furnaces (1), Diesel engines (1), others (2)

Table 6-2-10: Pharmaceutical Contract Content

Sector	Content
Pharmaceuticals (24)	Pharmaceuticals (24)
Other chemical products (2)	Dyes (2)

Table 6-2-11: Metal Products Contract Content

Sector	Content
Metal products (14)	Automobile fittings (5), welding equipment (3), screws (2), metal wiring products (2), bridges (1), welding rods (1)
Others (10)	Machinery fittings (2), plastic products (2), rubber products (2), chemical textiles (2), auto parts (1), parking equipment (1)

Table 6-2-12: Precision Equipment Contract Content

Sector	Content
Precision equipment (17)	Cameras (14), measuring instruments (2), medical instruments (1)
Others (16)	Software (1), semiconductors (1), electronic parts (1), video equipment (1), copiers (1), test chemicals (1)

Table 6-2-13: Textile Contract Content

Sector	Content
Textiles (6)	Dye adjusters (3), yarn (2), knit goods (1)
Other garments/textile products (4)	Textile products (4)
Transport equipment (4)	Auto parts (4)
Others (6)	Chemical textiles (2), organic chemicals (2), textile machinery (1), outerwear (1)

Table 6-2-14: Ceramics Contract Content

Sector	Content
Ceramics (13)	Pottery (5), fireproof materials (3), cement (2), glass (1), tile (1), enamel (1)
Inorganic chemicals (3)	Inorganic chemical products (3)
Others (4)	Metal fittings (1), auto parts (1), construction (1), others (1)

Table 6-2-15: Other Chemicals Contract Content

Sector	Content
Other chemical products (17)	Agricultural chemicals (10), adhesives (3), metal surface processing compounds (3), others (1)
Organic chemicals (2)	Resin-related (2)
Inorganic chemicals (1)	Inorganic chemicals (1)

Table 6-3: Analytical Results By Sector

Sector	Exporting		Cap. interest		Export to Asia		Short contracts	
	FY 93	FY 94	FY 93	FY 94	FY 93	FY 94	FY 93	FY 94
ALL	23.6%	27.0%	31.2%	40.8%	56.2%	61.8%	31.3%	35.4%
Autos	36.8%	57.5%	26.0%	45.4%	48.0%	55.7%	26.0%	30.9%
Elec. eqpmt	29.8%	38.3%	47.5%	55.8%	77.0%	77.9%	23.0%	35.1%
Comm/measuring	27.8%	27.5%	43.0%	65.8%	65.8%	69.9%	49.4%	25.0%
Machinery	29.1%	30.0%	30.6%	43.3%	79.6%	55.2%	34.7%	31.3%
Iron/steel	34.5%	40.6%	9.5%	21.0%	42.9%	54.8%	52.4%	75.8%
Integrated chems	35.9%	40.0%	33.9%	40.4%	50.0%	67.3%	8.9%	15.4%
Oils/paints	50.0%	46.2%	42.1%	57.6%	50.0%	69.7%	52.6%	27.3%
Nonferr metals	44.4%	33.3%	31.2%	66.7%	59.4%	75.8%	31.3%	24.2%
Other trspt eqpmt	36.4%	50.0%	14.3%	25.9%	64.3%	70.4%	28.6%	25.9%
Pharmaceuticals	42.5%	31.3%	17.6%	19.2%	27.5%	38.5%	3.9%	7.7%
Metal products	7.1%	30.3%	22.2%	25.0%	66.7%	58.3%	66.7%	45.8%
Precisions	17.6%	43.8%	25.0%	8.7%	75.0%	65.2%	50.0%	82.6%
Textiles	20.8%	45.8%	7.7%	33.3%	69.2%	75.0%	61.5%	50.0%
Ceramics	30.0%	27.3%	38.5%	45.0%	61.5%	70.0%	11.5%	10.5%
Other chemicals	17.6%	31.6%	80.0%	65.0%	80.0%	45.0%	20.0%	45.0%

Sector	Initial payments		Run royalties		Exclusive rights		Sublicense rights	
	FY 93	FY 94	FY 93	FY 94	FY 93	FY 94	FY 93	FY 94
ALL	62.6%	55.5%	76.8%	76.8%	34.6%	34.3%	13.6%	8.8%
Autos	76.0%	66.3%	72.0%	72.8%	14.3%	34.0%	0.0%	6.2%
Elec. eqpmt	60.9%	50.7%	93.5%	95.7%	9.8%	24.7%	3.3%	10.4%
Comm/measuring	46.2%	36.0%	90.4%	90.0%	15.2%	41.7%	6.3%	12.7%
Machinery	62.8%	52.6%	83.7%	93.0%	44.9%	50.8%	4.1%	1.6%
Iron/steel	36.8%	51.8%	73.7%	37.3%	14.3%	6.5%	7.1%	3.2%
Integrated chems	71.4%	80.0%	75.5%	64.0%	39.3%	26.9%	14.3%	15.7%
Oils/paints	76.3%	39.4%	94.7%	90.9%	57.9%	45.5%	50.0%	9.1%
Nonferr metals	66.7%	69.7%	59.3%	75.8%	19.4%	28.1%	16.1%	3.0%
Other trspt eqpmt	84.6%	73.9%	92.3%	92.0%	50.0%	55.6%	3.6%	3.7%
Pharmaceuticals	44.4%	63.2%	83.3%	57.9%	64.7%	50.0%	29.4%	26.9%
Metal products	77.8%	52.6%	55.6%	73.7%	77.8%	65.2%	11.1%	17.4%
Precisions	25.0%	22.7%	100.0%	95.5%	55.6%	17.4%	0.0%	4.3%
Textiles	71.4%	69.2%	41.7%	69.2%	15.4%	35.0%	0.0%	10.0%
Ceramics	76.9%	56.3%	84.6%	88.2%	53.8%	36.8%	11.5%	5.3%
Other chemicals	80.0%	40.0%	80.0%	90.0%	60.0%	45.0%	25.0%	5.0%

Table 6-4: Sectoral Exports By Country/Area

	Automobiles				Electrical equip.				Communications/measuring gear			
	FY 93		FY 94		FY 93		FY 94		FY 93		FY 94	
	A	B	A	B	A	B	A	B	A	B	A	B
1	Korea	12	USA	18	China	21	China	23	USA	14	USA	13
2	USA	5	Korea	17	Korea	8	Korea	11	China	12	China	11
3	Britain	4	China	5	USA	7	USA	7	Korea	11	Taiwan	11
4	Germany	4	Taiwan	5	Taiwan	7	Taiwan	6	Taiwan	9	Korea	10
5	Taiwan	4	Britain	4	India	3	Thailand	6	Thailand	4	Singapore	6
6	Hungary	3	Spain	4	Hongkong	3	India	5	Hongkong	4	Malaysia	5
7	Thailand	3	Malaysia	4	Canada	2	Indonesia	4	Britain	3	Germany	3
8	Malaysia	3	Indonesia	4	Germany	2	Germany	3	France	3	Hongkong	3
9	Mexico	3			Thailand	2	Malaysia	3	Malaysia	3	Thailand	2
10									Singapore	3	India	2
	Others	9	Others	36	Others	6	Others	9	Others	13	Others	7
	Total	50	Total	97	Total	61	Total	77	Total	79	Total	73

A = Country B = Number of contracts

	Machinery				Iron/steel				Integrated chemicals			
	FY 93		FY 94		FY 93		FY 94		FY 93		FY 94	
	A	B	A	B	A	B	A	B	A	B	A	B
1	Korea	25	USA	15	USA	8	USA	12	USA	14	USA	10
2	USA	6	Korea	14	Britain	6	China	12	Korea	8	Korea	9
3	China	4	China	6	Korea	4	Thailand	7	Taiwan	5	Taiwan	8
4	Taiwan	4	Italy	4	Indonesia	4	Taiwan	4	Germany	4	China	4
5	Thailand	3	Indonesia	4	Taiwan	3	Malaysia	4	China	4	Thailand	4
6	Italy	2	Germany	3	Canada	2	Australia	3	Thailand	4	Indonesia	4
7			Taiwan	3	China	2	India	3	Britain	3	Singapore	4
8			Thailand	3	Malaysia	2	Brazil	3	Indonesia	3	Belgium	3
9			Malaysia	2	Singapore	2	France	2	Singapore	3		
10			India	2								
	Others	5	Others	11	Others	9	Others	12	Others	8	Others	6
	Total	49	Total	67	Total	42	Total	62	Total	56	Total	52

A = Country B = Number of contracts

	Oils/paints				Nonferr metals				Other transport equipment			
	FY 93		FY 94		FY 93		FY 94		FY 93		FY 94	
	A	B	A	B	A	B	A	B	A	B	A	B
1	China	4	Korea	6	China	7	Taiwan	7	Korea	10	Korea	11
2	Britain	3	Thailand	6	USA	6	USA	5	USA	4	China	5
3	Germany	2	China	4	Taiwan	3	Korea	4	Italy	3	USA	3
4	Holland	2	USA	3	Australia	3	China	4	China	3	India	2
5	Korea	2	Taiwan	3	Sweden	2	Malaysia	4	Taiwan	2		
6	Taiwan	2	Germany	2	Korea	2	Thailand	3	Thailand	2		
7	India	2	India	2	Malaysia	2	Indonesia	2				
8	Philippines	2										
9	Australia	2										
10	New Zealand	2										
	Others	15	Others	7	Others	7	Others	4	Others	4	Others	6
	Total	38	Total	33	Total	32	Total	33	Total	28	Total	27

A = Country B = Number of contracts

	Pharmaceuticals				Metal products				Precision equipment			
	FY 93		FY 94		FY 93		FY 94		FY 93		FY 94	
	A	B	A	B	A	B	A	B	A	B	A	B
1	USA	7	USA	3	Korea	3	Taiwan	8	Korea	2	Korea	5
2	Germany	6	Germany	3	India	2	USA	5	USA	1	Taiwan	5
3	China	5	Britain	2	USA	1	China	2	China	1	USA	4
4	France	3	France	2	Germany	1					Germany	3
5	Italy	3	Spain	2	China	1					Honkong	3
6	Korea	3	Korea	2	Mexico	1						
7	Taiwan	3	China	2								
8	Mexico	3	Philippines	2								
9	Chile	3										
10												
	Others	15	Others	8	Others	0	Others	9	Others	0	Others	3
	Total	51	Total	26	Total	9	Total	24	Total	4	Total	23

A = Country B = Number of contracts

	Textiles				Ceramics				Other chemicals			
	FY 93		FY 94		FY 93		FY 94		FY 93		FY 94	
	A	B	A	B	A	B	A	B	A	B	A	B
1	France	3	China	6	China	6	China	8	China	2	USA	3
2	Thailand	3	USA	3	India	5	Taiwan	3	Thailand	2	Thailand	3
3	Indonesia	3	Thailand	3	Britain	3	USA	2	USA	1	Korea	2
4	Taiwan	2	Germany	2	USA	2	Korea	2			China	2
5			Korea	2	Korea	2	Brazil	2			Taiwan	2
6			Taiwan	2	Brazil	2					Australia	2
7												
8												
9												
10												
	Others	2	Others	2	Others	6	Others	3	Others	0	Others	6
	Total	13	Total	20	Total	26	Total	20	Total	5	Total	20

A = Country B = Number of contracts

VII. Analysis results regarding capital relationship and the number of technological exports

1. Change in the number of technological exports to export partners with and without capital relationship

As mentioned in Chapter 3, among technological exports from Japan in the Fiscal Year of 1994, technological exports to non-related companies account for 59.2% and those to related companies account for 40.8%; the majority of technological exports during three years were to non-related companies. (see Fig. 3-7)

An interesting feature emerges when changes of technical exports are categorized in terms of capital relationship. The number of technological exports to non-related companies in FY 1992 was 461, that in FY 1993 was 431 with a decrease of 6.5% and that in FY 1994 was 431: there is no increasing trend. By contrast, technological exports to related companies were 249 in FY 1992, changing to 195 in FY 1993, a 21.7% decrease in comparison to previous fiscal year. However, in FY 1994 the number of exports to related companies increased to 297, an increase of 52.3% in comparison to that of previous fiscal year. (see Table 7-1)

A quantity closely related to the number of technological exports to related companies is the change in overseas investment. Statistics reported by the Ministry of Finance show Japan's overseas investment started to decrease in 1989. In FY 1992, Japan's overseas investment exhibited a big fall to 34.138 billion dollars, representing a 17.9% reduction in comparison to that of the previous fiscal year. However, in FY 1993 there was a 5.5% increase compared with the previous fiscal year. This trend continued into the following fiscal year with an increase of 14.0% to reach 41.51 billion dollars. When Japan's overseas investment is calculated specifically for manufacturing industry, there was a decreasing trend in FY 1992. However, in 1993 Japan's overseas investment started to increase to reach 13.783 billion dollars in FY 1994, an increase of 23.8% in comparison to the previous fiscal year. This increase in Japan's overseas investment sum coincides with the similar trend shared by the number of technological exports to related companies. (see Table 7-2)

A trend to a higher exchange rate for the yen culminated in a break through the one dollar to 100 yen rate in FY 1994. Because of the large difference between manufacturing costs for domestic products and those for overseas products, direct investment for the transfer of manufacturing bases overseas were promoted as one countermeasure. In line with this trend, technologies necessary for local production seem to have been exported in large quantities in FY 1994. (see Table 7-3)

Thus, changes in the number of technological exports during the period from FY 1992 to FY 1994 were seen to have been largely influenced by the change in the number of exports to related companies rather than that to non-related companies. Given this knowledge, we attempt to analyze the change of technological exports to related companies in terms of exporting destination and technological content.

Table 7-1 Change in number of technological exports with and without capital relationship

	Without capital relationship		With capital relationship		Total	
	Number of cases	Ratio between current year and previous year	Number of cases	Ratio between current year and previous year	Number of cases	Ratio between current year and previous year
FY 1992	461	—	249	—	712	—
FY 1993	431	-6.5%	195	-21.7%	626	-12.1%
FY 1994	431	0.0%	297	52.3%	730	16.6%

Table 7-2 Change in Japanese overseas direct investment
(Statistics reported by the Ministry of Finance, unit: one million dollars)

	Total		Manufacturing industry		Non-manufacturing industry	
	Sum	Ratio between current year and previous year	Sum	Ratio between current year and previous year	Sum	Ratio between current year and previous year
FY 1991	41,584	-26.9%	12,311	-20.5%	28,809	-29.1%
FY 1992	34,138	-17.9%	10,057	-18.3%	23,720	-17.7%
FY 1993	36,025	5.5%	11,131	10.7%	24,627	3.8%
FY 1994	41,051	14.0%	13,783	23.8%	26,877	9.1%

Citation from Japan Trade Promotion Association ("Overseas direct investment in the world and Japan")

Table 7-3 Change in yen/dollar exchange rate

Period	Average rate during corresponding period
January to March FY 1992	128.43
April to June	130.30
July to September	124.89
October to December	122.98
January to March FY 1993	121.01
April to June	110.06
July to September	105.57
October to December	108.14
January to March FY 1994	107.62
April to June	103.33
July to September	99.05
October to December	98.83
January to March FY 1995	93.11

Citation from "Overseas economic data" by the Economic Planning Agency

2. Change of the number of exports to related companies by export destination regions

Comparing change of the number of exports to related companies and that of the number of exports to non-related companies, we notice not only a large variation in total number of exports but also a great change in the distribution of destinations.

In FY 1992, there were 52 exports to North America (20.9% of total exports), 37 exports to Europe (14.9% of total exports) and 147 exports to Asia (59.0% of total exports). However, in FY 1993 there was a large drop in the number of exports to North America and Europe (42.3% and 45.9% reduction compared to previous year, respectively). Since FY 1994, the number of exports to Asia has shown a great increase (56.4% increase compared to previous year), the proportion of exports going to North America fell to 16.5% and to Europe 8.1% while those to Asia advanced to 73.7%. The Asian proportion of exports to related companies increased. (see Fig. 7-1)

Furthermore, in FY 1992 the higher ranked countries/regions in terms of the number of exports to related companies were the United States, Republic of China and Southeast Asia countries. However, in FY 1993 the number of exports to related companies in these countries/regions fell greatly. On the other hand, the number of exports to related companies in China increased dramatically (from 12 to 44 exports) to become the largest exporting destination. In FY 1994, the number of exports to related companies in China further increased to account for 20.9% of total exports. On the other hand, in FY 1994 the number of exports to related companies in the Republic of China and Southeast Asian countries increased again. Of the top 9 countries/regions to which exports are sent to related companies, 8 countries except the United States of America are all in Asia without a European country in evidence. (see Table 7-4)

In relation to the change of the number of exports to related companies by geographic destination, looking at the change in direct investment for manufacturing industry, we notice the following changes. Direct investment for manufacturing industry in North America was recovering from the decreasing trends seen until FY 1992 since FY 1993 to reach 4.575 billion dollars in FY 1994. However, direct investment for manufacturing industry in Europe decreased rapidly until FY 1992 and decreased further to 1.855 billion dollars in FY 1994. On the other hand, direct investment for manufacturing industry in Asia was on a decreasing path until FY 1991. However, the trend turned up in FY 1992 to reach 5.181 billion dollars in FY 1994 an annual increase of 41.6% accounting for approximately 40% of the total overseas direct investment sum and Asia became the largest investment destination for Japan. (see Table 7-5)

The reduction in direct investment to Europe is not specific to Europe but is a worldwide trend. We believe that the large factor for the reduction comes from a pause in direct investment aimed at the integrated EC market. However, a more plausible reason for the reduction comes from the fact that Asia has become very attractive in terms of cheap manufacturing costs and investment acceptance policy. Based on this fact, Japanese manufacturing industry is trying to expand investment. As a result, most technological exports to related companies is directed toward Asia.

Fig. 7-1 Counterparty regions with and without capital relationship.

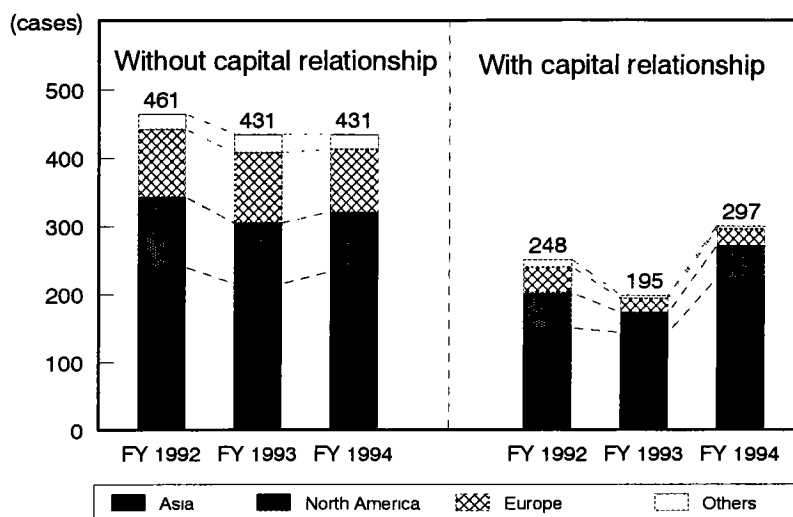


Table 7-4 Technological exports to related companies/higher ranked countries/regions

	FY 1992			FY 1993			FY 1994		
	Country	Number of cases	Proportion	Country	Number of cases	Proportion	Country	Number of cases	Proportion
1	U.S.A.	48	19.3%	China	44	22.6%	China	62	20.9%
2	Thailand	34	13.7%	U.S.A.	26	13.3%	U.S.A.	44	14.8%
3	Republic of China	24	9.6%	Thailand	20	10.3%	China	36	12.1%
4	Malaysia	22	8.8%	Korea	19	9.7%	Thailand	30	10.1%
5	Singapore	15	6.0%	China	16	8.2%	Korea	22	7.4%
6	United Kingdom	12	4.8%	Hong Kong	11	5.6%	Malaysia	19	6.4%
7	Republic of Korea	12	4.8%	Singapore	9	4.6%	Singapore	14	4.7%
8	People's Republic of China	12	4.8%	Malaysia	8	4.1%	Indonesia	13	4.4%
9	Indonesia	11	4.4%	India	6	3.1%	Philippines	8	2.7%
				Germany	5	2.6%			
	Other	59	23.7%	Other	31	15.9%	Other	49	16.5%
	Total	249	100.0%	Total	195	100.0%	Total	297	100.0%

Table 7-5 Change of direct investment sum to manufacturing industry by region (Statistics reported by the Ministry of Finance, Unit: one million dollars)

	North America		Europe		Asia		Total	
	Sum	Relative to previous year	Sum	Relative to previous year	Sum	Relative to previous year	Sum	Relative to previous year
FY 1991	5,559	-13.0%	2,690	-41.4%	2,928	-4.6%	12,311	-20.5%
FY 1992	3,784	-31.9%	2,101	-21.9%	3,104	6.0%	10,057	-18.3%
FY 1993	4,039	6.7%	2,041	-2.9%	3,659	17.9%	11,131	10.7%
FY 1994	4,575	13.3%	1,855	-9.1%	5,181	41.6%	13,783	23.8%

Citation from "Overseas direct investment in the world and in Japan" by Japan Trade Promotion Association

3. Change in number of exports to related companies by technological content

As expected, looking at the change in technological exports to related companies by technological field, the change is extremely large compared to technological exports to non-related companies.

Exports to non-related companies do not show a large variation for the three years with most accounted for by the "machinery" and "chemical" sectors. By contrast, looking at exports to related companies, in FY 1992 the "electrical" field had 93 cases (37.3% of the total), "machinery" field had 60 (24% of the total), "chemical" field had 31 (12.4%), "metals" field had 24 (9.6% of the total) and "miscellaneous" field had 41 (16.5% of the total). We notice a small decrease in the number of exports in the "electrical" field though the proportion occupied by this field remains very high and the number of exports in the "chemical" field increased for two consecutive years. The number of exports in the "machinery" field increased dramatically in FY 1994. In FY 1994, the numbers of exports were 88 (29.6%) in "electrical" field, 88 in "machinery" field (29.6%), 55 (18.5%) in "chemical" field, 32 in "metals" field (10.8%) and 34 in "miscellaneous" field (11.4%). The proportions occupied by the "machinery" and "chemical" fields increased from those in FY 1992. (see Fig. 7-2)

Focusing on technological exports to related companies in Asia by technological field, the change of the number of exports in the "machinery" and "chemical" fields shows a clear increasing trend. From FY 1992 to FY 1994, the number of exports in the "machinery" field doubled (30 to 60) and that in "chemical" tripled (15 to 45). (see Fig. 7-3)

Next, looking at the change in the number of exports to related companies by technological category, the increase in "transport machinery" is the largest. However, the number of exports in this category shows erratic fluctuation from 42 in FY 1992, 18 in FY 1993 and 54 in FY 1994. We can see the change in the number of exports in the "machinery" field fluctuated together with the number of exports in "transport machinery". In FY 1992, other than the category of "transport machinery", the "electrical" technologies such as "computers", "electric/communications parts" and "electrical household machines and equipment" were ranked higher. In FY 1994, in addition to these, technologies in the "chemical" field such as "oil and fat/paint", "organic chemical" and "other chemical products" showed an increase in the number of exports. Looking at the proportion accounted for by Asia in the change of technological exports to related companies by technological category, we notice that there are technology categories for which most exports are to destinations in Asia from FY 1992 on, for example see "electrical household machines and equipment." This increasing trend of technological exports to Asia is also seen in "transport machinery" (45.2% to 72.2%) and "electric/communications parts" (55.6% to 92.0%), where most of the export destinations are in Asia. However, with regard to "computers", since there are many software exports directed to North America, the proportion accounted for by Asia is low. (see Table 7-6)

Fig. 7-2 Technological field with and without capital relationship

(number of cases)

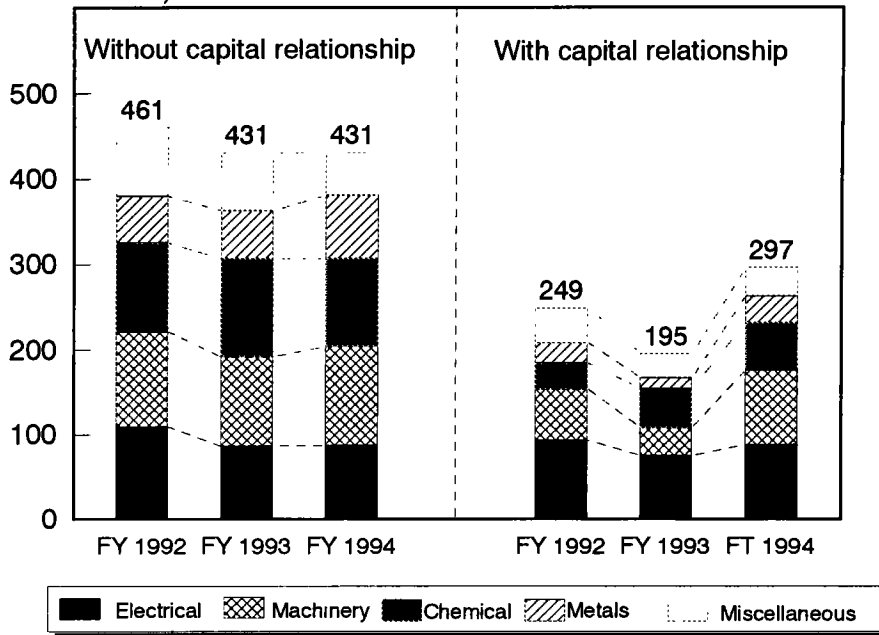


Fig. 7-3 Technological exports to Asia directed to related companies (by technological field)

(number of cases)

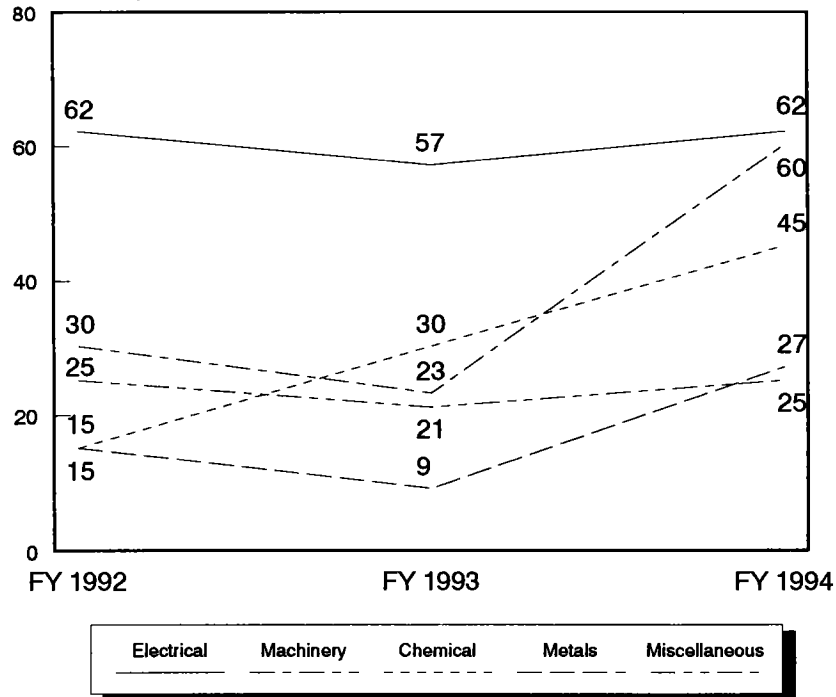


Table 7-6 Technological exports to related companies - high-ranking technological fields

	FY 1992				FY 1993				FY 1994			
	Technological category	Number of exports	Within Asia	Proportion accounted for by Asia	Technological category	Number of exports	Within Asia	Proportion accounted for by Asia	Technological category	Number of exports	Within Asia	Proportion accounted for by Asia
1	Transport machinery	42	19	45.2%	Transport machinery	18	12	66.7%	Transport machinery	54	39	72.2%
2	Computers	30	19	63.3%	Fat and oil/paint	18	13	72.2%	Computers	25	7	28.0%
3	Electric/communications parts	18	10	55.6%	Computers	17	11	64.7%	Electric/communications parts	25	23	92.0%
4	Electrical household machines and equipment	16	15	93.8%	Electric/communications parts	17	13	76.5%	Non-steel metals	18	15	83.3%
5	Metal products	11	6	54.5%	Electrical household machines and equipment	14	14	100.0%	Fat and oil/paint	15	15	100.0%
6	Rubber products	10	5	50.0%	Cable/wireless communications machinery	10	6	60.0%	Organic chemical	15	13	86.7%
7	Cable/wireless communications machinery	9	4	44.4%	Organic chemical	9	8	88.9%	Other chemical products	14	11	78.6%
8	Textiles	9	5	55.6%	Ceramics	9	7	77.8%	Electrical household machines and equipment	13	13	100.0%
9	Metal manufacturing machinery	8	7	87.5%	Radio/TV/Audio	7	4	57.1%	Metal manufacturing machinery	13	7	53.8%
10	Non-steel metals	8	6	75.0%	Other chemical products	7	4	57.1%	Metal products	10	9	90.0%
					Plastic products	7	5	71.4%				
	Other	88	51	58.0%	Other	62	43	69.4%	Other	95	67	70.5%
	Total	249	147	59.0%	Total	195	140	71.8%	Total	297	219	73.7%

With respect to changes of technological exports in "transport machinery", focusing on transport machines (*Footnote 14) of the above statistics on change in overseas direct investment reported by the Ministry of Finance, there was a large increase from FY 1993 to FY 1994 with a 114.5% year-on-year increase as shown in the figures of 1.188 billion dollars in FY 1992, 0.942 billion dollars in FY 1993 and 2.021 billion dollars in FY 1994.

Most of technologies in "transport machinery" are related to automobiles. A transfer of manufacturing bases overseas promoted due to the relative increase in domestic manufacturing costs in relation to overseas production caused by higher yen exchange rates, is also visible in the automobile industry. In addition to this, due to an increase in income in East Asia and Southeast Asia, demand for automobiles is increasing. To respond to these demands, necessary technologies seem to have been exported in large quantities to these overseas regions.

Also noticeable are increases in technological exports to related companies in such "chemical" fields as "fat and oil/paint" and "organic chemical." Advance made by the fat and oil/paint industry and the chemical industry, both of which are capital-intensive industries, seems to have been due to the increase in the number of users in the automobile industry and electrical machines and equipment industry rather than a search for cheaper personnel expenses.

14) The category "transport machines" used in statistics reported by the Ministry of Finance is a category in terms of industry rather than technological contents used in the present survey "transport machinery." Since these two entities have different meanings, care should be exercised when the statistics are interpreted.

(Reference) Technological exports to non-related companies

Table 7-7 Technological exports to non-related companies/higher ranked countries/regions

	FY 1992			FY 1993			FY 1994		
	Country	Number of cases	Proportion	Country	Number of cases	Proportion	Country	Number of cases	Proportion
1	USA	93	20.2%	Korea	85	19.7%	USA	80	18.6%
2	Korea	85	18.4%	USA	74	17.2%	Korea	79	18.3%
3	China	44	9.5%	China	36	8.4%	China	39	9.0%
4	China	29	6.3%	Republic of China	36	8.4%	China	37	8.6%
5	United Kingdom	23	5.0%	United Kingdom	25	5.8%	Germany	22	5.1%
6	Germany	19	4.1%	Germany	21	4.9%	Thailand	17	3.9%
7	Thailand	17	3.7%	Indonesia	15	3.5%	India	17	3.9%
8	India	16	3.5%	France	14	3.2%	United Kingdom	12	2.8%
9	France	13	2.8%	India	12	2.8%	Italy	12	2.8%
10	Indonesia	12	2.6%	Thailand	12	2.8%	Indonesia	11	2.6%
10	Malaysia	12	2.6%				France	11	2.6%
	Other	98	21.3%	Other	101	23.4%	Other	94	21.8%
	Total	461	100.0%	Total	431	100.0%	Total	431	100.0%

Table 7-8 Technological exports to non-related companies/categories of higher ranked technology

	FY 1992			FY 1993			FY 1994		
	Category name for technology	Number of cases	Proportion	Category name for technology	Number of cases	Proportion	Category name for technology	Number of cases	Proportion
1	Transportation machinery	57	12.4%	Transportation machinery	47	10.9%	Transportation machinery	54	12.5%
2	Drugs and medicines	38	8.2%	Drugs and medicines	44	10.2%	Steel	41	9.5%
3	Electrical/communications parts	29	6.3%	Metal products	30	7.0%	Computers	32	7.4%
4	Organic chemistry	22	4.8%	Fat/oil industry	23	5.3%	Organic chemistry	29	6.7%
5	Metal products	22	4.8%	Electrical/communications parts	22	5.1%	Drugs and medicines	25	5.8%
6	Power generation and transmission/industrial electrical machinery	19	4.1%	Computers	21	4.9%	Metal products	23	5.3%
7	Ceramics	19	4.1%	Organic chemistry	20	4.6%	Precision machinery	21	4.9%
8	Construction industry	18	3.9%	Other general industrial machinery	17	3.9%	Electrical/communications parts	15	3.5%
9	Radio/TV/Audio industry	18	3.9%	Electrical household machines and equipment	16	3.7%	Power generation and transmission/industrial electrical machinery	15	3.5%
10	Fat/oil industry	18	3.9%				Other chemical products	14	3.2%
	Other	201	43.6%	Other	191	44.3%	Other	162	37.6%
	Total	461	100.0%	Total	431	100.0%	Total	431	100.0%

VIII. Analysis of companies with capital less than 1 billion yen

1. Purpose of survey

Analyses given in "trend analysis of introduction of foreign technologies" discussed in Chapter V was created using reports on technological introduction such as "Foreign exchange and foreign trade management methods." Therefore, the analyses targeted all types of companies regardless of their scale. (see Table 5-1)

On the other hand, the present survey restricted companies to which questionnaires were distributed to those with more than one billion yen of capital in the previous fiscal year. However, most of the companies engaging in technological imports are companies with capital less than one billion yen (55.4% of companies) while the number of exports accounted for as much as 33.1% of the total (see Fig. 5-1). Together with the movement of large companies' manufacturing bases overseas caused by higher exchange rate for yen, overseas movement of related companies is frequently seen. In light of these circumstances, for this report we attempted a survey of companies with capital less than one billion yen.

2. Survey method

1) Target companies selected for this survey: Companies with capital size greater than 100 million yen and less than one billion yen (1565 companies)

2) Survey method: First, confirming by calling responsible departments of the above companies if they have technological exports and if they can cooperate with the survey, the same questionnaires as were sent to companies, who had "possibilities of new technological exports in FY 1994", with capital greater than one billion yen were sent by mail.

3) Survey period:

Telephone survey January FY 1996

Mail survey was executed in the period starting from February 6th, FY 1996 (forwarding date) to February 26th, FY 1996 (closing date).

4) Collection of results:

Number of companies cooperating with telephone survey 1435 companies

Number of companies to whom questionnaires were sent 288 companies

Of the companies, those companies engaging in technological export are 44 companies.

Those companies do not engage in technological export are 178 companies.

No responses were obtained from 66 companies.

3. Distribution of collected samples by industrial category

Following page shows the breakdown of companies targeted by telephone survey, companies cooperating with telephone survey and companies responded with reply saying that they had new technological exports in the fiscal year of 1994 classified by industrial category. (see Table 8-1)

Table 8-1 Distribution of responses (saying that they have technological exports) of companies targeted by this survey with capital size less than one billion yen classified by industrial category

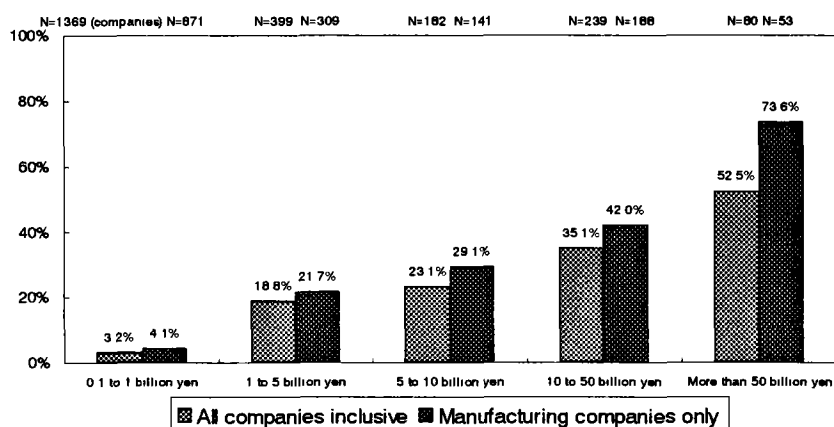
Industrial category	Number of targeted companies in this survey	Number of cooperative companies	Number of companies saying that they have technological exports	Proportion of companies with technological exports
(1) Agriculture, Forestry and Fisheries industry	7 (0.4)	7 (0.5)	0 (0.0)	0.0%
(2) Mining industry	8 (0.5)	7 (0.5)	0 (0.0)	0.0%
(3) Construction industry	293 (18.7)	257 (18.8)	6 (13.6)	2.3%
(4) Food industry	87 (5.6)	82 (6.0)	0 (0.0)	0.0%
(5) Textile industry	58 (3.7)	55 (4.0)	2 (4.5)	3.6%
(6) Pulp/paper industry	18 (1.2)	15 (1.1)	0 (0.0)	0.0%
(7) Publishing/printing industry	3 (0.2)	3 (0.2)	0 (0.0)	0.0%
(8) Integrated chemical industry	92 (5.9)	76 (5.6)	1 (2.3)	1.3%
(9) Fat and oil/paint industry	16 (1.0)	12 (0.9)	0 (0.0)	0.0%
(10) Drugs and medicines industry	18 (1.2)	18 (1.3)	0 (0.0)	0.0%
(11) Other chemical industry	0 (0.0)	0 (0.0)	0 (0.0)	0.0%
(12) Petroleum products/coal products industry	6 (0.4)	6 (0.4)	0 (0.0)	0.0%
(13) Plastic industry	2 (0.1)	2 (0.1)	0 (0.0)	0.0%
(14) Rubber industry	17 (1.1)	17 (1.2)	2 (4.5)	11.8%
(15) Ceramics industry	75 (4.8)	70 (5.1)	2 (4.5)	2.9%
(16) Steel industry	40 (2.6)	34 (2.5)	2 (4.5)	5.9%
(17) Non-steel metal industry	28 (1.8)	26 (1.9)	0 (0.0)	0.0%
(18) Metal products industry	89 (5.7)	80 (5.8)	4 (9.1)	5.0%
(19) Machinery industry	134 (8.6)	112 (8.2)	9 (20.5)	8.0%
(20) Electrical machinery and equipment industry	28 (1.8)	25 (1.8)	4 (9.1)	16.0%
(21) Communication/electric/electrical measuring instrument industry	82 (5.2)	70 (5.1)	4 (9.1)	5.7%
(22) Automobile industry	41 (2.6)	32 (2.3)	3 (6.8)	9.4%
(23) Other transport machinery industry	21 (1.3)	17 (1.2)	1 (2.3)	5.9%
(24) Precision machinery industry	23 (1.5)	16 (1.2)	0 (0.0)	0.0%
(25) Other manufacturing industry	118 (7.5)	103 (7.5)	2 (4.5)	1.9%
(26) Transport/communication/non-profit industry	0 (0.0)	0 (0.0)	0 (0.0)	0.0%
(27) Wholesale/retail industry	7 (0.4)	5 (0.4)	0 (0.0)	0.0%
(28) Information service/survey/advertisement industry	87 (5.6)	80 (5.8)	0 (0.0)	0.0%
(29) Other service industry	167 (10.7)	142 (10.4)	2 (4.5)	1.4%
Total	1565 (100.0)	1369 (100.0)	44 (100.0)	3.2%

* The number of cooperative companies was calculated by subtracting the number of non-responding companies from the number of companies cooperating in the telephone survey.

The survey revealed that 3.2% of all types of companies with capital size less than one billion yen had engaged in new technological exports in FY 1994. Focusing on manufacturing companies, new technological exports were handled by 4.1% of all manufacturing companies.

Since the survey method used for companies with capital size greater than one billion yen and that used for companies with capital size less than one billion yen are different, it is not a simple task to compare these two figures. Companies with capital size less than one billion yen have very small proportion of being engaged in technological exports both in "all companies inclusive" and "manufacturing companies only." (see Fig. 8-1)

Fig. 8-1 Proportion of companies with technological export agreements



4. Breakdown of technologies exported

We will compare the breakdown of technologies exported by companies with capital size less than one billion yen with that of technologies exported by companies with capital size greater than one billion yen.

Looking at the breakdown of technologies exported by companies with capital size less than one billion yen in terms of technological fields, the largest are 32.9% for the "machinery" field and the "miscellaneous" field followed by the "electrical" field, "chemical" field and "metals" field accounting for 13.7%, 11.0% and 9.6% of total exports, respectively. Companies with capital size less than one billion yen have larger proportions for "miscellaneous" and "machinery" fields with low proportions for "electrical", "chemical" and "metals" fields. (see Fig. 8-2)

Looking at the breakdown of technologies exported by technological category, for companies with capital size less than one billion yen as well as companies with capital size greater than one billion yen, the proportion accounted for by "transport machinery" is as high as 19.2%. Other than "steel", higher ranking technological categories do not have overlaps between years. Technological categories ranked higher in companies with capital size greater than one billion yen such as "computers" (0%), "electric/communication parts" (2.7%), "organic chemicals" (1.4%) and "drugs & medicines" (0%) seldom overlap with higher ranked technological categories in companies with capital size less than one billion yen. Instead, higher ranked technological categories in companies with capital size less than one billion yen are "miscellaneous" category such as "other technologies" (11.0%), "construction" (6.8%) and "chemical machinery and equipment" (8.2%). (see Table 8-2)

5. Counterparty countries/regions

In the category of companies with capital size greater than one billion yen, Asia accounted for approximately 60% (61,8%) of total destinations. However, in the category of companies with capital size less than one billion yen, the proportion of Asia is much higher, approximately 80% (79.5%). (see Fig. 8-3)

Furthermore, looking at counterparties by countries/regions, the United States has the largest proportion, 16.7% of the total agreements, in the category of companies with capital size greater than one billion yen. However, in the category of companies with capital size less than one billion yen, the United States accounts for only 8.2%. However, Republic of Korea accounts for 24.7% of the total agreements in this category. All the other higher ranking countries/regions (top 10) are accounted for by Asian countries except the United States. In the category of companies with capital size less than one billion yen, there is a stronger tendency of Asian countries being counterparties than is the case for a similar breakdown of the counterparty countries in the category of companies with capital size greater than one billion yen. (see Table 8-3)

Fig. 8-2 Technological field

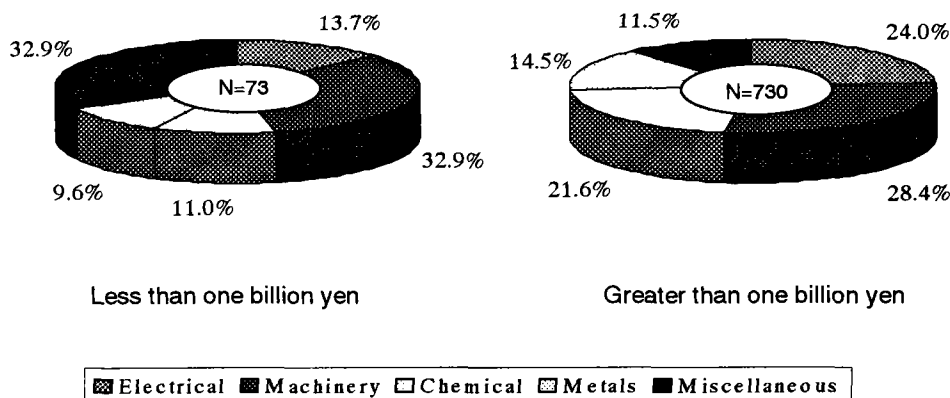


Table 8-2 Comparison of capital size less than one billion yen and capital size greater than one billion yen (breakdown by technological category)

Technological category	Number of agreements	Proportion	Technological category	Number of agreement	Proportion
Transport machinery	14	19.2%	Transport machinery	110	15.1%
Other technologies	8	11.0%	Computers	57	7.8%
Chemical machinery and equipment	6	8.2%	Steel	45	6.2%
Steel	6	8.2%	Organic chemical	44	6.0%
Construction	5	6.8%	Electric/communication parts	40	5.5%
Electrical household machines and equipment	4	5.5%	Metal products	33	4.5%
Ceramics	4	5.5%	Drugs and medicines	30	4.1%
Metal manufacturing machinery	3	4.1%	Other chemical products	28	3.8%
Other Machinery	3	4.1%	Non-steel metals	28	3.8%
Rubber products	3	4.1%	Fats and oil/paint	27	3.7%
			Precision machinery	24	3.3%
Other	17	23.3%	Other	264	36.2%
Total	73	100.0%	Total	730	100.0%

Fig. 8-3 Counterparty regions

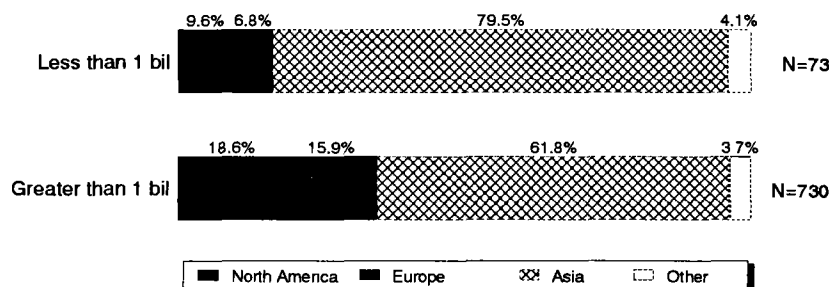


Table 8-3 Comparison of capital size less than one billion yen and capital size greater than one billion yen (breakdown by export partner countries/regions)

Less than one billion yen			Greater than one billion yen		
Region	Number of agreements	Proportion	Country	Number of agreements	Proportion
Korea	18	24.7%	USA	122	16.7%
Thailand	9	12.3%	China	101	13.8%
Taiwan	8	11.0%	Korea	101	13.8%
China	7	9.6%	China	73	10.0%
USA	6	8.2%	Thailand	49	6.7%
Indonesia	3	4.1%	Germany	28	3.8%
Malaysia	3	4.1%	Malaysia	26	3.6%
Singapore	3	4.1%	Indonesia	24	3.3%
Philippines	2	2.7%	India	23	3.2%
			Britain	15	2.1%
			Italy	15	2.1%
Other	14	19.2%	Other	153	21.0%
Total	73	100.0%	Total	730	100.0%

6. Counterparty companies and capital relationship

Approximately 60% (59.2%) of companies with capital size greater than one billion yen exported to non-related companies and approximately 40% (40.8%) exported to related companies. For companies with capital size less than one billion yen, related companies as counterparties only account for approximately 20% (20.5%) of the total number of agreements. In particular, the proportion of exports to "subsidiary companies (over 50% capital ownership)" is as low as 4.1%. (see Fig. 8-4)

7. Agreement period

The proportion of companies with capital size greater than one billion yen having an agreement period of more than 5 but less than 10 years is the largest at 34.4%. The proportion of companies with capital size greater than one billion yen having agreement period longer than 10 years is 16.5% and with the majority longer than 5 years (50.9%). Agreement periods less than 5 years accounted for 35.4%. However, the proportion of companies with capital size less than one billion yen having agreement periods less than 5 years but in excess of one year is the largest at 30.1%. The proportion of companies with capital size less than one billion yen having an agreement period less than one year is as high as 21.9%. Agreement periods of less than 5 years account for the majority of cases (52.0%). In general, "less than one billion yen" has greater proportion of shorter agreement periods in comparison to "greater than one billion yen." Moreover, "less than one billion yen" has very low proportion of "agreement is effective while industrial property right lasts", which is 1.4%. (see Fig. 8-5)

8. Value receiving methods

With respect to the method of receiving value, the proportion of companies receiving initial payment is greater in companies of "less than one billion yen" compared to companies of "greater than one billion yen." However, companies of "less than one billion yen" exhibit a lower proportion of receiving running royalties than have those of "greater than one billion yen." (see Fig.8-5)

Combining these together, the proportion of companies receiving "running royalty only" for "greater than one billion yen" is approximately 40% (39.7%). However, the proportion is as low as 13.1% in the "less than one billion yen" category. While the proportion of receiving "initial payment only" in companies of "greater than one billion yen" is as low as 18.2%, the proportion of receiving "initial payment only" in companies of "less than one billion yen" is 39.2%. (see Fig. 8-7)

Fig. 8-4 Capital relationship with counterparties

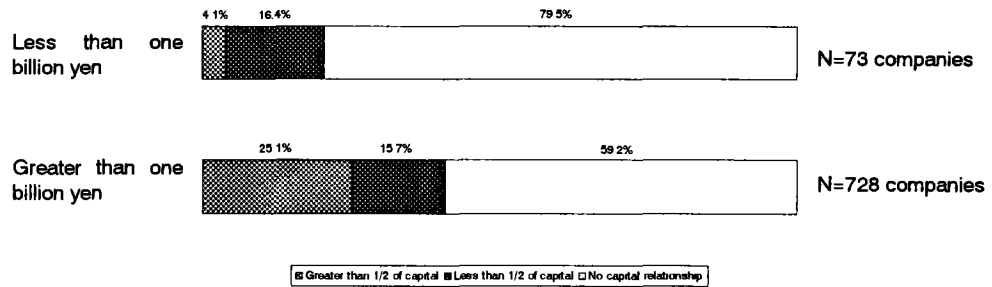


Fig. 8-5 Agreement period

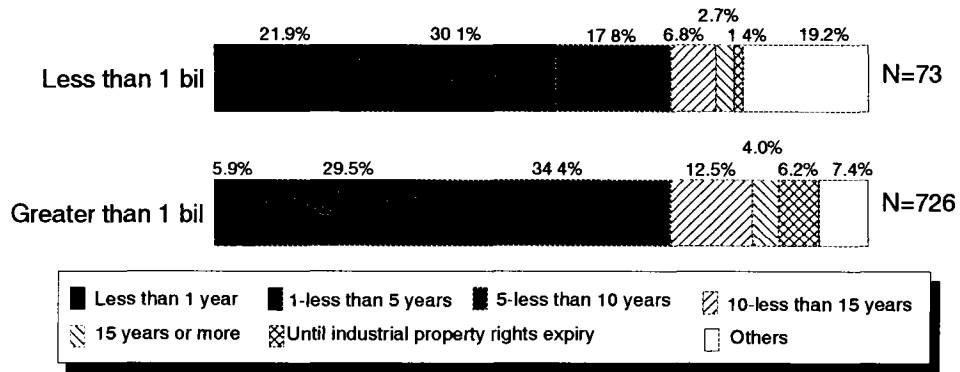


Fig. 8-6 Agreements with initial payments/running royalties

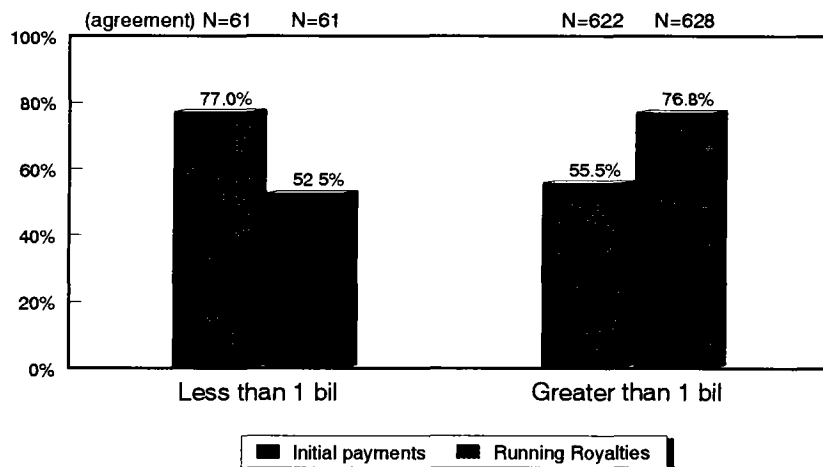
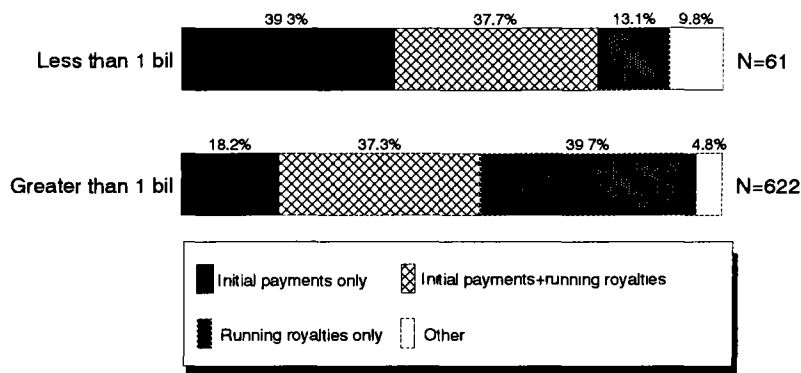


Fig. 8-7 Initial payments and running royalties combined



9. Exclusive/sub-license rights

Regarding the proportion of granting exclusive/sub-license rights, the proportion of granting sub-license for companies of "less than one billion yen" and "greater than one billion yen" is around 10% without much difference. However, the proportion of granting exclusive rights is larger for companies of "less than one billion yen" with their proportion being 53.6%. (see Fig. 8-10)

10. Sorts of technology

Looking at sorts of technology included in technological export agreements, comparing "less than one billion yen" with "greater than one billion yen", we notice that the proportion of agreements including patents are low but that of agreements including know-how is high with the proportion being 97.0%, it accounts for almost all of the agreements. Moreover, the proportion of agreements including trade marks for companies of "less than one billion yen" are very low with the proportion being 6.1%. (see Fig. 8-9)

Next, looking at the proportion of agreements including patents/utility models/trademarks, companies of "less than one billion yen" show a larger proportion of including patents pending than do companies of "greater than one billion yen." Companies of "less than one billion yen" show a very low proportion of including trademarks. (see Fig. 8-10)

Since surveying methods used for companies with capital size less than one billion yen and those used for companies with capital size greater than one billion yen are different, a simple comparison cannot be made between the results. The proportion of companies with capital size less than one billion yen engaged in technological exports were low with the number of technological exports being few. However, since capital strength and breakdown of contents of exported technology of companies with capital size less than one billion yen are different to those of companies with capital size greater than one billion yen, there were large differences in export destinations and trends in agreement types.

Since companies with capital size less than one billion yen have a large share in technological exports, understanding the actual situation of their technological exports is important in performing a trend analysis of technological trade. From next year on, we would like to review our survey methods to ensure accurate determination of proportions in execution of technological exports to continue our survey.

Fig. 8-8 Agreements granting exclusive rights/sub-license rights

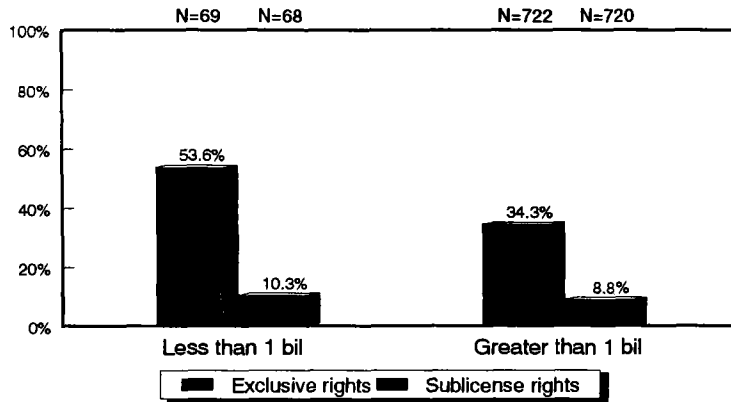


Fig.8-9 Agreements with patents/know-how/trademarks

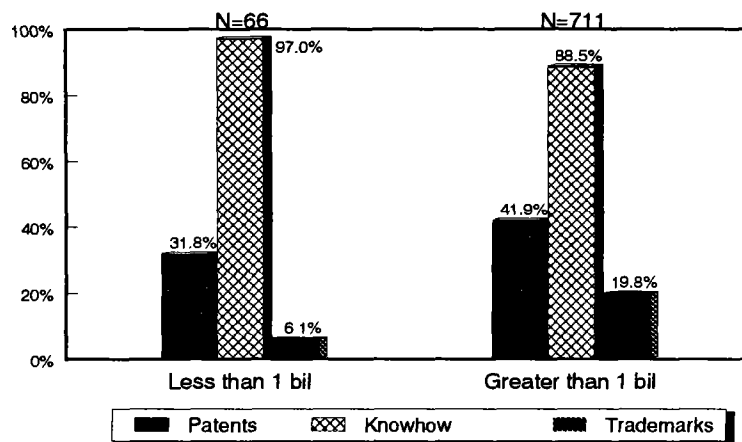
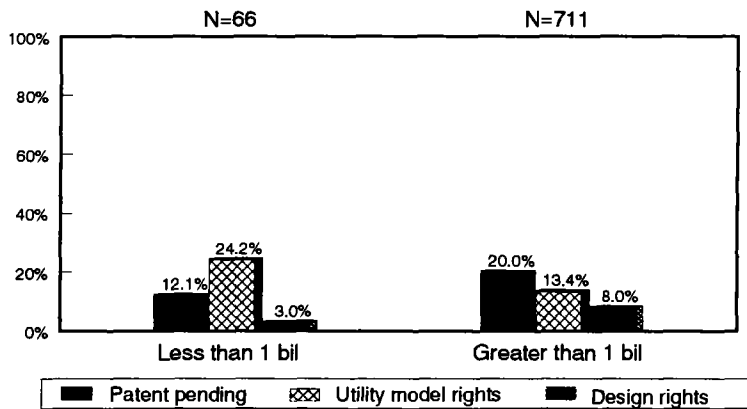


Fig. 8-10 Agreements with patent pending/utility model rights/design rights



IX. Summary

A questionnaire survey was conducted for a year in FY 1994 on new situation in "Technological Exports" regarding the contents of technological exports, sorts of technology (patents/know-how/trademarks, etc.) and methods of receiving value. This report attempts to dig deeply into the actual situation concerning technological exports through cross-tabulation of the survey results by technology breakdown, by export partner countries/regions and by industrial category. Furthermore, for this report we attempted a survey for companies with capital size less than one billion yen in the same format as for companies with capital size greater than one billion yen conducted before. We now summarize the major results obtained. However, to discuss the survey results, we need to pay attention to the following points.

(1) From Chapters III to IV, survey targets were companies with capital size greater than one billion yen. Analyses were restricted to companies conducting research activity and those associated with technological exports.

(2) The present survey was conducted through tabulating obtained survey ballots from target companies. Therefore, this survey does not represent an exhaustive survey results of actual technological exports.

(3) This survey was conducted in FY 1994 to capture new technological exports. There might be points where this survey is influenced by the economic situation of that period.

1. General trends

(1) The proportion of companies engaging in technological exports in FY 1994 turned out to be 27.0% of the companies which responded to this survey. The proportion increased from the previous fiscal year (23.6%), restoring to the level of FY 1992 (26.6%). Looking at the proportion by capital size of company, as the scale of capital becomes larger, higher is the proportion of engagement in technological exports. (see Figures. 3-1 and 3-2)

(2) Looking at the change in the number of technological exports from FY 1992 to FY 1994, FY 1992, FY 1993 and FY 1994 had 712, 626 and 730 exports, respectively. There was a large increase from FY 1993, which showed a decrease, to FY 1994. (see Table 3-3)

(3) By region, 61.8% went to Asia, 18.6% to North America, 15.9% to Europe and 3.7% to other regions. The proportion of technological exports to Asia increased in two consecutive fiscal years to reach more than 60% in the current fiscal year. (see Fig. 3-6)

(4) Looking at technological exports by country/region, the United States is the largest export partner with its share being 16.7%. The United States is followed by the Republic of Korea (13.8%), People's Republic of China (13.8%), Republic of China (10.0%) and Thailand (6.7%). Asian countries/regions account for 4 out of 5 higher ranking countries/regions. Focusing on the changes in three years, the share of the People's Republic of China increased most dramatically (with 7.9% in FY 1992 and with 13.8% in FY 1994). (see Table 3-6)

(5) The proportion of companies having a capital relationship with counterparty companies accounts for 40.8% of all technological export agreements. The proportion increased from the previous fiscal year (31.2%). Particularly, proportions accounted for by Asia and North America are increasing. (see Fig. 3-7 and Table 3-7)

(6) Looking at periods of agreements, the proportion of agreements with periods "longer than five years and shorter than ten years" was 34.4% and that of agreements with periods "longer than one year and shorter than five years" was 29.5%. Both of them accounted for more than 60% of agreement periods. By region, exports to Asia have a higher proportion of periods of agreement validity being less than ten years in comparison to North America and Europe. The proportion of agreements accounted for by "until the industrial property right expires" was low. The cause of this low proportion is considered to be due to the influence of breakdown of technological exports and difference in regulations of export partner countries/regions. (see Fig. 3-9 and Table 3-8)

(7) Looking at agreement format of technological export agreements, the proportion of gratuitous agreements was 85.5%, that of onerous agreements was 8.9% and that of cross-licensing agreements was 5.7%. Almost all the agreements were gratuitous agreements. By regions, the proportion of cross-licensing agreements in North America was 13.2%, which is higher than other regions. Close to majority of export partners in cross-licensing agreements during the last three years was accounted for by North America (46.3%). Looking at the breakdown of cross-licensing agreements, figures of all regions inclusive showed 51.5% for "receiving value", 36.8% for "equivalent exchange" and 11.8% for "paying value." There was a large difference in regions. Cross-licensing agreements in Asia were accounted for by "receiving value" (82.6%). The format of "receiving value" accounted for only 33.3% but that of "paying value" accounted for 23.8% in North America. The relationship between Japan and each region in terms of technological power influences the kinds of formats taken in cross-licensing agreements. (see Figures 3-11 to 3-13 and Table 3-10)

(8) Looking at the methods of receiving value, the proportion of receiving initial payment was 55.5% and that of receiving running royalty is 76.8%. As before, the proportion of receiving running royalty is higher. Methods of receiving value depends on the presence and absence of capital relationship with export partner companies. The proportion of receiving initial payments from non-related companies was large. Looking at the proportion of receiving initial payments by Asian country/region, Thailand and Malaysia where the proportion of export to related companies was large had lower proportions. However, the Republic of Korea and India where the proportion of exports to non-related companies is higher had higher proportions. (see Figures 3-14 to 3-18)

(9) Looking at categories of technology included in technological export agreements, patents accounted for 41.9%, know-how 88.9% and trademarks 19.8%. Most of agreements included know-how. By region, the proportion of patent inclusion is higher in Europe and North America but that of know-how inclusion is higher in Asia. This is considered to be due to the breakdown of technological contents exported and the difference of capabilities in technological absorption at export destinations. (see Figures 3-22 to 3-25)

2. Trends by technological breakdown

(1) Dividing exported technology into "electrical", "machinery", "chemical", "metals" and "miscellaneous", the order of the proportions from the highest to the lowest is as follows: "machinery" (28.4%), "electrical" (24.0%), "chemical" (21.6%), "metals" (14.5%) and "miscellaneous" (11.5%). On the one hand, "electrical" field accounted for approximately 30% (29.2%) in 1992 but its proportion decreased in two consecutive years. On the other hand, the share held by the "machinery" field increased in comparison to the previous fiscal year, becoming the largest field of technological exports. Looking at exported technology by technological category, technology related to "transport machinery" was the largest technological category during the last three consecutive years. In particular, "transport machinery" showed a large increase in the current fiscal year (15.1% of the total) in comparison to the previous fiscal year (10.4%). (see Fig. 4-1 and Table 4-1)

(2) Comparing characteristics of destination regions of exports and the trends in the whole technological exports, the proportion accounted for by "chemical" is large for Europe and small for Asia. However, Asia accounted for the majority in all of the fields in this fiscal year. (see Fig. 4-2 and Table 4-2)

(3) Looking at counterparties' capital relationships, the majority of exports in the "electrical" field is accounted for by related companies (50.3%). In comparison to the previous fiscal year, an increase in exports to related companies was observed in all fields. Particularly, the increase in the "machinery" field is remarkable (from 23.7% to 42.9%). (see Fig. 4-5 and Table 4-4)

(4) With respect to agreement formats, the proportion of cross-licensing agreements was the highest in the "electrical" field (12.6%) and the proportions of "machinery" (2.5%) and "metals" (1.0%) fields were low. Looking at the technological fields of cross-licensing agreements during the last three years, "electrical" field accounted for almost a majority (48.5%). "Electrical/communications parts" was accounted for by cross-licensing agreements with a share of 26.5%. The format of cross-licensing agreements varies depending on technological contents. Of 16 agreements in "paying value", 13 of them were in "electrical" field. Among "electrical" field making cross-licensing agreements, 7 of them were in technology related to semiconductors. Regarding semiconductors, basic patents are held by United States companies. Cross-licensing agreements were therefore signed to reduce large royalties involved. (see Figures 4-22 to 4-25, Tables 4-10 and 4-11)

(5) Other than these, we believe that large changes observed with respect to lengths of agreement periods, methods of receiving value and sorts of technology included in agreements are due, to a large extent, to export destination regions and presence and absence of capital relationship rather than technological content.

3. Comparison of technological exports and imports

The following results derived from a comparison of the results of the current survey and analysis results of technological exports of the present institute in "Trend analysis of introduction of foreign technology, FY 1994" (survey research data No. 45 of National Institute of Science and Technology Policy (NISTEP)).

(1) With respect to technological exports, "electrical", "machinery", "chemical" and "metals" all exported approximately the same amount. However, technological imports concentrate in the "electrical" field accounting for approximately 70% of total imports. This is due to the large proportion of software imports (50.8%) in technological imports of "computer" related technology. (see Figures 5-2 and 5-11)

(2) Comparing technological imports and exports, the proportions of receiving initial payments were low (export: 55.5%; import: 72.3%). However, the proportions of receiving running royalty were high (export: 76.8%; import: 54.4%). This difference is due to the high proportions of included software, in which initial payments are considered to be the mainstream for technological imports. (see Fig. 5-8)

The proportion of technological exports granting exclusive rights was higher than that of technological imports (export: 8.8%; import: 31.9%). (see Fig. 5-9)

The proportion of technological exports including patents in agreements was higher than that of technological imports (export: 41.9%; import: 26.3%). Know-how is included in agreements of both exports and imports. (see Fig. 5-10)

4. Change in number of technological exports with respect to presence and absence of capital relationship

(1) Looking at the change in the number of technological exports using a classification scheme by presence or absence of capital relationship, we notice that the number of exports to non-related companies does not change much but the number of exports to related companies shows a drastic change in each fiscal year: 249 exports in 1992, 195 exports in 1993 and 297 exports in 1994. The number of technological exports in this three year period was greatly influenced by the change in the number of exports to related companies.

As an item showing a close relationship with related companies, we examine the change in overseas direct investment by manufacturing industry. Overseas direct investment in manufacturing industry was on a decreasing trend until FY 1992. However, it started to increase in FY 1993 and made a large increase in FY 1994 with the proportion of increase compared to the previous fiscal year being 23.8%. In 1994, the trend to higher exchange rates for the yen reached the level of 100 yen per dollar. Due to this higher rate of exchange for yen, the difference between manufacturing costs at home and abroad became large. Transfer of manufacturing bases to overseas sites were advanced to cope with this problem. Technology necessary for this transfer was then exported. (see Tables 7-1 to 7-3)

(2) Turning now to export destination regions for technological exports to related companies, the share of Asia in the total number of technological exports increased annually to reach more than 70% (73.7%) in 1994. Overseas direct investment of manufacturing industry showed a dramatic increase in the proportion occupied by Asian destinations to reach approximately 40% of total exports in 1994. Japan's manufacturing industry is attracted by Asia and is expanding investments in Asia due to cheap manufacturing costs. As a result, a larger proportion of Japan's technological exports to related companies is accounted for by Asia. (see Fig. 7-1, Tables 7-4 and 7-5)

(3) Looking at technological contents exported to related companies, the increase in technology related to the "machinery" field, in particular, "transport machinery" was remarkable. With respect to the automobile industry as well as other industries, technological exports are said to be the means of coping with higher exchange rates for the yen. In addition to this, an increase in the income levels of East Asian countries facilitates the expansion of automobile demand. In response to this, necessary technology is exported in large quantity. (see Figures 7-2 and 7-3, Table 7-6)

5. Technological exports by companies with capital size less than one billion yen

Since the survey method used for companies with capital size greater than one billion yen is different from that used for companies with capital size less than one billion yen, it is not possible to simply compare the figures. However, the proportion of companies with capital size less than one billion yen being engaged in new technological exports is 3.2% all industry inclusive and 4.1% for manufacturing industry only. The proportion of export engagement by companies with capital size less than one billion yen is lower than that by companies with capital size greater than one billion yen.

Since the contents of technology exported by companies with capital size less than one billion yen is different from the categories of technology exported by companies with capital size greater than one billion yen and since their capital sizes are different, accordingly trends in export destination and agreement formats are different for these two types of companies.

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Hakutou shobou

[Postscript]

This report has summarized the results of a survey conducted since FY 1992 on Japan's technological exports.

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