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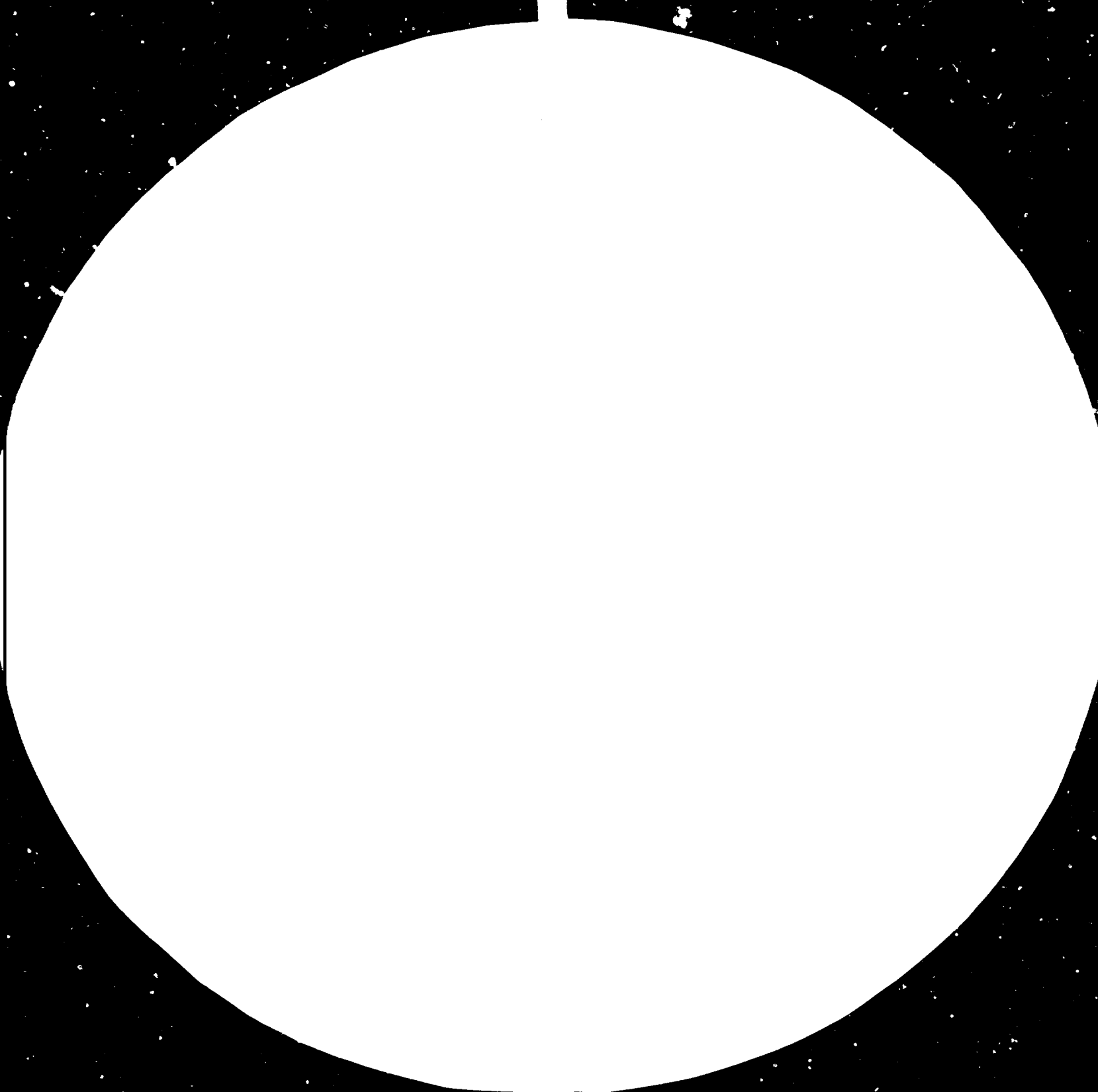

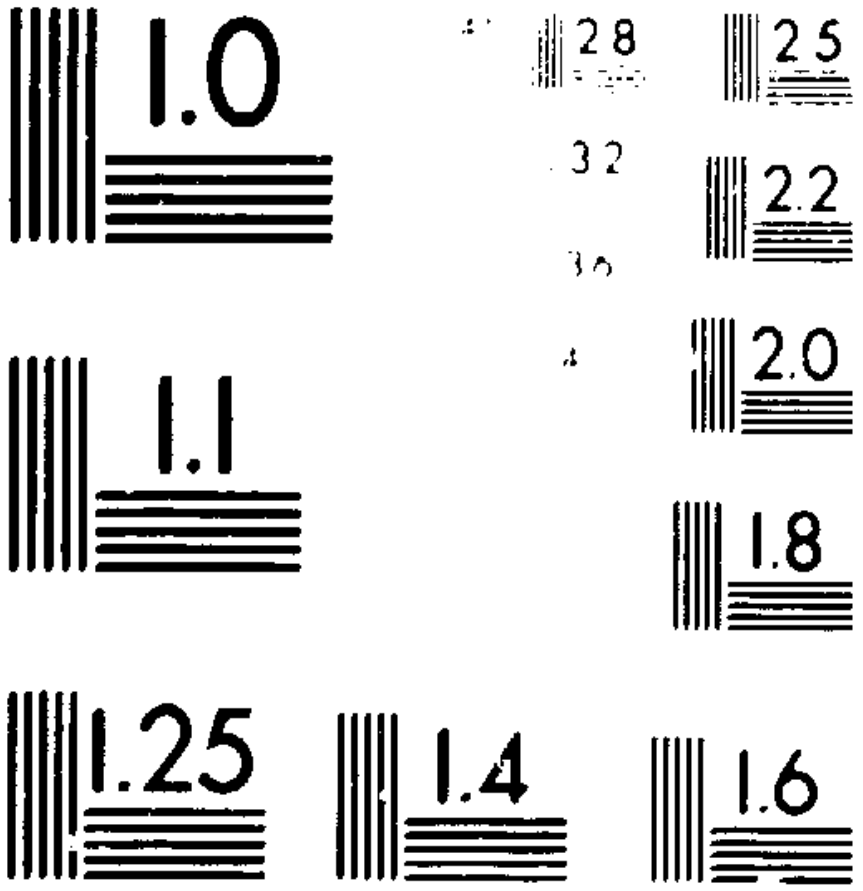

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INTERNAL TRANSFER AND TECHNOLOGY TRANSFER FROM ABROAD: JAPANESE EXPERIENCE*

by

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Introduction

This paper dealts with the Japanese experience of internal transfer and introduction from abroad, of the technology. I think that the most interesting period, in terms of policy and strategy, is the 1950's, in the technology transfer of Japan, because the role of government policy and strategy was greater than it in any other period. Though this paper dealts with 4 periods, the 1950's, the 1960's, the 1970's, and the 1980's, however, I intend to give greater attention to the 1950's and the 1960's. We are also necessary to make to make a long-run assessment of policy and strategy, especially in the technology transfer.

Section 1 of this paper provides a condenced account of the relationship between the economic growth and the technology transfer in Japan after the world war II.

Section 2 analyzes the technology transfer from abroad and examines its policies of the government and companies in the light of effectiveness and appropriateness for the national development. It is intended to contribute to the discussions of policy formation in the field of technology transfer from abroad.

Section 3 centers on the analysis of the mechanism of internal technology transfer from viewpoints of the modernization and the industrial restructuring. In the 1970's, the transfer policies for small companies were enriched rapidly, and the international exchange of policy information went on increasing in volume.

Finally, some concluding remarks and discussions are written in Section 4.

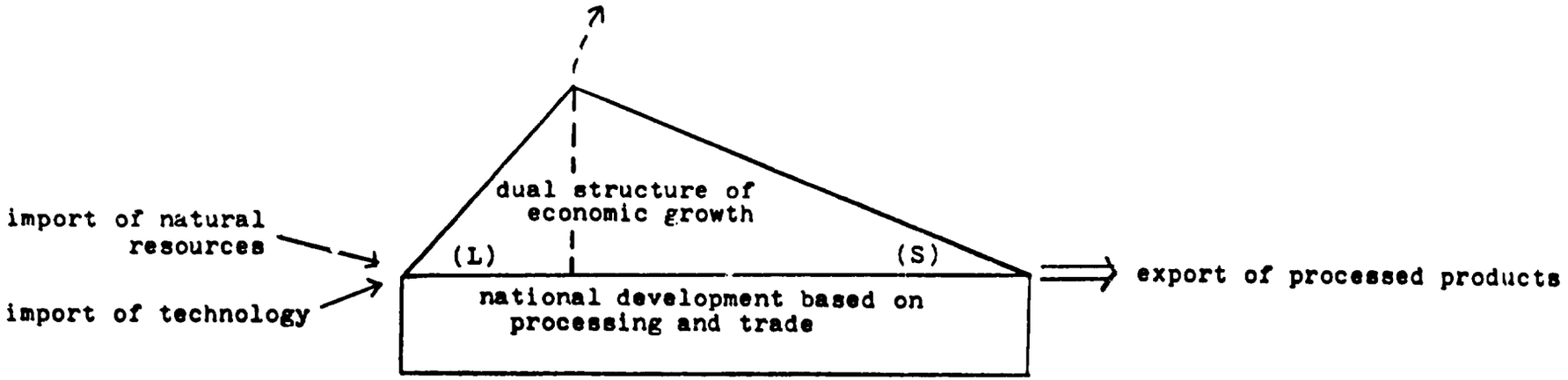
1. Changing pattern of economic growth

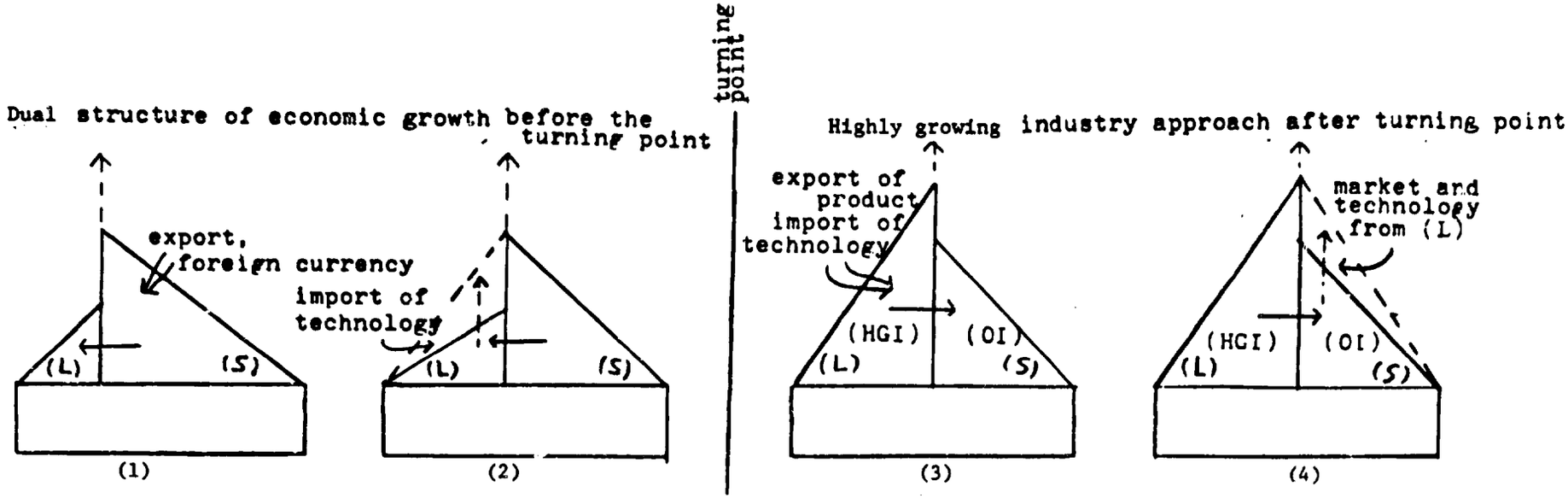
(1) Economic structure and growth policy

Japan has the big population and scant natural resources. Therefore Japanese economy has depended largely upon overseas markets and imports of natural resources, that is, the pattern of economic growth, imports of natural resources → processing them → exports of the processed products → earning of foreign currencies → imports. In the world market, Japan has been faced with the competitions from both sides of developed and developing countries. It is important to notice here that Japan wants always higher level of technologies and the high rate of capital accumulation for her entry to the world market and for keeping out of catching up from developing countries.

It is useful to consider the growth mechanisms of Japanese economy stage by stage in terms of the transfer of technology.(1) Many economists recognize that the turning point of Japanese economy is about the middle of 1960's. The turning point means a point in that the dual structure of economy is disorganized or the industrial structure is qualitatively changed to another type of it. The growth pattern of Japanese economy before the turning point can be, as shown in Figure 1, depicted as the dual structure of economic growth based on the growth mechanism of processing and trade. Generally speaking, the dual economy of developing country means that the national economy is seperated into two sectors, modern and traditional sectors, which don't have the effective connection each other for economic development. While the dual structure of Japanese economy had the intimate interrelationship between two sectors, modern and traditional

Figure 1 Growth pattern of Japanese economy
before the turning point (about the middle of 1960's)





(L) = Large companies. (S) = Small companies. (HGI) = highly growing industry (OI) = other industry

sectors or large and small enterprises.

Before the turning point, small companies earned foreign currencies by exports and made a high rate of capital accumulation, and supplied them to large companies. The large companies bought new technologies from abroad and made the investment for modernization and rationalization by using the foreign currencies and the accumulated capital from small companies. In this period, small companies were the leading sector of exports, because a large part of exports was the products from light and labour intensive industries. Large companies had grown up by using the spring-board of which small companies supplied.

(2) Growth strategy and technologies

The first half of 1960's was a very important period for the economic development of Japan. The Economic Plan for Doubling the Income started in 1960. Japan took her place in the systerfood of developed countries by signing Article 8 of IMF,the International Monetary Fund, and by becomming a member of OECD in 1964. Japan had also made greater efforts for the liberalization of trade and capital transaction to accomodate to the request of foreign countries. At that time, one of main subjects for Japanese economy was how to improve her international competitiveness by the modernization, the rationalization, innovations increasing productivity, etc.. As shown in Table 1,Japanese business managers made greater efforts to modernize and to improve the organization of their companies and to introduce the rationalization of production and the innovation into their companies.

After the turning point, the growth pattern of Japanese economy changed from

Table 1

Main points mentioned by business managers in 100 large companies in 1961.

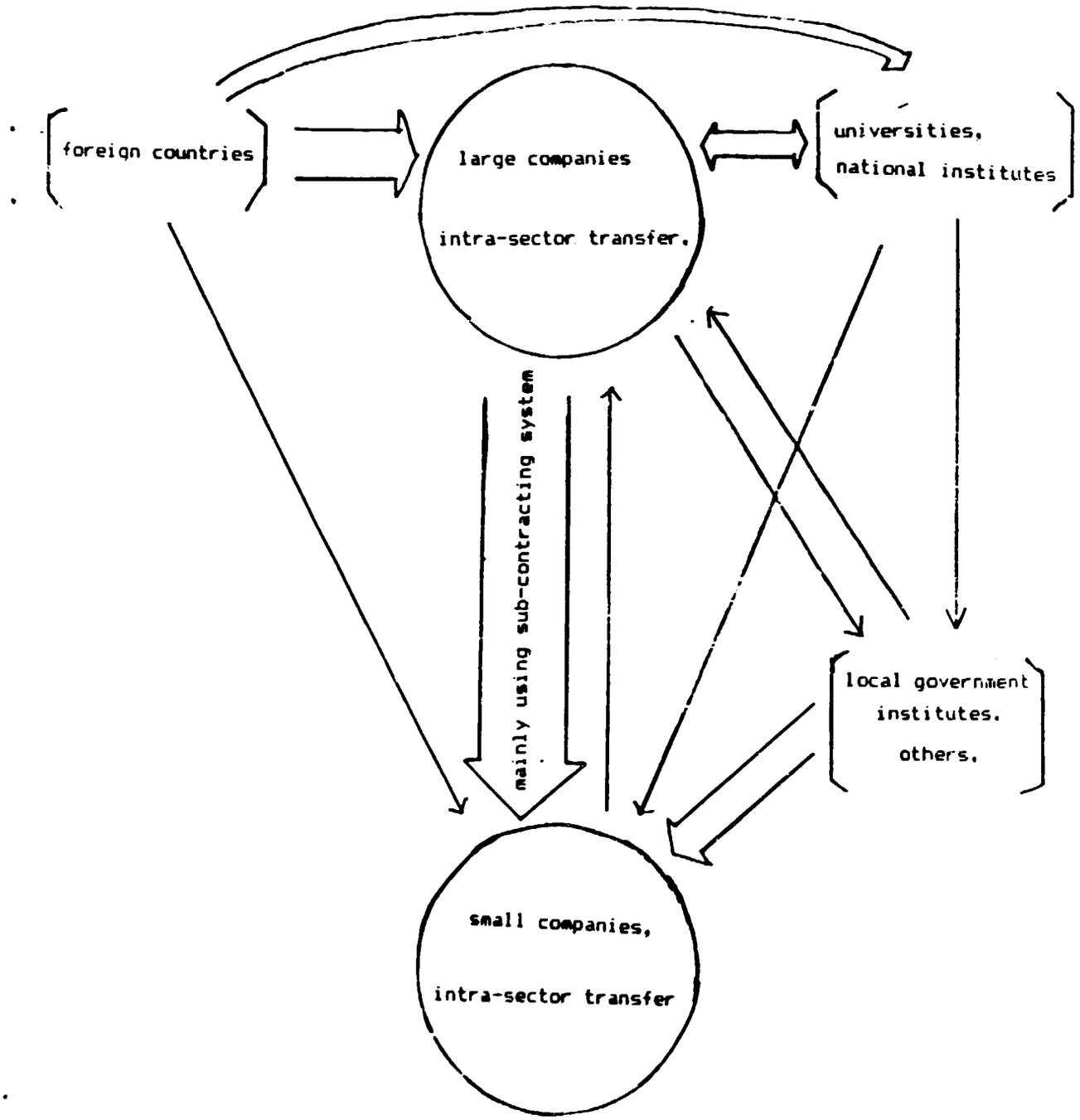
A. Strengthening and planning of management	71
1. office automation	13
2. improving the general stuffs in planning, research, etc.	18
3. introduction of a long-run planning	11
4. planning of management	8
5. improvment of budget and cost control	8
6. establishment of basic policy and integrated management	3
7. rationalization and another merits of management improvement	15
B. Modernization of the business organization	65
8. establish clear-cut lines of authority and responsibility, and transfer them to more appropriate sectors	18
9. systematizing of a board of executive directors and its functional strengthening	11
10. making a divisional system	6
11. strengthening of a self-supporting accounting system	3
12. usage of the project system	5
13. improvement of intersectional communication and co-operation	5
14. establishment of the line - stuff organization	3
15. another improvement of the organization	16
C. Improvement and rationalization of the human relations	34
16. training of employees	11
17. improvement of the human relations	8
18. improvement of the labour management	3
19. fairness and rationalization of the personnel management	3
20. improvement of the relations between employers and employees	4
21. improvement of communication	2
22. others	3
D. Rationalization of production and innovation	26
23. research and development	7
24. development of new products	3
25. technological improvement/modernization/automation	5
26. rationalization/productivity increase/cost decrease	4
27. quality control	4
28. others	3
E. Marketing	14
29. establishment of the marketing system	4
30. strengthening/systematization/integration, of sells organization	3
31. improvement and strengthening of the service network	3
32. another marketing strategies	4
F. Total	270

Source: Toyo keizai Shinpo-sha, edited, Analysis of Japanese Management, pp.277 - 278, 1961, (Nippon Keiei no Kaimei)

the dual structure of economic growth to the highly growing industry (HGI) approach. The HGI approach is to take such strategies that support the upbringing of highly growing industries and make the leading industries for economic growth among them. Such leading industries play a role of locomotive for the development of national economy and promote the growth of following industries. In this period, many of HGIs were heavy, mass-production, and capital intensive , which were also large companies. In Japan, the leading industries are always the leading industries in exports in the same time.

In the HGI approach, the relationship between large and small companies was reorganized to establish the integrated industrial groups in which the intra-industry division of labour worked effectively by using the sub-contract system between both sectors. For the development of such integrated industrial groups, it is necessary to level continuously up their technologies not only in large companies but also in small related companies. Although the R & D capacity of the latter was very poor, its volition for learning new technology was remarkably strong, because the competition for getting the sub-contract among small companies was very keen. For examples, a big automobil company has about 200 - 400 of sub-contracting companies. and a big shipbuilding company has about 100 - 200 of sub-contracting companies. The large companies have mainly introduced new technologies from foreign advanced countries and domestically from universities and national R & D institutes, as seen in Figure 2. But the main channels of technology transfer from outside to small companies were, firstly the sub-contracting system with large companies, secondly local government institutes, thirdly foreign countries, universities, and national instutes.(2)

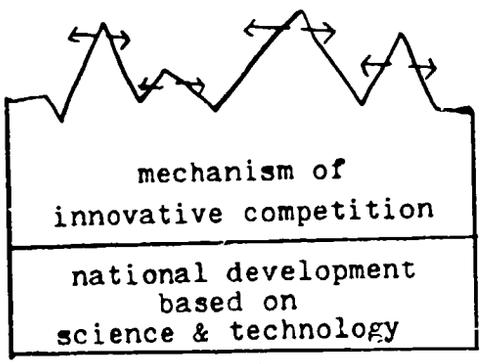
Figure 2 Main channels for introducing new technologies from outside, in 1955 - 1965.



(3) Growth pattern and technology transfer

In the 1970's, main policies of the Ministry of International Trade and Industry centered on making the industrial structure more knowledge intensive. The sub-contracting system also was reorganized in terms of not costs, submissiveness, quantity, but technological capacity, quality. The transfer of technology to small companies has been increased rapidly by their own efforts.

Comming into the 1980's, the development fundamentals of Japanese economy have been changing from industrial processing and trade to the advancement of science & technology. This is not to say, of cause, that industrial processing and trade are unimportant in the 1980's, but to say that the ranking of importance was changed. There is now no almost any discrimination between large and small companies in the innovative competition (3)



(5)

The internationalization of industrial organization is in rapid progress through the transfer of capital and technology, while domestically innovations are strengthening inter-industries or inter-sectors relations.Therefore, coresponding to these changes, the mechanism of technology transfer is reorganizing domestically and internationally to make it more efficiant and to diversify.

2. Technology transfer from abroad and its policies

(1) Industrialization and transfer policies

The technology transfer from abroad into Japan has been increased with her economic growth as shown in Table 2. It is important to notice here that Japanese economy has been able to introduce almost useful technologies from abroad corresponding to each stage of industrialization and both the government and private sectors made greater efforts to introduce advanced foreign technologies by thinking of the innovation as a indispensable requirement for the economic development.

In the 1950's, the development strategies were the industrialization centered on heavy and petrochemical industries and the modernization of Japanese economy. Japanese economy completed such basic or modern materials-supplying industries as steel and petrochemical industries by using the technology transfer from abroad in this period. Large quantities of new machines were also imprted to modernize the industrial structure. For these, main policies of the government were the policy guidance for the technology transfer to the company and the preferential allotment of foreign currencies to the imports of required technologies and the tariff exemption to importing very important machineries.(4) The policy guidance means that the stuff in charge of the Ministry holds a consultation with the companies and induces to make the most useful and effective strategy for accomplishing their purposes without any compelling power. The coincidence of both needs of the government and the company can be able to make steady progress in the same direction by using the policy guidance.

Table 2 Japan's Technological Trade

F.Y.	Technological introduction			International transaction in technological trade *		
	Class A	Class B	Total	Receipts A	Payments B	A / B
	(Cases)	(Cases)	(Cases)	(in million dollor)	(in million dollor)	(%)
19 '50	27	49	76	0.0	2.6	–
'51	101	87	188	0.0	6.7	–
'52	142	110	252	0.0	9.9	–
'53	102	133	235	0.1	13.9	0.7
'54	82	131	213	0.4	15.8	2.5
'55	71	113	184	0.2	20.0	1.0
'56	143	167	310	0.3	33.3	0.9
'57	118	136	254	0.2	42.6	0.5
'58	90	152	242	0.7	47.8	1.5
'59	153	225	378	0.8	61.9	1.3
'60	327	261	588	2.3	94.9	2.4
'61	320	281	601	3	113	2.7
'62	328	429	757	7	114	6.1
'63	564	573	1,137	7	136	5.1
'64	500	541	1,041	15	156	9.6
'65	472	486	958	17	166	10.2
'66	601	552	1,153	19	192	9.9
'67	638	657	1,295	27	239	11.3
'68	1,061	683	1,744	34	314	10.8
'69	1,154	475	1,629	46	368	12.5
'70	1,330	438	1,768	59	433	13.6
'71	1,546	461	2,007	60	488	12.3
'72	1,916	487	2,403	74	572	12.9
'73	1,931	519	2,450	88	715	12.3
'74	1,572	521	2,093	113	718	15.7
'75	1,403	433	1,836	161	712	22.6
'76	1,461	432	1,893	173	846	20.4
'77	1,527	387	1,914	233	1,027	22.7
'78	1,755	384	2,139	274	1,241	22.1
'79	1,700	416	2,116	342	1,260	27.1
'80	1,860	282	2,142	378	1,439	26.3
'81	2,076	–	2,076	537	1,711	31.4

Source: Bank of Japan

*1: Figures in column A are the numbers of appointed technologies with payment over ¥ 100 million.

*2: The government abandoned the distinction between Class A and Class B in December, 1980.

Although Japanese economy had many kinds of technological needs in this time, she concentrated the transfer of technologies from abroad on few kinds of basic and most useful technologies, because of a serious shortage of resources including foreign currencies, high level of engineers, investment fund, required for the technology transfer.

Japanese companies went abroad rather positively to buy the advanced technologies than waiting the offer of them from foreign companies. The Japan Productivity Center (JPC) was established in 1955. JPC sent 454 teams, total 4665 managers into U.S.A. in the period of 1955 - 1963, and sent also other teams into European countries for the trip of industrial inspection. These managers absorbed several kinds of informations related to new technologies, new management method, new marketing, etc., and after their return to Japan, they tried to apply them to their businesses. They joined these teams, naturally, by paying money from their companies. Japanese companies introduced new technologies from abroad through their positive access and the empirical study by paying their own money. The inspection abroad like this gave rise to the revolution in not only the technology, but also management consciousness, the organization of company toward the modernization of economy.

In general, the transfer of technology depends upon the relationship between needs (N) and resources (R) for it. Both (N) and (R) change from stage to stage corresponding to the economic growth. For the introducing country, (N) is the technology wanted to introduce and (R) is the resources including required personel, money, the organization for its introduction, while for the supplying country, (N)' is the needs substituted for profits by supplying the technology and (R)' is the resources including the technology and necessities

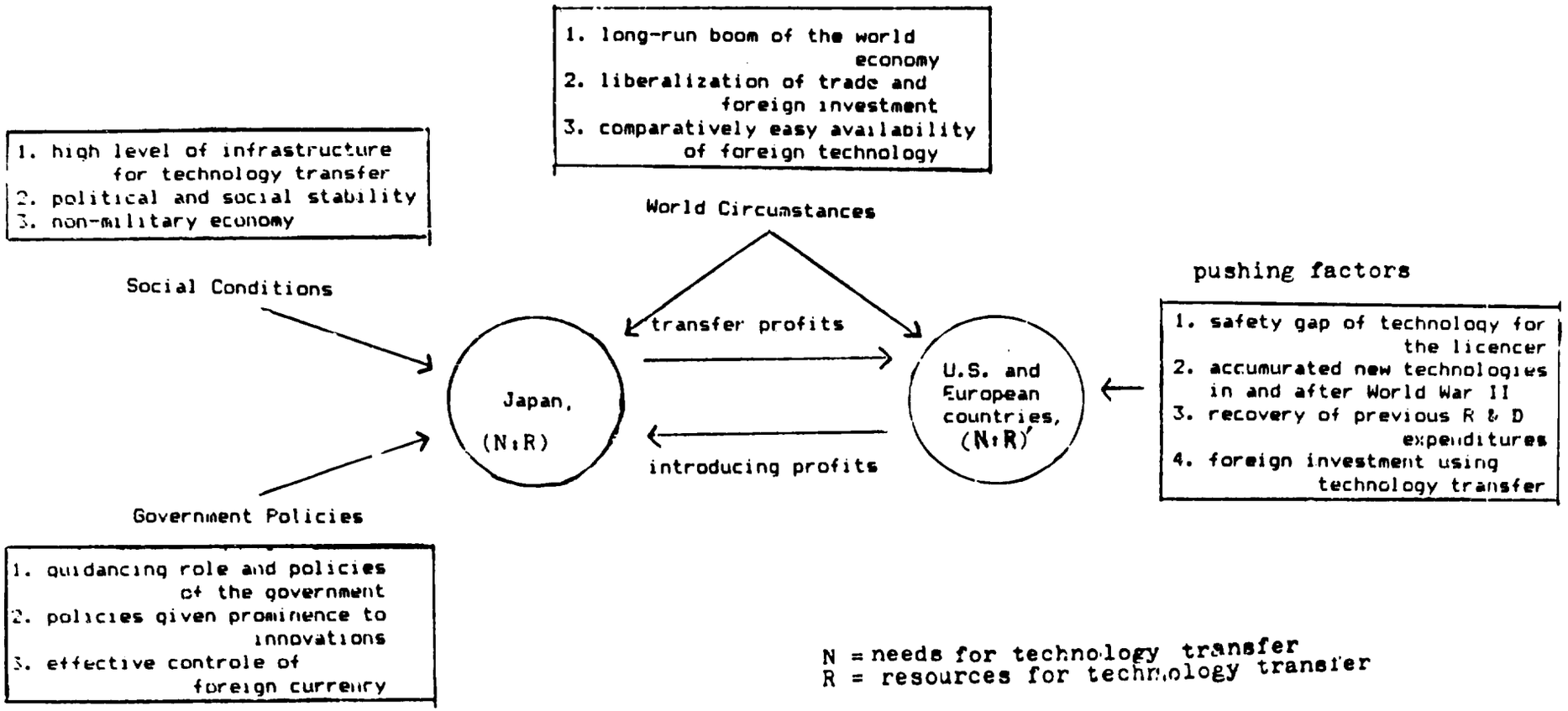
for its supply. The necessary condition for the success of technology transfer is to have the resources being able to meet the needs, (R) ≒ (N) in the introducing country, (R)'≒ (N)' in the supplying country. The sufficient condition is the harmonization between (N:R) and (N:R)' relationships.

(2) N:R relations in the transfer of technology

In the 1960's, main needs for the technology transfer from abroad were technologies requested for the establishment of welfare state in a big drive ahead to the rapid internationalization of Japan. Japan introduced mainly the advanced technologies for such maturing industries as textile, automobile, electric and electronics, to increase exports by improving her international competitiveness in this period. The Japanese economy made greater efforts to improve its productivity and to reduce costs by importing advanced technologies for mass-production and automation.

As shown in Figure 3, the time of 1960's gave several kinds of terms advantageous to the mechanism of technology transfer from abroad to Japan. The N:R relationships of both countries, Japan and the country exporting technology, were easy to harmonize, because of favourable world circumstances with effective pulling and pushing factors for the technology transfer. In the period like this, social conditions are very important. Japan had a high level of infrastructure for technology transfer, such as education, R & D capacity, international communication, effective patent system, etc.. Japan has been also relatively in political and social stability. Therefore, foreign direct investments into Japan increased rapidly in this period. Now, the number of foreign companies in Japan

Figure 3 Mechanism of technology transfer from overseas to Japan, in the 1960's



is about 2,000. It should be mentioned that Japanese economy has been able to allocate more resources than other countries to the economic development and also to the technology transfer from abroad, because Japan is a country of the renunciation of war after the world war II.

Government policies related to the technology transfer in this period centered on the liberalization of trade and foreign investment, and on the improvement of infrastructure for technology transfer. We were unnecessary to take the policy guidance further and able to depend upon the strategy of private sector. However, duplicated imports of the same technology increased by the excessive competition among companies.

The liberalization of trade and foreign investment promoted resaltantly the technology transfer from abroad into Japan. This does, however, not mean that the government did not take any direct policy for the technology transfer. It is important to add that the government attached the condition of public disclosure of patents to big foreign investors who wanted to invest into very important industries for Japan, as seen in the case of the foreign direct investment into Japan by IBM. Indeed, it is also true that any foreign company is hard to invest if the regulation is too strict. The government also have increased the number of science attache in main Japanese embassies. In 1965, 8 science attaches worked in U.S.A., U.K, France, West Germany, U.S.S.R, Vienna. Now the government sends many science attaches to many important countries from view points of the transfer of science & technology.

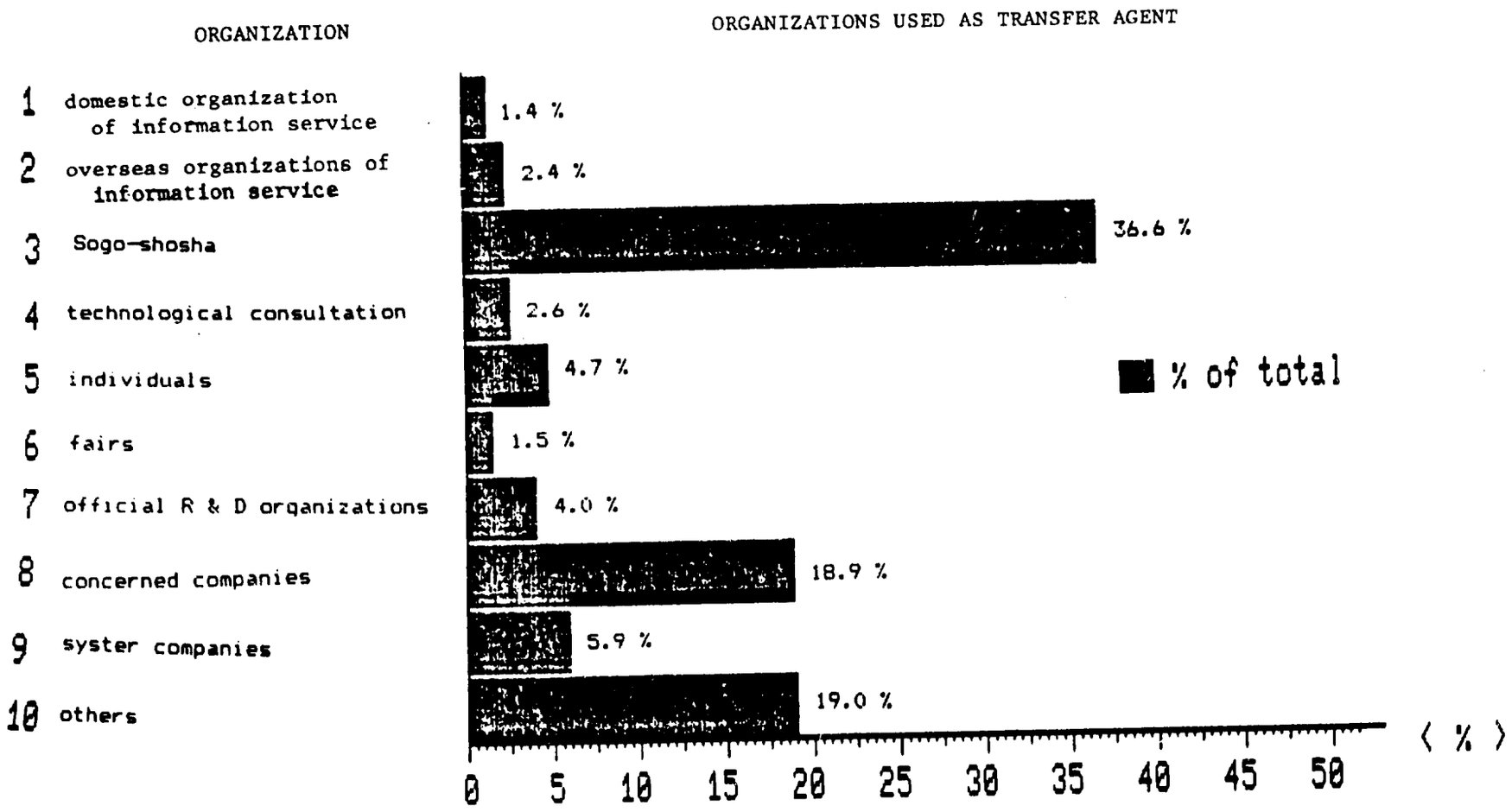
(3) The diversification of transfer channels

The development of transfer agents is very important in the process of modernization of the mechanism of technology transfer. Generally speaking, the professional agent and the patent broker play an important part as the transfer agent in U.S.A. and European countries. Especially in Japan, Sogo-shosha plays most important role as an agent in the technology transfer, as shown in Figure 4. Although Figure 4 is a result of the questionnaire research in 1977, it seems to me that Sogo-shosha played more important part in the 1960's than it in the 1970's.

In Sogo-shosha, the technology transfer was dealt with by special stuffs belonged to the machinery section in the early time. The number of such stuffs increased in each section dealing with technology - intensive industries in the 1960's. In the 1970's, many Sogo-shoshas established the division or the section of technology as the professional organization dealing with the technology transfer. Recently, Sogo-shoshas have been inputing their greater efforts on dealing with such new businesses of the high technologies as SLSI, bio-technology, new ceramics, opto-technologies, etc.. They reformed their organizations to correspond to this movement. Main strategies of Sogo-shoshas on the high technology are,

a. strengthening the capacity of high technology section
b. approach to the high technology industries
c. establishing some new sections dealing with high technology
d. establishing some affiliated companies related to high technologies
e. capital participation into the venture businesses

Figure 4



Source: JITTA, Technology Transfer Report, 1977.

f. organizing international network of technology transfer

g. technology transfer by promoting foreign direct investments.

In the 1970's, the technological needs of Japan centered on the technologies useful for upbringing of new leading industries, the improvement of living quality of the people and environment, and restructuring of the industrial structure toward more knowledge - intensive one. But the interrelationships of N:R among countries have been competitive more and more after the oil - shock in 1973, then the world economy went into a long tunnel of serious depression. It became uneasy to transfer new technologies from abroad by only money especially in the industries with small technological gap. The number of cases of the cross-licensing contracts has been increased in the technology transfer. Japan reached the top levels in the world technological competition in many industries in this period.

Main government policies were as follows, several kinds of international cooperations including the international promotion of the patent system, Patent Cooperation Treaty (1970), international R & D cooperation, establishment of the Japan Fund for international cultural exchange, and the improvement of the channels of technology transfer including the entire liberalization of the technology transfer from abroad (1972), increasing the budget for study abroad, etc.. The technological policies of Japan moved its priority from the technology transfer to the R & D activity in this period.

The introduction strategy of Japanese company was mainly to improve their development capacity of new products, therefore Japanese company bought positively new basic patents to develop their own new products by applying them, in this period.

In the 1980's, the technological needs of Japan are mainly such technologies as to make the autonomous and gapless development of the people's living among regions, to break the limitation from energy problems, to challenge the problems for the next generation.

3. Development process of the mechanism of intra-national technology transfer

(1) Modernization of the mechanism of technology transfer

The transfer mechanism of Japan has been developed in company with the economic growth. The higher stage of economic growth requests a more advanced mechanism of technology transfer, while the new transfer mechanism is able to promote the economic growth. It may be helpful to call attention to the fact that the infrastructure for technology transfer, the transfer agent and the N:R relationship are the factors fundamental to the understanding of the development of transfer mechanism, as shown in Figure 5.

In the 1950's, the Japanese economy was in the period of modernization and rationalization of existing industries and of introducing new industries from abroad, so that the government took the policies of technology transfer corresponding to them. For the equipment and the supplies of infrastructure of technology transfer, the government established the Japan Information Center of Science & Technology and promoted the movement of industrial standardization and took some policies for the modernization of infrastructure.

Many business associations were established in this period, and they were

Figure 5. Development Process of the Transfer Mechanism in Japan

	1950's	1960's	1970's
Infrastructure	equipment and supplies of infrastructure	leveling up of each infrastructure	systematization of infrastructure
Transfer agents	upbringing of transfer agents	diversification of transfer agents	building up as a professional industry
N:R. relationship	modernization of N:R relationship	organizing of N:R relationship	systematization of N:R relationship

very useful for the communication among member companies and incidentally worked as the transfer agents. The Japan Productivity Center (JPC) was established to promote the movement for productivity increase in 1955. The activities of JPC are as follows, (a).sending of inspection & study teams, and inviting foreign exparts and taking their lectures, (b).organizing study courses or seminars, (c).activities for modernization of the relations between employers and emplovees. Many companies introduced such modern management technologies as industrial engineering, marketing, top management, etc., through the participation in the movement for productivity increase. It must be recognized here, of course, that these companies made greater efforts on the modernization and the rationalization of production technology together with management technology.

In the N:R relationship of this period, technological needs became pressing to almost all companies, although resources were in a severe shortage, especially, of money or capital. The government established the Nippon Development Bank for financing to the key industries in 1951, and some financing corporations for smaller enterprises in the early 1950's. Main roles of the government were to cover the shortage and to promote the modernization of N:R relationship. For these, the government invested to increase the equipment and the supplies of infrastructure and put the law in force for upbringing of the transfer agents and also improved the government capacity of technology transfe. The local government has her several industrial institutes which are able to transfer advanced technologies to companies in the region. these local government institutes have played an important role in the technology transfer to small companies.

(2) Industrial restructuring and transfer policies

In the 1960's, Japanese economy was requested to be one of main suppliers of manufactured products to the world market. So, Japan took the policies for restructuring of Japanese economy to accede to this demand. Several kinds of innovations called for new investments and the investments were accompanied with the transfer of technology in the long boom of the world economy. The leading industries of economic growth changed from small industries to big industries, from small companies to large companies. The big companies integrated large number of small companies through the sub-contracts, and brought up the cooperative companies from them by transfering their technologies.

The infrastructure of technology transfer was leveled up by the establishing boom of new universities, the modernization of communication system and the building boom of industrial parks, etc.. The number of transfer agents increased rapidly in the private sector. It must also be mentioned that the information industries were developed in this period, which were useful for both the diversification of transfer agents and the level-up of the infrastructure.

A large number of companies established the central R & D institutes and the workshops in which N and R could be directly organized. The sub-contracting system became a main channel of technology transfer between large and small companies. Thus, the N:R relationship moved from the stage of modernization to the stage of organization building of (N:R)+(N:R)' links in this period. The demand for R, of course, increased largely and engineers in addition to the capital were insufficient for the technology transfer.

The government accomodated to the insufficient R with increasing the

government loan and improving preferencial tax system for the promotion of modernization and rationalization.(5) The government policies centered especially on small companies in this period, for examples, made a guidancing system for the management modernization, the plan of action for modernizing small industries from points of view of production, exports, manufacturing plant, technologies, marketing, labour problems, etc., and activities for the factory diagnosis.(6) To support the enforcement of the government policies, Japan Center for Smaller Enterprises (1962) and Smaller Enterprise Promotion Corporation (1967) were established. The policy measures were mainly sa follows,

a. consultation

b. guidancing

c. training

d. information

e. financing

f. tax policy

g. others.

(3) The knowledge intensive economy by using the technology transfer

In the 1970's, the growth strategy of Japan selected to increase the knowledge intensity of the economic structure.(7) Technological needs (N) changed from the technologies requiring large scale, mass-production to the needs for higher quality, new function, small quantity but various kinds,etc.. In this period, even small companies had to introduce new technologies including electronics, new materials, industrial robots, another high technologies, to

Table 3 Information Sources of Company in Technology Transfer

information source	scale of company by capital					
	< 10biln	10-100biln	100-300biln	> 300biln	total	%
1. business contacts	19 (12.7)	86 (16.1)	16 (16.7)	10 (13.3)	131	15.4
2. patent information	22 (14.8)	78 (14.6)	16 (16.7)	9 (12.0)	125	14.6
3. concerned companies	17 (11.4)	69 (12.9)	14 (14.6)	9 (12.0)	109	12.8
4. special/business journals	25 (16.8)	48 (9.0)	10 (10.4)	10 (13.3)	93	10.9
5. Sogo-Shosha	14 (9.4)	60 (11.3)	9 (9.4)	8 (10.7)	91	10.7
6. sister companies	6 (4.0)	37 (6.9)	11 (11.5)	6 (8.0)	60	7.0
7. official R & D organizations	5 (3.3)	35 (6.6)	4 (4.2)	7 (9.3)	51	6.0
8. journals of scientific associations	7 (4.7)	26 (4.9)	3 (3.1)	7 (9.3)	43	5.0
9. fairs	10 (6.7)	19 (3.6)	2 (2.1)	2 (2.7)	33	3.9
10. catalogue	10 (6.7)	12 (2.3)	1 (1.0)	0 (0)	23	2.7
11. newwspapers	4 (2.7)	15 (2.8)	0 (0)	1 (1.3)	20	2.3
12. domestic information services	4 (2.7)	12 (2.3)	1 (1.0)	0 (0)	17	2.0
13. overseas information services	0 (0)	7 (1.3)	7 (7.3)	1 (1.3)	15	1.8
14. others	2 (1.3)	9 (1.7)	1 (1.0)	3 (4.0)	15	1.8
15. private contacts	3 (2.0)	11 (2.0)	0 (0)	0 (0)	14	1.6
16. technological consultants	1 (0.8)	9 (1.7)	1 (1.0)	2 (2.7)	13	1.5
17. total	149(100%)	533(100%)	96(100%)	75(100%)	853	100%

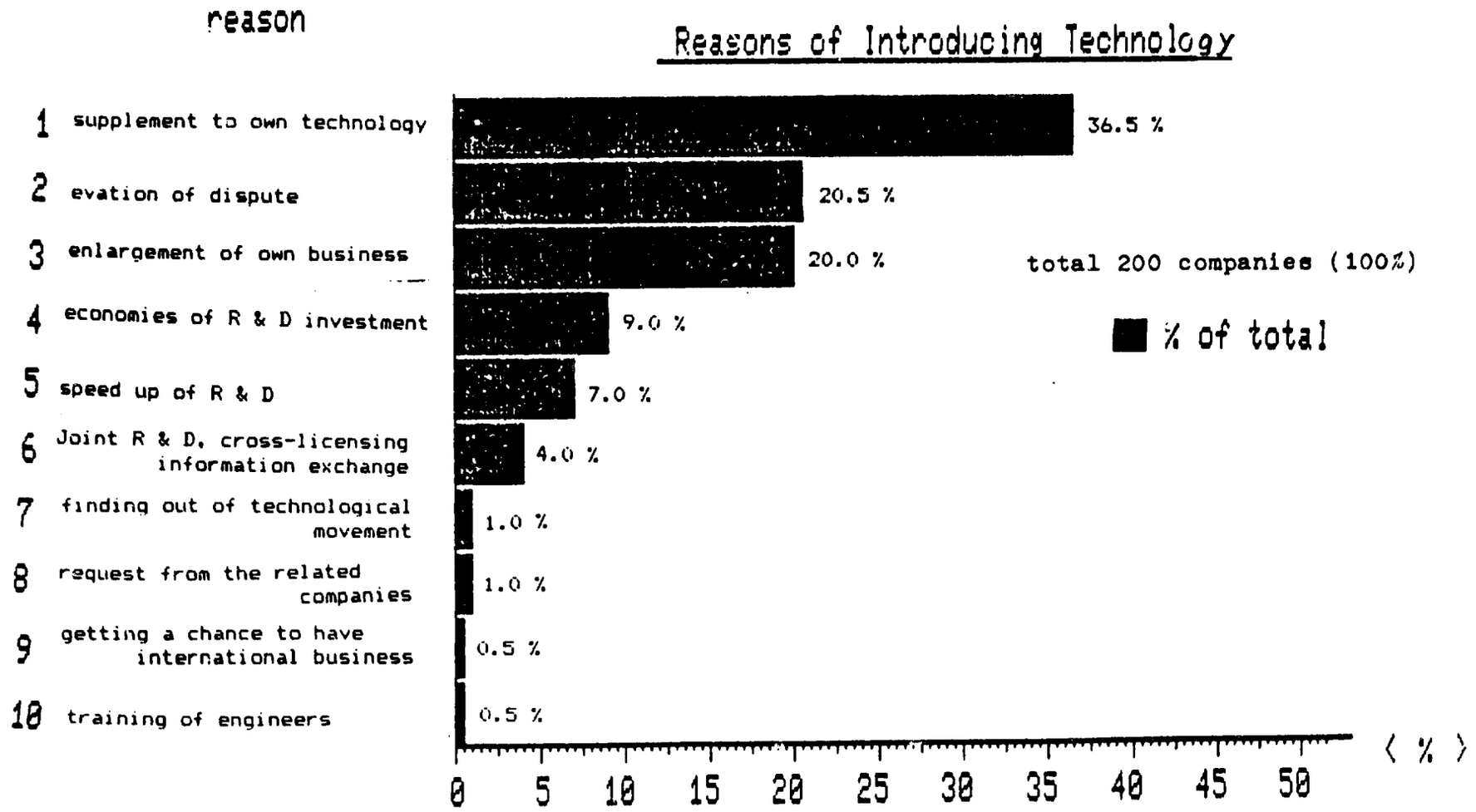
Source: JITTA, see Fig 4

swim with the stream of technological advancement. The sub-contract became to attach more importance to the technological capacity rather than capital and cost. The technological competition among companies was very keen in the long world - wide depression like this period.

The information channels for technology transfer have been diversified. But the information sources are different between large and small companies, as seen in Table 3. Main information sources are business contacts, patent information, concerned companies, special / business journals and Sogo-shosha. However, large companies make relatively more % of official R & D organizations, journals of scientific associations, syster companies, while small companies have higher % in industrial fairs, catalogues, private contacts. The reason for this that the smaller the scale of company is, the stronger the personal character is, and the larger the scale of company is, the stronger the organizational character is, in the communication.

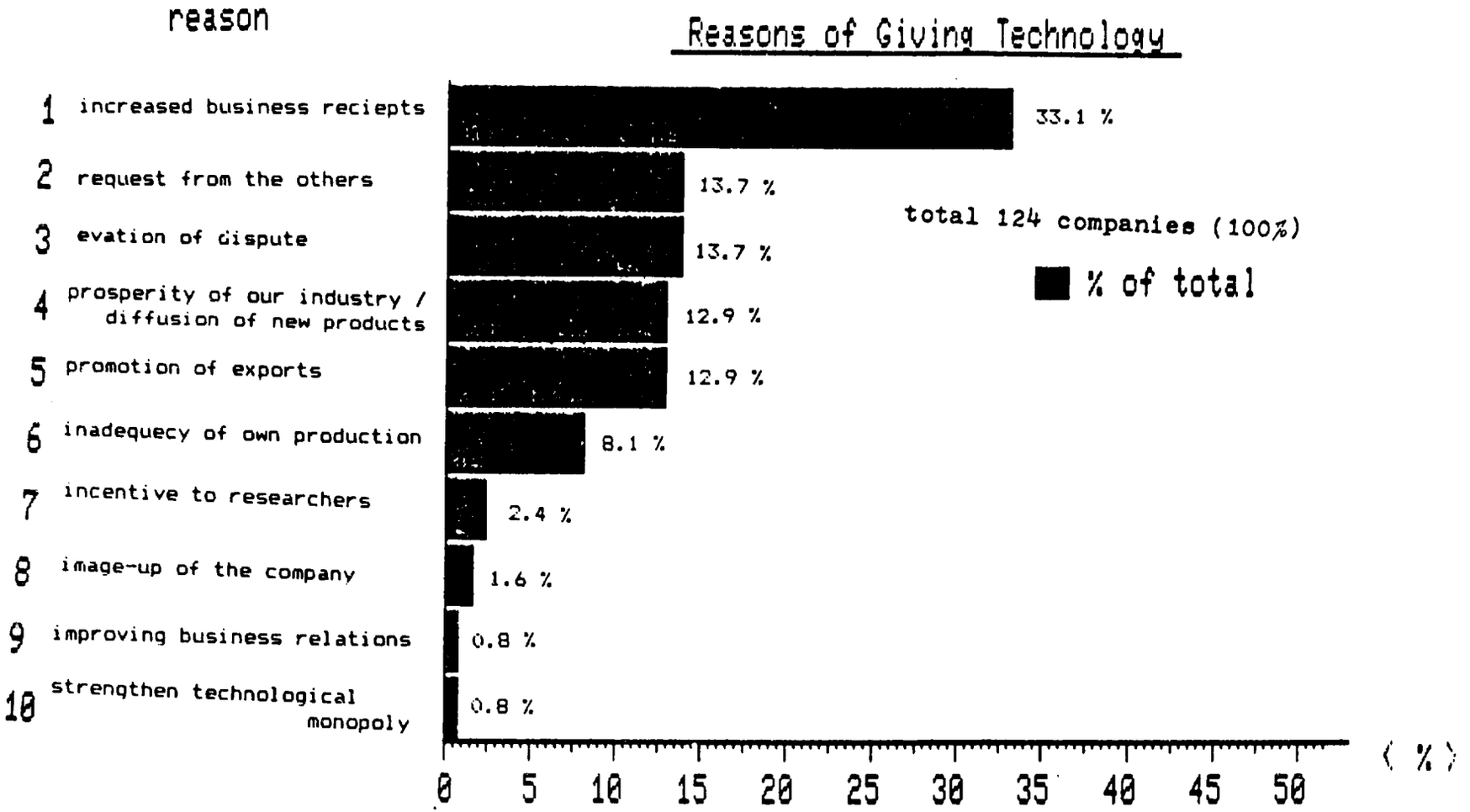
The transfer of technology is very hard if there is no conformity of conditions or requirements between the licenser and licensee. The introducers think of following factors as important reasons of introducing technology, as shown in Figure 6, (a).supplement to own technology, (b).to evade patent dispute (c).enlargement of new business, (d).economies of R & D investment. While the licensers think of following factors as important reasons of licensing technology, as shown in Figure 7, (a).to increase business reciepts, (b).request from others, (c).to evade patent dispute, (d).to be useful for the prosperity of our industry / diffusion of our new products.

Figure 6



Source: JITTA, see Figure 4

Figure 7

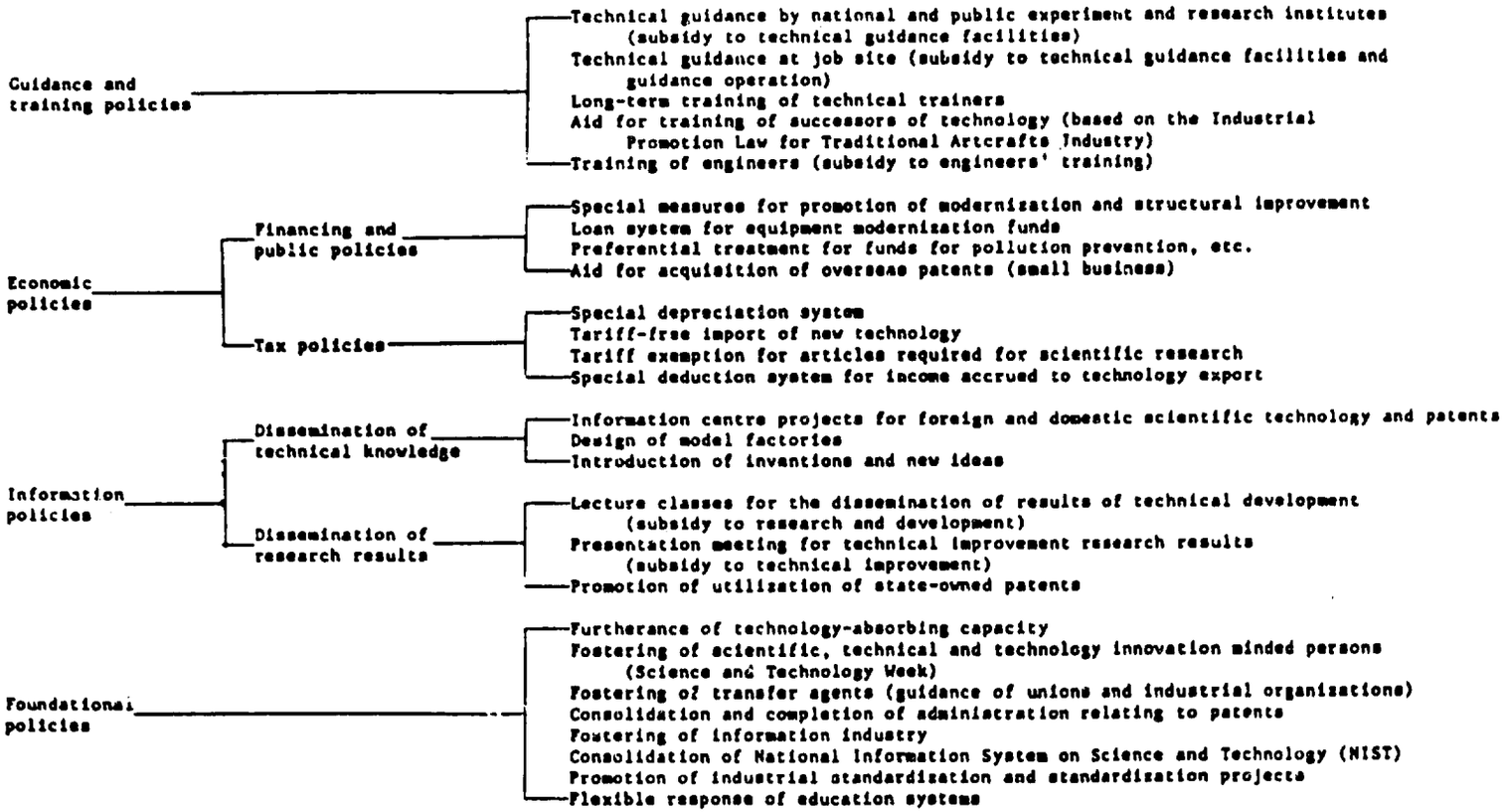


Source: JITTA, see Figure 4

The systematization of many related infrastractures of the technology transfer has been promoted by improving the information networks, for examples, the project of NIST (National Information System of Science & Technology), Japan Patent Information Center (1971), and by establishing Tsukuba Park of Science & Technology, etc.. Transfer agents also have been established as a professonal industry. All local governments employed some authorized senior engineers as the part-time technological advisers to smaller enterprises. The number of consulting companies has also been incleased rapidly. This period was clearly characterized by the systematization of N:R relationship. The linking of N:R relationships among related sectors has been strengthened by increasing the mobility of scientists and engineers among sectors, joint researches, information exchange, joint projects among the government, university, and industry,etc..

It seems to me that the government did not have almost any clear policy concept of the technology transfer until the biginning of the 1970's. Such policy was launched upon the small enterprises. In this period, the government gave more care to make an effective policy system by integrating verious fields of related policies, for examples, economic policies related to the technology transfer, the information policy, guidancing and training policies, and the infrastructural policy, etc., as shown in Table 4. The linking of R & D activities and the technology transfer was also mentioned in making the more effective policy system. Such policies of technology transfer in Table 4 were enforced mainly to improve the technological capacity of the small companies in the 1970's.

Table 4. Policy Measures of Government for Technology Transfer



Source: M.Saito,"Technology Transfer Policies of Japan",Asian Productivity organization Technology Transfer in Some Asian Countries, 1979.

4. Toward more appropriate mechanism of technology transfer

It is surely the fact that Japan has been able to develop her national economy by using the technology transfer from abroad. The technology transfer from abroad in Japan could have an efficient linkage effect from time to time and from industry to industry, for examples, from heavy & chemical, materials-supplying industries and their technologies in the 1950's, to new processing, mass-production technologies in the 1960's, and to the technologies for increasing value added and for improving quality, muniter and accurater processing technologies in the 1970's.

In the 1950's, Japan had the very low par-capita income almost same as less developed countries and unstable national economy. Japanese people had to work hard to crawl up from the near subsistence level and had to save large parts out of their incomes to import requested natural resources and new technologies. This period might be most important for Japanese economy from viewpoint of the development strategy, because the fundamentals for national development were builded on severer conditions than any later period's. After all, main direct actors in the technology transfer are private enterprises, and the government policy is only to promote it. Private enterprises put their greater efforts on the technology transfer to alive in keen domestic and international competitions. In any time, zealous and effective activities of private sectors are necessary to be successful in the technology transfer.

After the world war II, several kinds of restrictions to the social system were removed, and the incentive to innovations and the mobility of resources for the technology transfer (R) also increased rapidly. I think that the big obstacle

to technology transfer is the shortage of, not (R) but rather the zeal and (N) in the long run. It is true that several sides of social reforms were useful to promote the modernization of technology transfer mechanism after the world war II. Anyway, the impediments to the incentive are irrational restrictions in the social system and a hopeless situation to the people. Further, I would suggeste that a problem is to depend too much upon the administrative techniques and aids of the government, and the vitality of enterprise or the entrepreneurship is greatly important for the development of technology transfer.

It is also important to notice that Japan has experienced such problems in the technology transfer, as pollutions, the transfer of inappropriate technologies, technological monopoly and technological dependence. In order to resolve these problems, Japan has been excerting all possible efforts including the improvement of assessment capacity of technology, making preventive laws to those problems, research and development of preventive technologies, and increasing R & D capacity, etc..

In the 1980's, new policies toward more appropriate mechanism of technology transfer have been trying by using the reginal reallocation of R&D resources, vitalizing creative R & D capacity, the concerted attack to big R & D subjects among the government, companies and academic society, reforming the R & D organizations, etc..

Note

1. Masaru Saito, Transfer of Technology , (Gijutsu Iten Ron), Yuhikaku, 1979.

2. _____, "Diffusion Mechanism of Technology and Industrial Transformation : Case of small Scale Industries in Japan", OECD, Transfer of Technology for Small Industries, 1974.

3. _____ Nation Building based on Science & Technology, (Gijutsu Rikkoku Ron) Yuhikaku, 1983.

4. _____ "Technology Transfer Policies of Japan", Asian Productivity Organization, Technology Transfer in Some Asian Countries, 1979.

5. Ministry of International Trade and Industry, The Histry of Policies of Trade and Industry, (Shoko Seisaku Shi), Vol.10

6. Smaller Enterprise Agency, White paper on Smaller Enterprise, (Chusho Kigyo Hakusho), 1972.

7. Industrial Structure Council (MITI), The Policies of Trade and Industry in the 1970's.