

NISTEP REPORT No.16

# The Interchange of Researchers and Engineers Between Japan and Other Countries

— A Study Based on the “Annual Report of Statistics on Legal Migrants”、 “Statistics on Foreigners Staying in Japan” and the “Annual Report of Statistics on Japanese Nationals Overseas” —

(SUMMARY)

March, 1991

2nd Policy-oriented Research Group

Akio Nishimoto

Hajime Nagahama

National Institute of Science and Technology Policy (NISTEP)

SCIENCE AND TECHNOLOGY AGENCY

**Translation from  
Japanese version**

## Contents

1. Preface	1
2. Data and Scope of Study	2
1) State of interchange of researchers and engineers	4
2) Stay by researchers and engineers	4
3. Outline of Voyage and Residential Categories	5
1) When foreign researchers and engineers enter and stay in Japan	5
2) When Japanese researchers and engineers go abroad	8
3) When Japanese researchers, etc., stay abroad	8
4. Explanation of Terms	9
1) Scope of survey	9
2) Researchers and engineers	9
3) Number of researchers and engineers	9
4) Interchange ratio	9
5) Stay ratio	10
5. Outline of Findings	11
1) General situation of interchange of researchers and engineers	11
(1) 1989 trends	11
(2) 20-year trends	15
2) Recent characteristics of interchange	19
3) General situation of stay by researchers and engineers	20
(1) 1988 trends	20
(2) Past trends	22

## 1. Preface

In the recent years the international community has become borderless in which firms from different countries carry out activities across national borders in search of more advantageous conditions and in which people, things, money and services freely come and go. With the growth of such borderless activities problems such as of trade and investment friction and acceptance of foreign workers have become prevalent between countries, with the result that they are energetically discussing measures to solve these problems.

In the area of science and technology also foreign countries have come to make demands on and pose problems for Japan regarding basic research and research and technology interchange, this means that Japan is being pressed to make an appropriate response. It will be a natural international obligation for Japan which has become an economic super power and technologically advanced country to precisely cope with these demands. Mistakes could develop into a more serious problems. Recognizing the matter's seriousness and promoting mutual understanding is important for Japan to develop into a country which is trusted and respected by others in the international community.

In the recent years Japan is being demanded to develop the level of its basic research by establishing R&D centers which will pass current best practice in the world and match the so-called "centers of excellence." It is said that there an imbalance has occurred between Japan and other developed countries, in particular in the interchange of researchers, because of lack of such R&D centers in Japan and the inadequacies of Japanese acceptance systems. This has come to draw the attention recently as a serious problem which could aggravate the science and technology friction if neglected.

The interchange of researchers is believed to produce the following effects through free exchange of researchers having different thinking patterns and cultural background.

- (1) It will promote complementation of the mutual research and technological abilities and production of original ideas.
- (2) It will promote the transfer of research and technological achievements and know-how.
- (3) It will promote mutual understanding by researchers and maintenance of good competitive relationship.

The issue of imbalance of interchange of researchers surfaced when it was pointed out by the U.S. side in the 2nd Japan-U.S. Conference on Advanced Technology and International Environment held in Kyoto in 1986 and the subsequent negotiations for signing of the Japan-U.S. Agreement on Cooperation in Research and Development in Science and Technology. Specifically it has been pointed out that while Japan has been sending a massive number of researchers to the Western countries to acquire knowledge and connecting this to product development back home by having them bring back Western achievements, Japan is closed when it comes to acceptance of researchers from the Western countries and has not been taking positive acceptance measures.

In coping with such claims Japan has been producing steady results by taking measures recently such as creation of fellowship systems. However, while part of the interchange records have been made public recently the record of interchange of researchers which becomes the basis of arguments has not been grasped fully.

Given such a situation, this study has as comprehensively as possible studied and analyzed the record of interchange of researchers between Japan and other countries by using statistical data made available by the Justice Ministry and the Foreign Office. However, since these data have been collected from the government offices' own positions of controlling departures and entries and grasping the actual condition of foreigners in Japan it is impossible to extract data only on researchers.

Hence this study covers not only natural scientists but cultural and social scientists as well. It also covers those involved in the acquisition and provision of industrial technologies and skills. These are all called "researchers and engineers."

## 2. Data and Scope of Study

Figure A outlines the sources of the data on the research and technological interchange activities carried out between

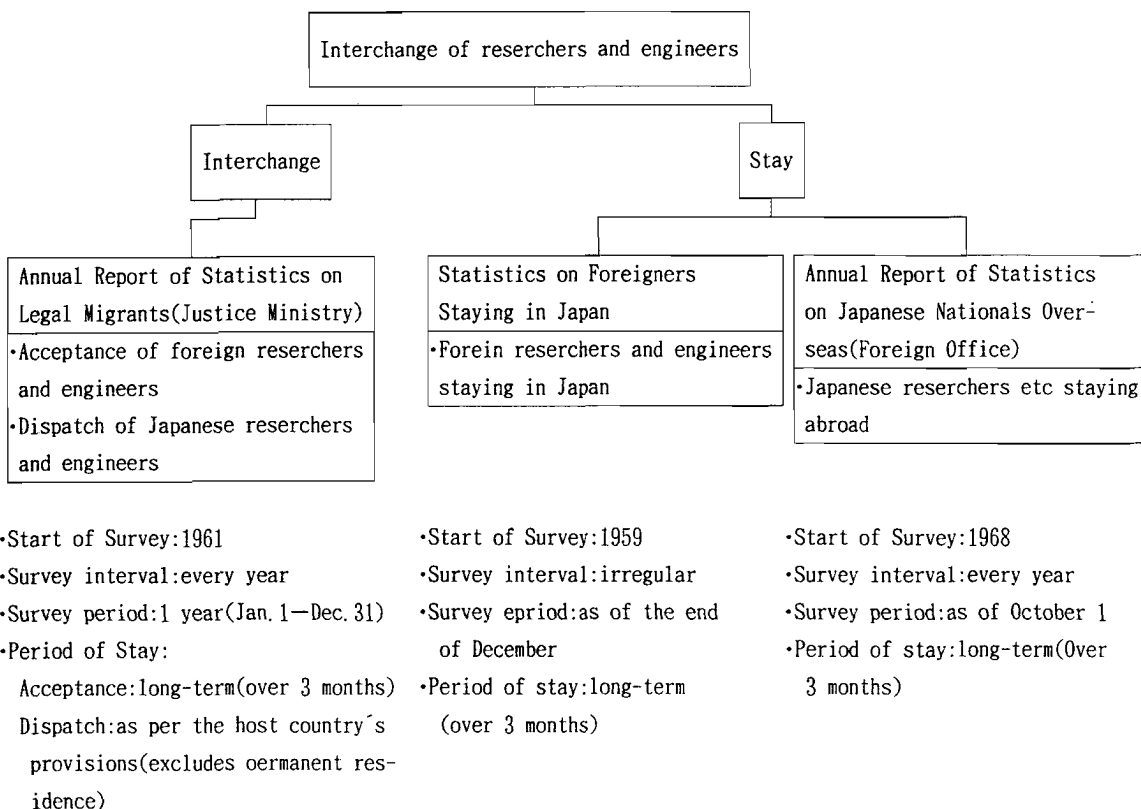


Figure-A Data Sources

Japan and other countries. Table A shows the differences between the data on dispatch of Japanese researchers and engineers overseas and acceptance of foreign researchers and engineers by Japan. Table B shows the differences between the data on Japanese researchers staying abroad and foreign researchers and engineers staying in Japan. As is clear from these figures and tables there are some differences in the length of stay and purpose of visit both in the areas of interchange and stay. Since these are fundamental differences related to purposes and methods they cannot be eliminated. Hence in comparing the dispatch and acceptance of researchers and engineers and their stay in Japan and abroad it will be necessary to interpret the findings by fully taking account of

Table-A Differences in the Data on Departure and Entry of Reserchers and Engineers (Interchange)

Item	Entry(foreign reserchers and engineers)	Departure(Japanese reserchers and engineers)
Length of Stay	•Only long-term stay(over 3 months)	•As per the host country's provisions(excludes permanent residence)
Purpose of visit	•"Study" does not include schooling •Includes "provision of technology" •"Training" was added after 1982	•"Study" includes schooling •Does not include "provision of technology" •"Training" has been included in "Study and acquisition of technology" since 1971
Screening	•Screening based on the residential qualifications based on the Legal Migrants and Refugees Law	•The purpose of visit is freely declared on the entry and departure card

Table-B Differences in the Data on Reserchers(Engineers) in Japan and Abroad (Stay)

Item	Foreign reserchers and engineers in Japan	Japanese reserchers, etc. , abroad
Number	•The figures do not include families	•Since the figures include families the number of reserchers, etc. , were estimated using 1988 figures
Persons covered	•"Study" does not include schooling •Does not include instructors of foreign language schools •Includes those involved in aquisition or provision of technology and skills	•"Study" includes schooling •Includes Japanese language and other instructors •Does not include those involved in aquisition or provision technology and skills
Survey method	•Based on foreigner registration records	•Based on residential notification based on the Passport Act as well as complementary surveys

the differences. However, while there are differences which cannot be eliminated, it is believed fully meaningful to grasp the general situation of interchange between and stay of researchers and engineers in Japan and other countries by fully utilizing the available data. The following gives the outline.

#### 1) State of interchange of researchers and engineers

The state of interchange of researchers and engineers was analyzed using the Justice Ministry's "Annual Report of Statistics on Legal Migrants." The survey covers the 20 years from 1970 to 1989.

Foreigners wishing to enter Japan are screened based on the residential qualification system based on the Legal Migrants and Refugees Law. Those satisfying the conditions are given the permit to enter Japan. The residential qualification system prescribes the activities in Japan and position and status of foreigners to be allowed entry and prescribes 18 residential qualifications. While the revision of this law which took effect on June 1, 1990, has increased the residential qualifications to 28, this study uses the 18 old qualifications.

Five of the 18 qualifications concern researchers and engineers: "study," "training" (added in 1982), "instructive activities," "artistic and academic activities" and "provision of advanced technology." In general the period of stay when foreigners enter Japan can be divided into three kinds namely short stay (under three months), long stay (over three months) and permanent residence. Foreign researchers and engineers entering Japan can only stay for a long stay. As a rule they are not allowed the short stay or permanent residence. Specifically, those visiting for "study," "training" and "artistic and academic activities" can stay either for three months, six months or one year and those for "instructive activities" and "provision of advanced technology" for three months, six months, one year or three years.

As regards Japanese going abroad the authorities' objective is to confirm the fact that they left the country and no permission is required. Hence, because departure by Japanese does not require screening the procedure is simple and the voyage categories are only 11 compared to 18 in the case of foreigners entering Japan. The category is determined based on the purpose of voyage freely declared by the travelers themselves on the departure card.

Two of the 11 voyage categories concern researchers and engineers namely "academic investigation and research" and "study, training and acquisition of technology." Since the period of stay of Japanese researchers and engineers who go abroad is subject to the host country's regulations it could be any of short stay, long stay or permanent residence. Since permanent residence is one of the 11 voyage categories, by excluding this it is possible to cover Japanese researchers and engineers who go abroad for a short or long stay. However, since the period of stay depends on the host country's regulations it is not possible to generalize about that of Japanese researchers and engineers.

#### 2) Stay by researchers and engineers

The patterns of stay of researchers and engineers were analyzed using the Justice Ministry's "Statistics on Foreigners Staying in Japan" (published by the Entry Control Association) and the Foreign Office's "Annual Report of Statistics on Japanese Nationals Overseas." The Justice Ministry study provides statistical data for grasping the patterns of stay of foreign researchers and engineers in Japan and the Foreign Office's for grasping that of Japanese researchers and engineers abroad. Since the stay of foreign researchers and engineers in Japan is directly connected with their entry their residential qualifications and period of stay are the same as the case of entry. While the Justice Ministry survey has been conducted seven times in the past in 1959, 1964, 1969, 1974, 1984, 1986 and 1988 this study covered the last five surveys conducted after 1969.

In contrast the Foreign Office has been studying Japanese who stay abroad. The survey is conducted based on the residential notification submitted to Japanese diplomatic establishments abroad. To ensure accuracy the Office is also surveying such organizations as Japanese affiliates abroad, Japanese associations and universities, research organizations and schools having Japanese researchers and students. Statistically Japanese who stay abroad are classified into six occupations. However, since none of the categories covers engineers and skilled workers this study covered "students, researchers and instructors" as a category related to researchers. These only cover those on long stay of over three months and exclude those on short stay of under three months and permanent residents. Japanese researchers abroad include their families. Since the Foreign Office survey ("Annual Report of Statistics on Japanese Nationals Overseas") conducted on October 1, 1988, released the number of researchers and their families separately for the first time the number of researchers in the past surveys were calculated based on this ratio. Hence the number prior to 1988 is estimation. In meeting with the Justice Ministry survey ("Statistics on Foreigners Staying in Japan") the study covered the five surveys conducted after 1969.

### **3. Outline of Voyage and Residential Categories**

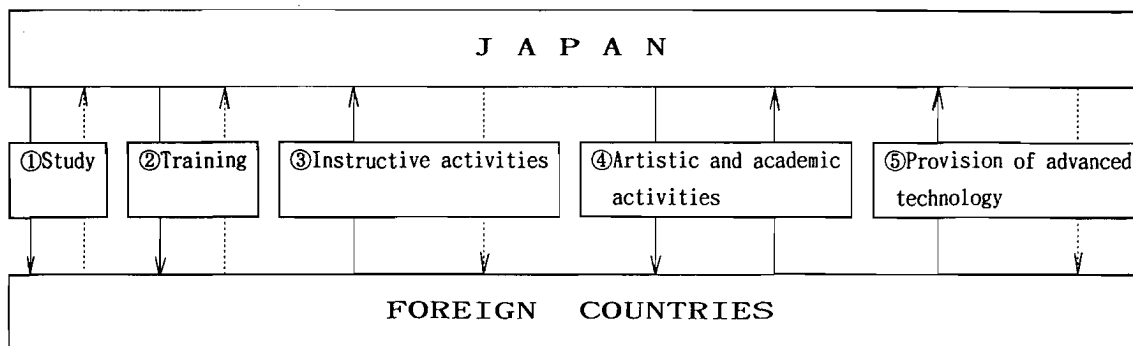
Since the categories used when foreign researchers and engineers enter and stay in Japan and Japanese researchers, etc., go and stay abroad are different the following gives their outline.

#### **1) When foreign researchers and engineers enter and stay in Japan**

The categories used here are based on Section 4, Part 2, Chapter 2 of the Legal Migrants and Refugees Law and are made up of five (residential qualifications). Figure B shows foreign researchers and engineers' residential qualifications and the flow of benefit enjoyed through research and technology interchange between Japan and other countries.

Of the five residential qualifications "study" and "training" place Japan in a position to provide benefit to foreign researchers and engineers such as through provision of opportunities for education and research and acquisition of technology.





- ①Those conducting research or receiving education at junior colleges and higher educational institutions
- ②Those accepted by Japanese public or private organizations and wishing to acquire industrial technology or skills
- ③Those providing guidance on research or education at academic research and educational organizations (full-time lectures, assistant professors and professors at junior colleges and higher educational and research organizations)
- ④Those wishing to execute artistic or academic activities (those wishing to carry out advanced musical, artistic, literary, scientific and other artistic or scientific activities)
- ⑤Those invited by domestic public or private organizations to provide advanced or special industrial technology and skills

Note : arrows indicate the flow of benefit

Figure-B Outline of Research and Technology Interchange

In contrast "instructive activities" and "provision of advanced technology" place Japan in a position to benefit from foreign researchers and engineers such as through research and educational guidance and provision of technology. "Artistic and academic activities" such as when Japanese and foreign researchers and engineers carry out joint research is a case in which it is not possible to tell which side benefits.

(1) Study (Paragraph 6, Sub-Section 1, Section 4)

"This provision covers those who intend to conduct specific research or receive education at Japanese academic research or educational organizations.

To open up academic research and educational organizations to foreigners will be to cooperate with development and expansion of cultural interchange with other countries, maintenance and promotion of friendship and training of manpower to contribute toward social and economic development. The academic research organizations here mean national, public or private organizations conducting research in natural, cultural or social sciences and include those belonging to universities, etc., in addition to independent organizations. This category includes those engaged in research at these organizations.

The educational organizations mean graduate schools, colleges, junior colleges and equivalent and exclude high schools and lower schools and miscellaneous schools."

The foregoing is this provision's interpretation. In reality however the Justice Minister determines the issuance of not of the residential qualification certificate by consulting with the Education Minister (competent minister) based on the Law's provisions. Hence in reality the provision covers students of institutions controlled by the Education Ministry namely colleges, graduate schools, junior colleges, technical colleges and special training schools (specialized courses) and does not cover those of national, public and private academic research organizations.

(2) Training (Paragraph 6-2 of Sub-Section 1, Section 4)

This provision covers those accepted by Japanese public and private organizations to acquire industrial technology or skills.

This category was newly set up as an independent residential qualification through a revision based on Law No. 85 of 1981 to set out Japan's positive attitude of accepting technical trainees. Accepting such trainees contributes toward developing the developing countries' technical and skill levels, economic cooperation and Japanese firms' overseas development as well as other forms of international cooperation.

If the training is to satisfy this provision it must be designed to acquire industrial technology or skills. The trainees must also be accepted by Japanese public or private organizations. Hence the category does not include student nurses or students of the legal business for example.

"Japanese public and private organizations" include foreign government-related organizations, international organizations and branches of foreign firms in Japan in addition to Japanese government organizations, local public bodies, public corporations and private firms. They also need not be organizations such as stock companies and can be personal businesses if they have the facilities and personnel for training.

(3) Instructive activities (Paragraph 7, Sub-Section 1, Section 4)

"This provision covers those who intend to guide research or provide education at Japanese academic research or educational organizations. It covers lecturers, assistant professors and professors who provide education or guide research at national, public or private academic research organizations (including those belonging to universities, etc.), graduate schools, colleges and junior colleges.

The definition of academic research and educational organizations is the same as the case of "study." This category does not include those engaged in clerical affairs at educational organizations, etc., and instructors of language schools."

The foregoing is the provision's interpretation. As in the case of study it only covers educational organizations.

(4) Artistic and academic activities (Paragraph 8, Sub-Section

1, Section 4)

This provision covers those who intend to carry out musical, artistic, literary, chemical, physical, mathematical and other artistic or academic activities in Japan.

Covered are musicians, artists, literati, chemists, physicists, mathematicians and other artists and those who intend to carry out cultural activities (including research) in Japan as academicians.

As a concept this overlaps with "study" and "instructive activities." However these persons need not carry out research and other activities at educational or research organizations hence include private persons carrying out independent research.

(5) Provision of advanced technology (Paragraph 12, Sub-Section 1, Section 4)

This provision covers those who are invited by Japanese public or private organizations to provide advanced or special industrial technology or skills.

To satisfy this provision it is necessary that the technology or skill is deemed difficult or impossible to acquire in Japan and that the person is invited by a public or private organization in Japan.

Satisfying this provision include atomic energy experts, computer engineers and space development-related engineers.

2) When Japanese researchers and engineers go abroad

When Japanese go abroad the only thing the authorities are interested in is to confirm that they left the country. Hence unlike in the case of foreigners coming to Japan they are not screened for entry by checking their residential qualifications. Hence the voyage categories related to researchers and engineers are simple consisting only of two namely "academic investigation and research" and "study, training and acquisition of technology." Based on the purpose of voyage freely declared on the departure card the sections in charge group the purposes into 11 and release them as statistical data. Since no screening is involved the grouping is less strict and accurate than the case of foreigners coming to Japan.

Other differences from the case of entry are (1) while "study" in the case of entry does not include schooling such as for learning languages it is included in the case of departure. (2) While entry includes "provision of technology" departure does not.

3) When Japanese researchers, etc., stay abroad

The number of Japanese who stay abroad is grasped using the Foreign Office's "Annual Report of Statistics on Japanese Nationals Overseas." This is prepared based on the residential notification which Japanese who stay abroad for over three months are obliged to submit based on the Passport Act as well as a complementary survey. The study extracted "students, researchers and instructors" as a category related to researchers, etc. It includes the following persons.

- (1) Public- and private-expense students
- (2) Those engaged in research or education at universities, research institutes and other research and educational organizations

(3) Japanese language and other instructors (excluding instructors of Japanese schools abroad and those dispatched by the government as lecturers)

The differences compared to the case when foreigners stay in Japan are 1) the category does not include engineers and skilled workers, 2) it includes Japanese and other language instructors and 3) "study" includes schooling.

#### **4. Explanation of Terms**

This section explains terms often appearing in later chapters.

##### 1) Scope of survey

The study collected data for 41 countries namely the developed countries (OECD's DAC member countries), EC countries, Soviet Union and Eastern European countries, ASEAN countries, Asian NIEs, China and India. Hence, while the study is designed to cover the entire world, in terms of survey by country it only covers the 41 countries. However these countries are believed to basically include all those having close relationship with Japan, those which are actively interchanging researchers and engineers or those in which Japan is relatively interested. Hence it was judged that there would be no problems in excluding other countries. However the figures for the entire world include those for other countries. The 41 countries also include those which temporarily joined the above blocs, etc.

##### 2) Researchers and engineers

Researchers and engineers mean those engaged in the study of cultural, social and natural sciences as well as those involved in the provision or acquisition of industrial technology and skills.

##### 3) Number of researchers and engineers

Unless otherwise noted the number of researchers and engineers involved in interchange is the total number. Hence it includes the number of reentries and redepartures in addition to those who entered or left for the first time.

##### 4) Interchange ratio

This was obtained by dividing the number of Japanese researchers and engineers who went abroad by the number of foreign researchers and engineers Japan accepted during the given period (Number of Japanese researchers and engineers dispatched / Number of foreign researchers and engineers accepted). If the same kind of researchers and engineers were sent and accepted the ratio varying around 1.0 should serve as an indicator of whether the number of Japanese researchers and engineers sent exceeded or was less than the number of foreign researchers and engineers accepted. However, since the kinds of Japanese researchers and engineers sent and foreign researchers and engineers accepted are not identical it is not possible to accurately talk about the balance of interchange between Japan and other countries based on this ratio.

For example, while the purpose of accepting foreign researchers and engineers includes "provision of advanced technology" that of dispatch of Japanese researchers and

engineers does not have the category "provision of technology." Also, while "study" in the case of foreign researchers and engineers does not include miscellaneous school education such as language study such is included in "study, training and acquisition of technology" in the case of Japanese researchers and engineers.

Also, acceptance before 1981 did not include "training." Hence, there might be the opinion that it is meaningless to talk about ratios when the framework of dispatch and acceptance is not identical. However, even if the ratio is insufficient in accurately grasping the real dispatch/acceptance balance, when looked at over time it is believed to serve as an indicator in examining if the imbalance is decreasing or increasing or when comparing with other countries and regions.

#### 5) Stay ratio

This was obtained by dividing the number of Japanese researchers, etc., staying abroad by the number of foreign researchers and engineers staying in Japan at a given point in time (Number of Japanese researchers abroad / Number of foreign researchers and engineers in Japan). As in the case of the interchange ratio the stay ratio varying around 1.0 is an indicator of the balance between Japanese researchers abroad and foreign researchers and engineers in Japan. However, as in the case of interchange the Japanese and foreign framework is somewhat different since Japanese researchers abroad do not include those related to acquisition or provision of technology and skills, include Japanese language and other instructors and "study" includes schooling. In this case also the ratio was obtained for the same purposes as the interchange ratio.

## 5. Outline of Findings

This section discusses the findings from the study of interchange of researchers and engineers between Japan and other countries using data for the 20 years from 1970 to 1989. The trends of stay was surveyed using data for 1969, 1974, 1984, 1986 and 1988.

### 1) General situation of interchange of researchers and engineers

#### (1) 1989 trends

In 1989, 146,488 Japanese researchers and engineers went abroad (1.5% of all Japanese departures) and Japan accepted 84,295 foreign researchers and engineers (2.8% of all foreign entries). The interchange ratio (dispatched/accepted) was 1.74.

To explore the actual condition of interchange between Japan and other countries in more detail the study attempted a multilateral approach. The following section discusses its findings.

Let us examine the state of interchange by country. Nearly 50% (69,556, 47.5%) went to the U.S. followed by the U.K. (13,511, 9.2%) and China (8,606, 5.9%) (Figure C). In contrast the greatest number came from Korea (20,286, 24.1%) followed by Taiwan (15,015, 17.8%) and China (11,763, 14.0%). Hence the top three sources of foreign researchers and engineers were Japan's neighboring countries (Figure D). As for the interchange ratio the Soviet Union's 24.46 was the highest followed by East Germany's 16.00 and Australia's 14.39. Malaysia's 0.16 was the lowest followed by the Philippines' 0.20 and Korea's 0.30.

Next, in terms of dispatch by social system and economic development phase 111,867 (76.4%) went to developed countries, 33,121 (22.6%) to developing countries and 1,500 (1.0%) to the Soviet Union and Eastern European countries.

In terms of the source of researchers and engineers 73,794 (87.5%) came from developing countries, 10,285 (12.2%) from

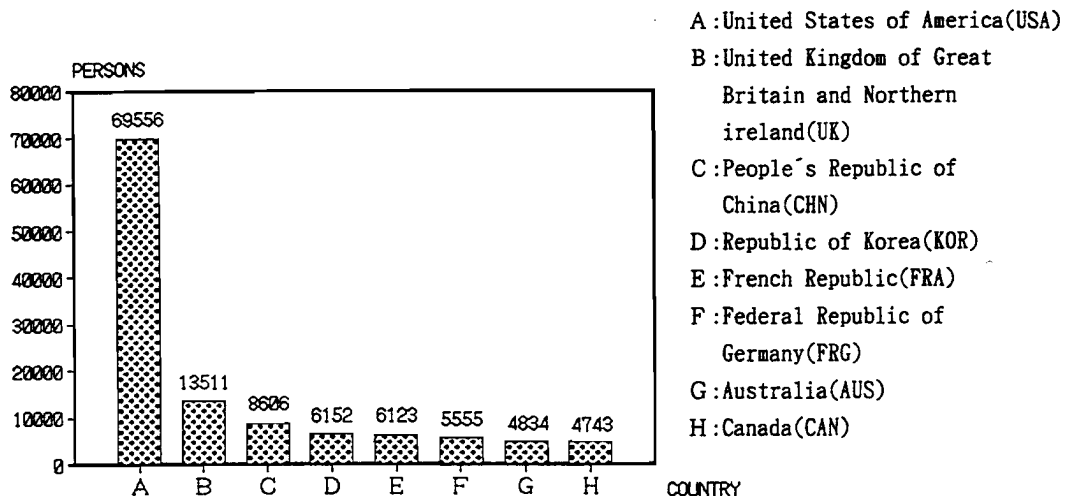


Figure-C Dispatch of Japanese Reserchers and Engineers by Countries(1989)

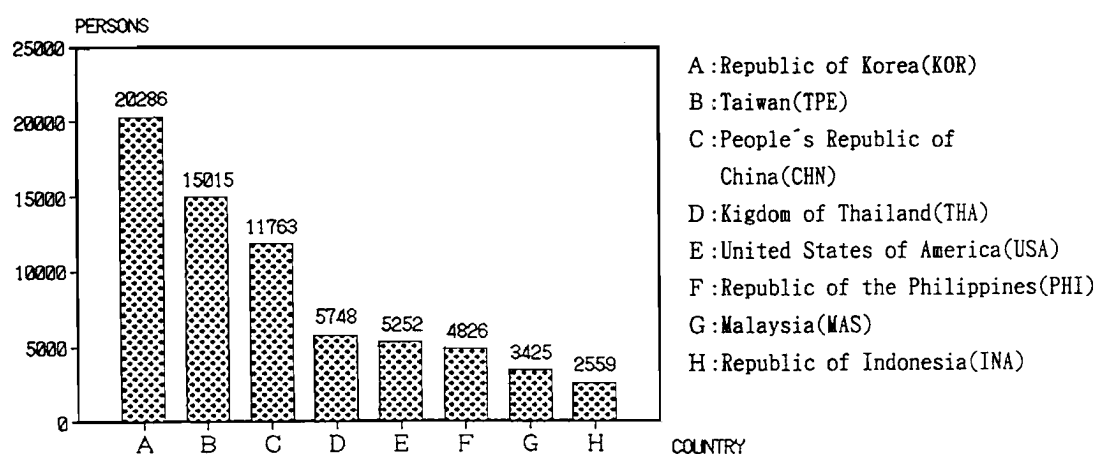


Figure-D Acceptance of Foreign Reserchers and Engineers by Country(1989)

developed countries and 216 (0.3%) from the Soviet Union and Eastern Europe.

Hence nearly 80% of the Japanese researchers and engineers went to developed countries and nearly 90% of the foreign researchers and engineers came from developing countries. In terms of economic development phase the relationship between dispatch and acceptance is the reverse--the dispatches are mainly to developed countries and acceptances mainly from developing countries. The interchange between Japan and the Soviet Union and Eastern Europe can be said to be very inactive.

Let us also examine the interchange ratio by social system and economic development phase. 111,867 Japanese researchers and engineers went to developed countries while 10,285 foreign researchers and engineers came from them. The interchange ratio was 10.88 hence dispatch substantially exceeded acceptance. 33,121 Japanese researchers and engineers went to developing countries and 73,794 came from them. The interchange ratio was 0.45 hence acceptance exceeded dispatch. 1,500 Japanese researchers and engineers went to the Soviet Union and Eastern Europe and 216 came from them. The interchange ratio was 6.94 hence dispatch considerably exceeded acceptance (Figure E).

Examining the state of dispatch of Japanese researchers and engineers by bloc shows that 29,840 (20.4%) went to the EC countries, 6,614 (4.5%) to the ASEAN and 15,909 (10.9%) to the Asian NIEs.

Examining the state of acceptance of foreign researchers and engineers by bloc shows that Japan accepted 4,124 (4.9%) from the EC countries, 17,182 (20.4%) from the ASEAN and 36,036 (42.7%) from the Asian NIEs.

In terms of dispatch of Japanese researchers and engineers by region 74,554 (50.9%) went to North America, 34,287 (23.4%) to Europe and 30,225 (20.6%) to Asia. Hence North America and Europe accounted for three-quarter of all dispatches and North America alone a half. In terms of acceptance of foreign researchers and engineers by region 67,248 (79.8%) came from

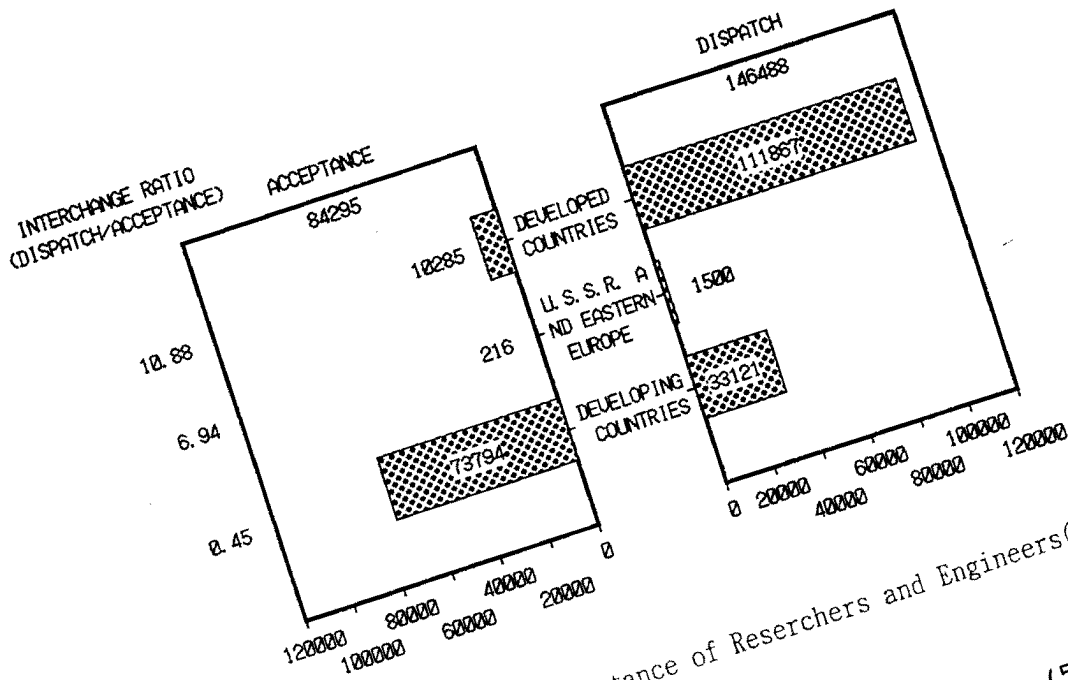


Figure-E Dispatch and Acceptance of Reserchers and Engineers(1989)

Asia, 6,255 (7.4%) from North America and 4,640 (5.5%) from Europe. Hence nearly 80% came from Asia.

Next, let us examine the state of interchange by purpose of visit.

113,234 (77.3%) of the Japanese researchers and engineers went abroad for "study, training and acquisition of technology" and 33,254 (22.7%) for "academic investigation and research" (Figure F). Hence nearly 80% of the dispatches from Japan were to acquire the host countries' knowledge and technology through study and training.

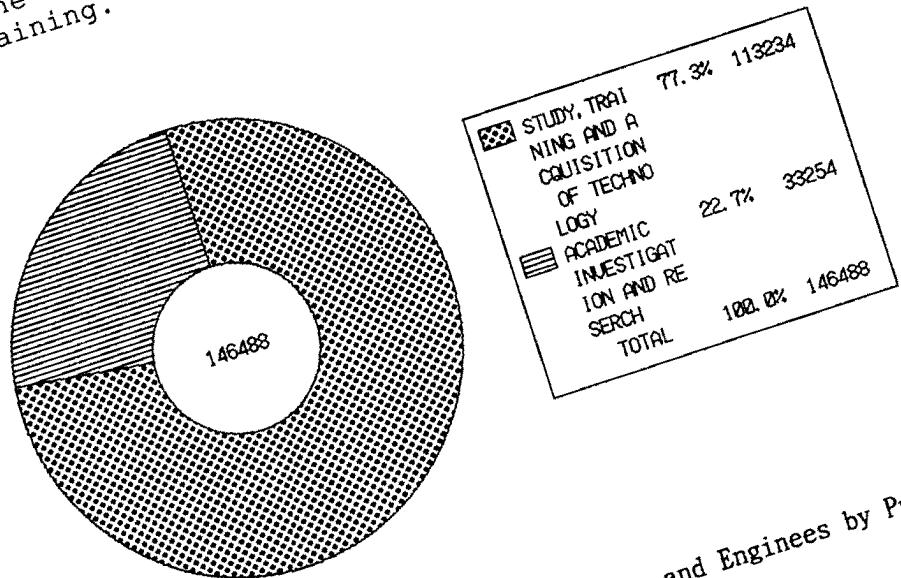


Figure-F Dispatch of Japanese Reserchers and Engines by Purpose(1989)



58,523 (51.7%) of the 113,234 sent for "study, training and acquisition of technology" and 11,033 (33.2%) of the 33,254 sent for "academic investigation and research" went to the U.S. Hence, regardless of the purpose the overwhelming portion of the dispatches were to the U.S.

In either of the purposes of "study, training and acquisition of technology" and "academic investigation and research" the main destinations were developed countries.

In terms of acceptance of foreign researchers and engineers 45,424 (53.9%) were for "study," 32,512 (38.6%) for "training," 3,633 (4.3%) for "artistic and academic activities," 2,611 (3.2%) for "instructive activities" and 65 (0.1%) for "provision of advanced technology" (Figure G). Hence over 90% of the researchers and engineers accepted were to acquire knowledge and technology in Japan through study and training. The number entering Japan to provide knowledge through instructive activities can be said as very small.

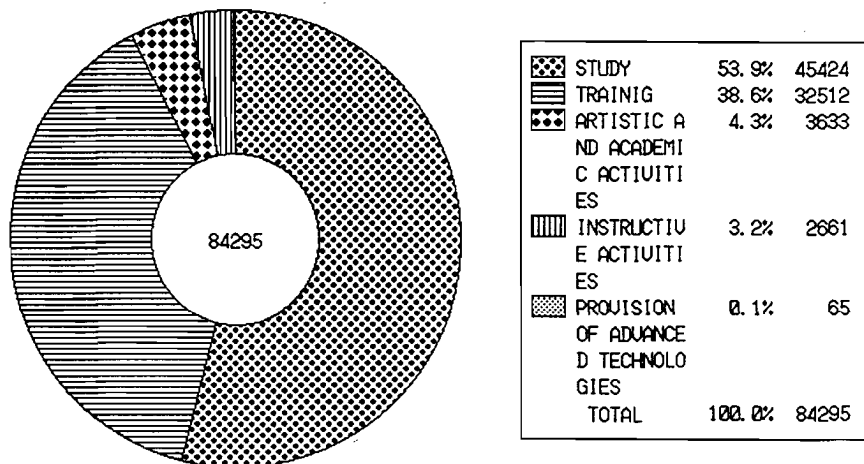


Figure-G Acceptance of Foreign Reserchers and Engineers by Purpose(1989)

The acceptance of foreign researchers and engineers for "study" and "training" is mainly from the neighboring Asian countries such as Korea, Taiwan and China.

In contrast, the main acceptances for "instructive activities" and "provision of advanced technology" were from the Western countries, mainly the U.S. Those for "artistic and academic activities" were split between Western countries and Asia. Over 90% of the acceptances for "study" and "training" were from developing countries, around 90% of the acceptances for instructive activities and provision of technology from developed countries and acceptances for artistic and academic activities were split between developed and developing countries.

(2) 20-year trends

During the 20 years from 1970 to 1989 Japan sent 730,218 researchers and engineers abroad (0.9% of all Japanese departures) and accepted 461,445 foreign researchers and engineers (1.6% of all foreign entries). The interchange ratio was 1.58 hence dispatches exceeded acceptances.

Examining the trends of dispatches and acceptances in the 20 years shows that dispatches always exceeded acceptances until 1981 but were on a par after 1982 and dispatches have again exceeded acceptances after 1985 (Figure H).

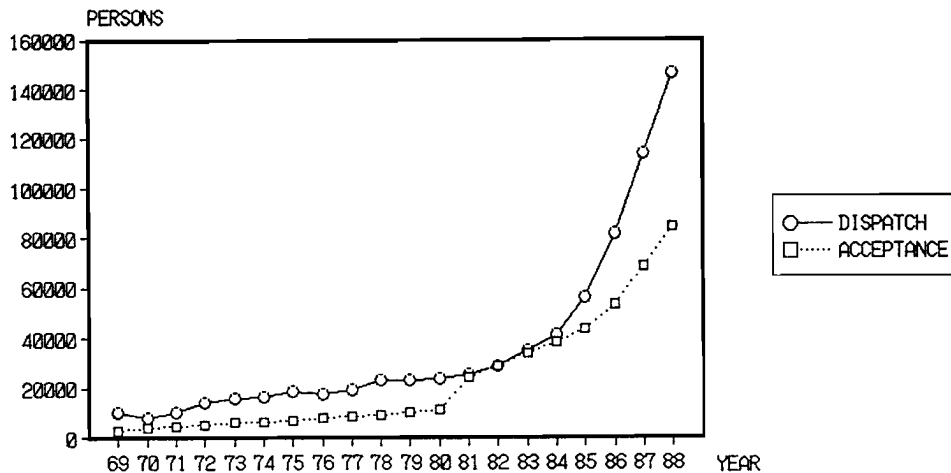


Figure-H Trends of Dispatch and Acceptance of Reserchers and Engineers between Japan and Other Countries

The increase of acceptances in 1982 is believed to have been due to addition of "training." Comparing the number dispatched and accepted in 1989 and 1970 shows that the number dispatched in 1989 was 13.8 times that in 1970 and the number accepted was 25.4 times. Hence the rate of increase of acceptances has exceeded that of dispatches. However, since there was no residential qualification of "training" in 1970 the rate of increase of acceptances is believed greater than the actual.

Let us examine the state of interchange by country. The U.S. has accounted for nearly 50% (353,852, 48.5%) of all dispatches from Japan followed by the U.K. (59,353, 8.1%) and France (39,727, 5.4%) (Figure I). Examining the dispatches to these countries during the 20 years shows that conspicuous has been growth of dispatches to the U.S. particularly after 1985.

The growth of dispatches to the U.K. and France has been gentle in comparison. However those to the U.K. have markedly been growing after 1985. Examining the trends of dispatches to China with which Japan established diplomatic relations in 1973 and Taiwan with which it severed them at the same time shows that the dispatch to these countries slowly increased until the mid 1970s and rapidly increased afterwards. In contrast Taiwan has been the greatest source of researchers and engineers coming to Japan (97,614, 21.2% of all) followed by Korea (87,145,

18.9%) and China (63,290, 13.7%). As in 1989 the top three countries were neighboring countries (Figure J). Examining the

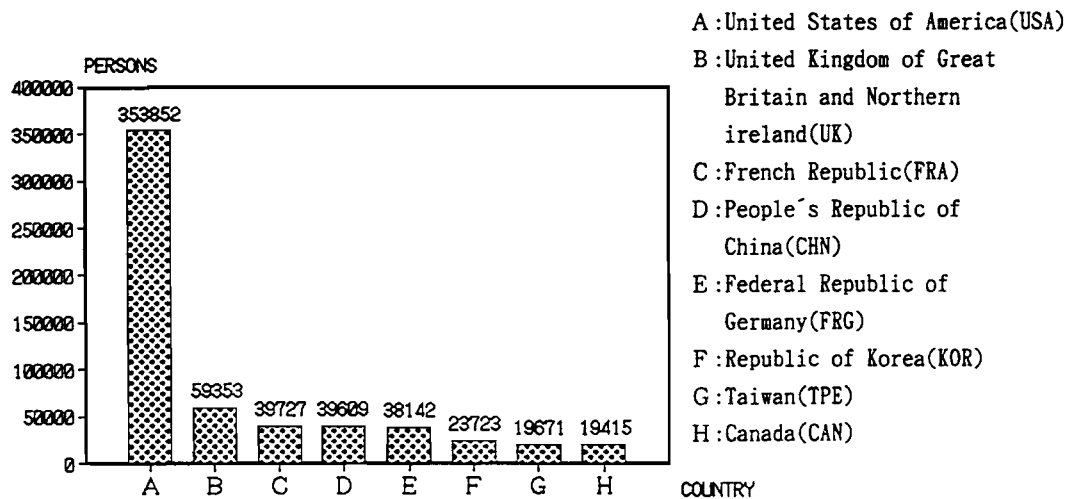


Figure-I Dispatch of Japanese Reserchers and Engineers by Countries(20 years)

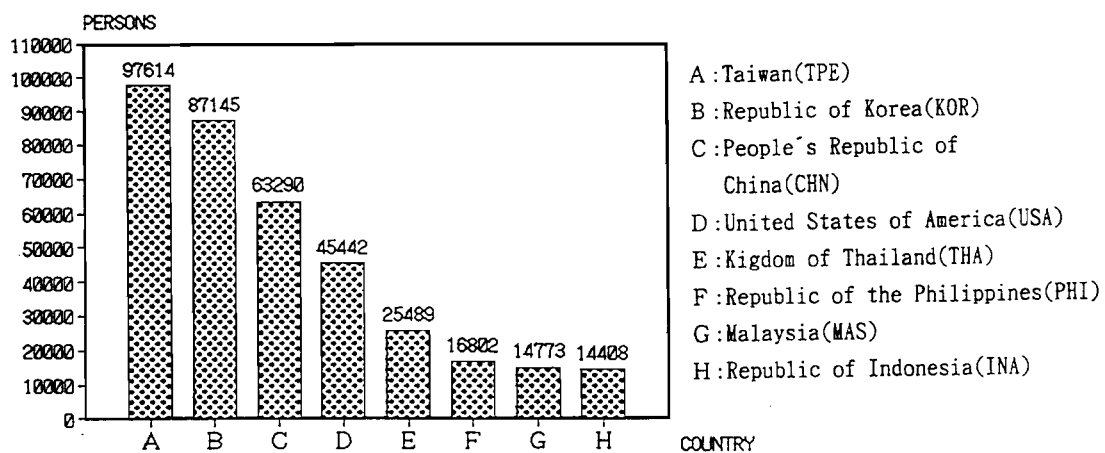


Figure-J Acceptance of Foreign Reserchers and Engineers by Country(20years)

Korean trends during the 20 years shows that visitors from it steadily increased after 1970 and the growth has been marked after 1982.

Examining the trends of acceptance from China after 1973 when diplomatic relations were established shows that the acceptance of researchers and engineers gradually increased but the increase was small until around 1980. However it rapidly increased from around 1985, temporarily decreased and again rapidly increased. The growth has been so rapid as to rank China third in the world in acceptance even for the entire 20 years.

Examining Taiwan's trends shows that while the acceptances steadily increased after 1973 when diplomatic relations were severed they temporarily decreased after 1983 but again rapidly increased afterwards. These trends show that severing of diplomatic relations had virtually no effect on human interchange. In terms of the interchange ratio for the 20 years the Soviet Union's 60.52 was the highest followed by Romania's 34.14 and East Germany's 10.99. Malaysia's 0.14 was the lowest followed by Taiwan's 0.20 and Korea's 0.27. Examining the ratio's trends during the 20 years shows that it basically declined until 1981, plunged in 1982 and remained on the same level and has subsequently been rising (Figure K). The plunge in 1982 was due to addition of the residential qualification of "training" to acceptance.

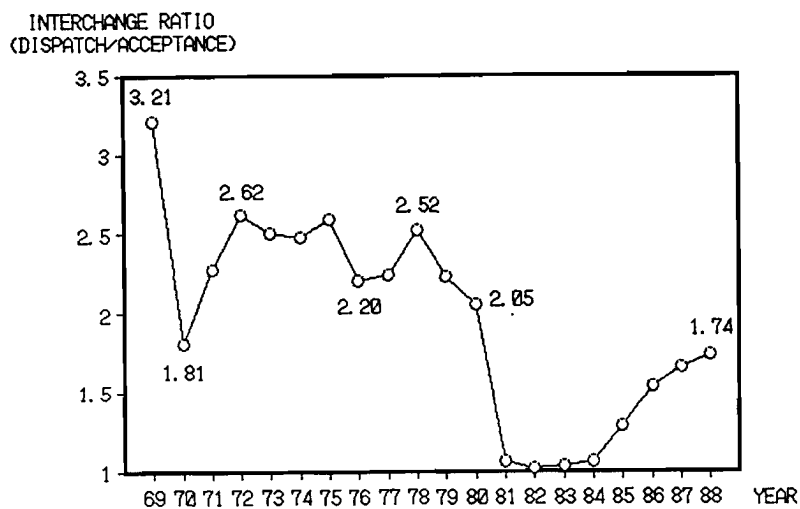


Figure-k Trends of Interchange Ratio of Reserchers and Engineers

Next, examining the dispatch of Japanese researchers and engineers by social system and economic development phase shows that 570,014 (78.1%) were sent to developed countries, 148,730 (20.4%) to developing and 11,474 (1.5%) to the Soviet Union and Eastern Europe.

In terms of acceptance of foreign researchers and engineers 380,176 (82.4%) were from developing countries, 79,581 (17.2%) from developed and 1,688 (0.4%) from the Soviet Union and Eastern Europe.

As for the interchange ratio, to developed countries Japan sent 570,014 researchers and engineers and accepted 79,581 for an interchange ratio of 7.16 hence dispatch has substantially exceeded acceptance. To developing countries it sent 148,730 researchers and engineers and accepted 380,176 for an interchange ratio of 0.39 hence acceptance has exceeded dispatch. To the Soviet Union and Eastern Europe it sent 11,474 and accepted 1,688 for an interchange ratio of 6.80 hence dispatch has considerably exceeded acceptance (Figure L).

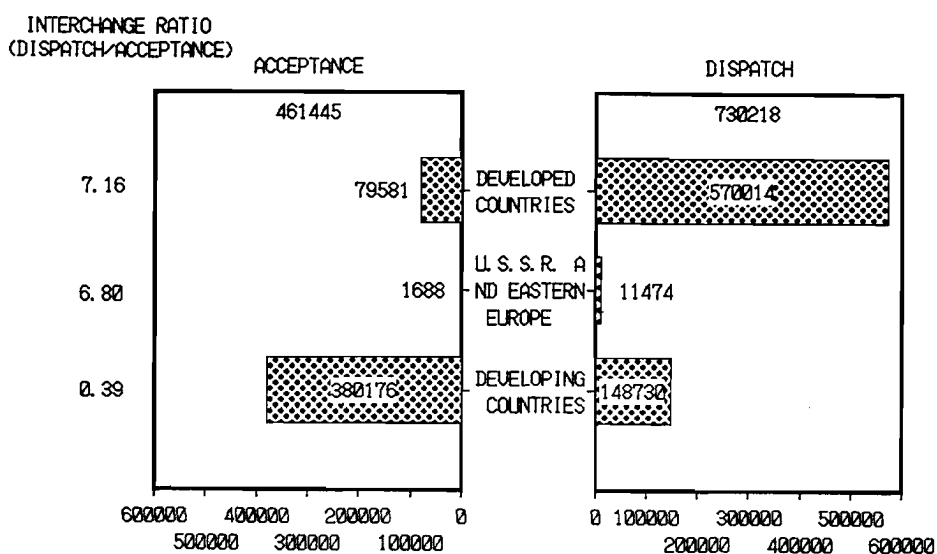


Figure-L Dispatch and Acceptance of Reserchers and Engineers(20years)

Examining the state of dispatch during the 20 years by bloc shows that 158,077 (21.6%) went to the EC countries, 29,103 (4.0%) to the ASEAN and 50,384 (8.8%) to the Asian NIEs.

Examining the state of acceptance during the 20 years by bloc shows that Japan accepted 26,191 (5.7%) from the EC countries, 76,161 (16.5%) from the ASEAN and 156,962 (39.5%) from the Asian NIEs. The figure for the Asian NIEs however is for the last ten years.

In terms of dispatch by region 377,132 (51.6%) went to North America followed by 192,433 (26.4%) to Europe and 129,955 (17.8%) to Asia.

In terms of acceptance 347,706 (75.4%) came from Asia followed by 52,150 (11.3%) from North America and 31,286 (6.8%) from Europe.

These trends during the last 20 years by social system and economic development phase, bloc and region are basically the same as those in 1989.

Let us next examine the interchange in the last 20 years by purpose of visit. 494,013 (67.7%) Japanese researchers and engineers were dispatched for "study, training and acquisition of technology" and 236,205 (32.3%) for "academic investigation and research" (Figure M).

In terms of acceptance of foreign researchers and engineers 265,923 (57.6%) were accepted for "study," 143,966 (31.2%) for "training," 29,906 (6.5%) for "artistic and academic activities," 20,743 (4.5%) for "instructive activities and 907 (0.2%) for "provision of advanced technology" (Figure N). The purposes of visit in the last 20 years also show tendencies similar to 1989's.

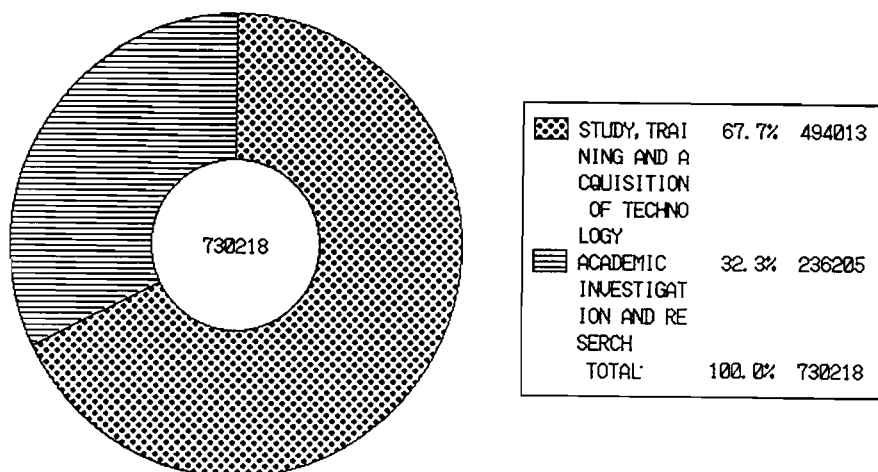


Figure-M Dispatch of Japanese Reserchers and Engineers by Purpose(20years)

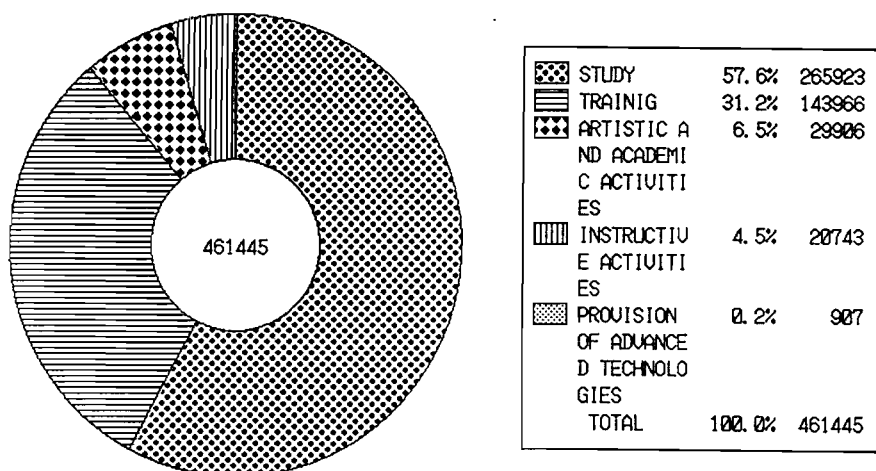


Figure-N Acceptance of Foreign Reserchers and Engineers by Purpose(20years)

## 2) Recent characteristics of interchange

Both dispatch and acceptance of researchers and engineers by Japan started to rapidly increase after 1985. The rate of increase of dispatch in particular has exceeded that of acceptance. Since 1985 is believed to be a turning point when the past tendencies greatly changed let us examine the tendencies during the five years after and the 15 years before 1985 by developed, developing country and the Soviet Union and Eastern Europe. Examination of these regions' shares in the

dispatch and acceptance shows that while the developed countries' and the Soviet Union and Eastern Europe's have been declining in the recent five years both in terms of dispatch and acceptance that of developing countries has been rising both in terms of dispatch and acceptance. Therefore the developing countries can be said to be activating their interchange compared to the developed countries and the Soviet Union and Eastern Europe.

Next, examination of the interchange ratio during the recent five years and the 15 years before 1985 shows that the ratio for the developed countries during the recent five years was 8.41 as compared to 5.93 for the 15 years before 1985. Those for the Soviet Union and Eastern Europe were 7.50 for the recent five years and 6.30 for the 15 years before 1985 and those for the developing countries 0.41 (recent five years) and 0.36 (15 years before 1985). In all three regions the ratio for the recent five years has exceeded that during the 15 years before 1985. Particularly marked has been the rise of the ratio in the case of the developed countries. This is believed to have led to the U.S. and other developed countries' criticism against Japan (Figures O and P).

Moreover, examining the purpose of visit during the recent five years and the 15 years before 1985 shows that although the share of acceptance from the Soviet Union and Eastern Europe for "study" and "training" has been declining, the share of "study" and "training" has been rising in all other cases namely dispatch to the Soviet Union and Eastern Europe and dispatch to and acceptance from developed and developing countries although there have been degree differences. Hence when the interchange is examined from the viewpoint of purpose of visit the share of study and training has generally been rising although there are degree differences and except in the case of acceptance from the Soviet Union and Eastern Europe.

### 3) General situation of stay by researchers and engineers

The interval of the data on stay by researchers and engineers is irregular due to changes in the interval of data collection itself and computerization of foreigner registration records. Hence the years for which data are available are 1969, 1974, 1984, 1986 and 1988.

#### (1) 1988 trends

In 1988 42,491 Japanese researchers stayed abroad and 41,115 foreign researchers and engineers stayed in Japan. The stay ratio (Japanese researchers abroad / Foreign researchers and engineers in Japan) was 1.03.

Examination of Japanese researchers who stayed abroad by country shows that the U.S. accounted for slightly over 50% (23,159, 54.5%) followed by the U.K. (4,761, 11.2%) and France (3,990, 9.4%). Examination of the number of foreign researchers and engineers staying in Japan by country shows that nearly half (19,533, 47.5%) came from China (including Taiwan) followed by South and North Korea (7,166, 17.4%) and Thailand (2,330, 5.7%).

Next, in terms of the number of Japanese researchers staying abroad by social system and economic development phase 38,657 (91.0%) were in developed countries, 3,606 (8.5%) in

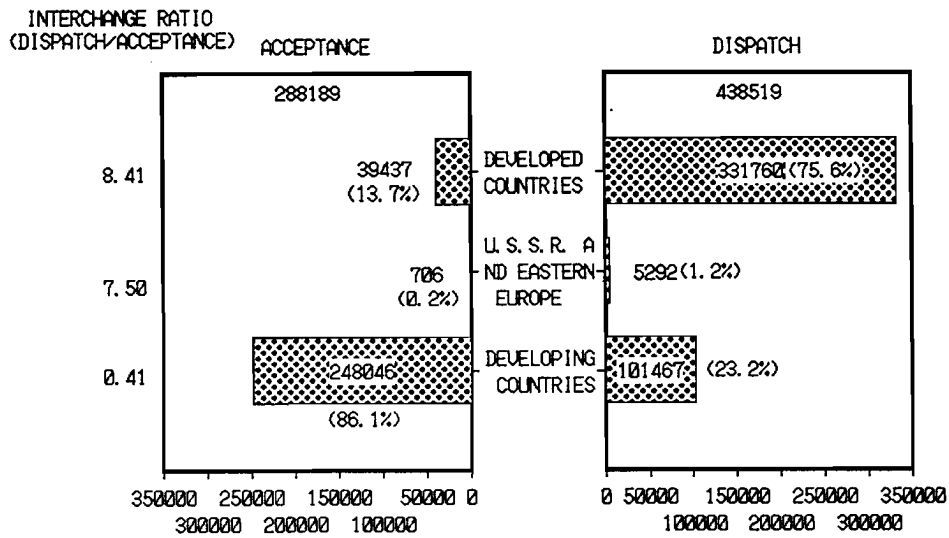


Figure-0 Dispatch and Acceptance of Reserchers and Engineers(1985-1989)

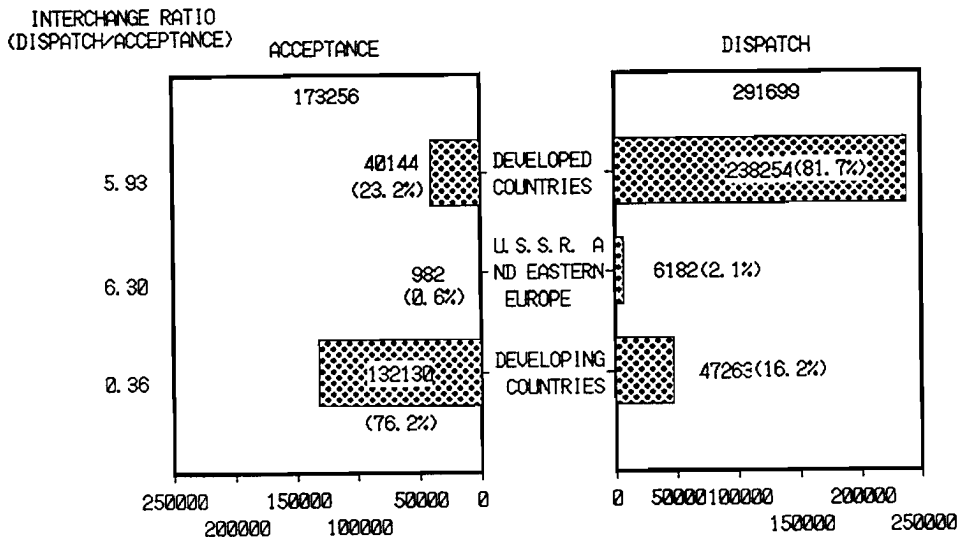


Figure-P Dispatch and Acceptance of Reserchers and Engineers(1985-1989)

developing countries and 228 (0.5%) in the Soviet Union and Eastern Europe.

In terms of the number of foreign researchers and engineers staying in Japan 36,708 (89.3%) were from developing countries, 4,284 (10.4%) from developed countries and 123 (0.3%) from the Soviet Union and Eastern Europe.

These findings show tendencies very similar to the case of interchange. Hence the relationship between developed and



developing countries is the reverse in terms of stay abroad and in Japan--90% of the Japanese researchers abroad stay in developed countries and 90% of the foreign researchers and engineers in Japan are from developing countries.

Examination of the number of Japanese researchers staying abroad by bloc shows that 12,603 (29.7%) were in the EC countries, 1,629 (3.8%) in the Asian NIEs and 421 (1.0%) in the ASEAN countries. Examination of the number of foreign researchers and engineers staying in Japan shows that 6,827 (16.6%) came from the ASEAN countries and 1,847 (4.5%) from the EC.

In terms of the number of Japanese researchers staying abroad by region over half (24,834, 58.4%) were in North America followed by Western Europe (13,304, 31.3%) and Asia (2,872, 6.7%). In terms of the number of foreign researchers and engineers in Japan most were from Asia (34,871, 84.8%) followed by North America (2,374, 5.8%) and Europe (2,134, 5.2%).

(2) Past trends

Due to a number of circumstances the data on stay are only available for the years 1969, 1974, 1984, 1986 and 1988. Nevertheless let us examine how the patterns of stay of researchers and engineers have changed based on the available data.

In 1969 10,113 Japanese researchers stayed abroad and 4,302 foreign researchers and engineers stayed in Japan for a stay ratio of 2.35. In 1974 the numbers were 17,100 and 6,703 for a stay ratio of 2.55. In 1984 they were 28,526 and 20,669 for 1.38. In 1986 they were 34,958 and 28,330 for 1.23 and in 1988 they were 42,491 and 41,115 for 1.03 (Figure Q).

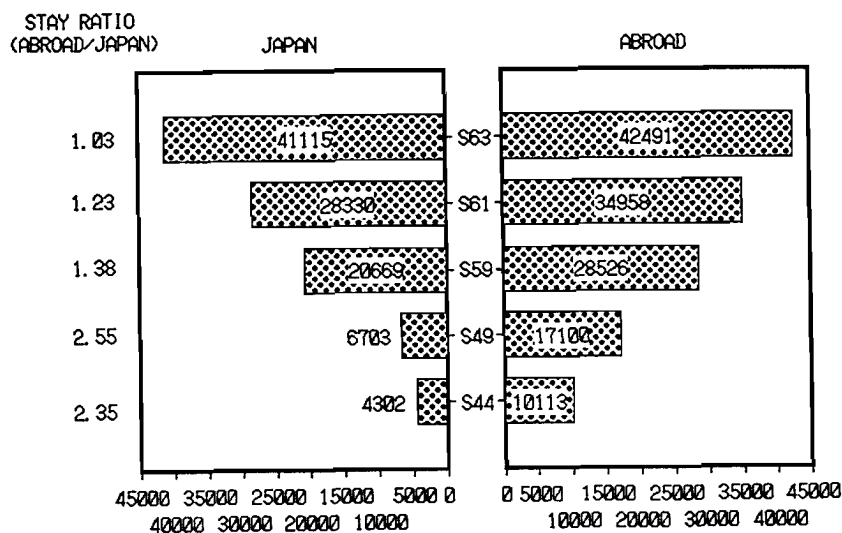


Figure-Q Comparison of Number of Rrsrchers(and Engineers) Staying Abroad and in Japan

Hence, while the stay ratio slightly rose in 1974, as a tendency it has steadily been declining so that in 1988 the ratio of 1.03 shows that the number of Japanese researchers abroad and that of foreign researchers and engineers in Japan were more or less balanced.

Examination of stay by country shows that while Japanese researchers have mainly stayed in the U.S. and other Western countries, the foreign researchers and engineers in Japan have come from the neighboring countries such as China, Taiwan and Korea as well as from the U.S.

By social system and economic development phase around 90% of the Japanese researchers have stayed in developed countries. In contrast 70 to 90% of the foreign researchers and engineers in Japan have come from developing countries. While there have been no changes over the years in the ratio of Japanese researchers staying in developed countries the ratio of foreign researchers and engineers in Japan coming from developing countries has gradually been increasing.

By bloc, both the number of Japanese researchers staying abroad and foreign researchers and engineers in Japan have been increasing in the case of the EC and ASEAN countries.

By region, North America has secured the top share in any year as the place of stay of Japanese researchers. Likewise, in any year Asia has secured an overwhelming share as the source of foreign researchers and engineers in Japan.

科学技術庁図書館



0110097860