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# ***JPRS Report***

# **Science & Technology**

***Japan***

INTERIM REPORT ON INTERNATIONAL  
EXCHANGE OF RESEARCHERS

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SCIENCE & TECHNOLOGY  
JAPAN

INTERIM REPORT ON INTERNATIONAL  
EXCHANGE OF RESEARCHERS

93FE0041 Tokyo MITI/AIST in Japanese Mar 92 pp i-128

[For earlier related report, see JPRS-JST-91-072-L, 26 Nov 91--Interchange of  
Researchers Between Japan, Other Countries]

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## Interim Report on International Exchange of Researchers

93FE0041A Tokyo MITI/AIST in Japanese Mar 92 pp i-128

[For earlier related report, see JPRS-JST-91-072-1, 26 Nov 91—Interchange of Researchers Between Japan, Other Countries]

### [Text] Preface

Japan's science and technology has evolved in such a way that in many fields it is now regarded as being forefront in the world.

There is keen interest from overseas in Japan's R&D activities, which are also seen as being a very important tool in Japan's fulfillment of its international role.

In order for Japan to carry out its international role through R&D activities, it must actively accept foreign researchers; Japan must have the same amount of enthusiasm in maintaining research environments in which foreign researchers can pursue S&T studies in Japan as it does in sending Japanese researchers overseas.

Based on the ideas above, in this research study we attached primary importance to the direct and very effective contributions to international community that Japan should accomplish, and we endeavored to provide as much information as possible that is considered useful in getting industry, government, and universities together to expand the "acceptance of foreign researchers in Japan."

This information will be the start of further expansion of Japan's acceptance of foreign researchers. We hope that the excellent foreign researchers who are received in Japan will bring about results in Japan's research environment and that they will become pioneers in natural science research.

In compiling this report, we gained very friendly and positive cooperation from the many companies, universities, national laboratories, and other organizations to which we sent various questionnaire surveys, and we were able to obtain results that had not been achieved before in past surveys.

Valuable insights and guidance were gained from the counselors and secretaries of the U.S., British, and French embassies who participated as members of the "Society for Studies Toward New Developments in Researcher Exchange" along with Japanese members who have deep knowledge and experience in researcher exchange.

In considering concrete measures to expand international researcher exchange that make the most of Japan's idiosyncrasies, the tremendous cooperation we received in this research study is regarded as extremely significant.

We thank those who cooperated in this effort, and we look forward to their assistance in the future.

March 1992

Society for Studies Toward New Developments in Researcher Exchange  
Chairman Satoshi Sugiura  
Vice-chairman of the Japan Society for the Promotion of Machine Industry  
Former AIST director

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## Overview

### 1. Background of Survey

(1) The focus on the importance of researcher exchange along with the shift toward basic, international research in Japan's industrial technology (creative R&D, international contributions, etc., brought about through researcher exchange)

(2) The higher level of Japan's industrial technology and the sudden increase in foreign researchers' desire for access to Japan (access to Japan's advanced high technology, mastering Japanese technical systems)

(3) To that end, since the end of the 1980s a number of new systems for inviting researchers have been set up (AIST fellows, STA fellows, MOE fellows, etc.)

(4) However, in the current state of affairs, there are qualitative and quantitative inadequacies. Improvement is urgently needed. In comparison with public fellowships, only some of the private sector is starting to set up fellowships.

(5) In order to bring about these improvements, it is essential to get a new grasp on:

- a) the reality of the quantitative balance between sending and receiving researchers (quantitative aspects), and
- b) the reality of invisible obstacles in expanding the acceptance of foreign researchers (qualitative aspects).

(In the current state of affairs, a) there is a definite lack of statistics, in comparison with trade statistics, etc., with which we can grasp the actual sending/receiving situation; and b) studies of such obstacles from the standpoints of foreign researchers are inadequate.)

(6) The objective of the survey (a FY91 undertaking) is to get close to the truth about both the qualitative and quantitative aspects mentioned above, especially in regard to relationships with advanced countries. The survey was implemented after setting up a study society made up of knowledgeable people from within and outside of Japan, and from industry, government, and universities. (In FY92, we will continue surveys with even deeper aims.)

### 2. Characteristics of the Survey

(1) In order to bring out the obstacles from the viewpoints of foreign researchers,

- a) scientific counselors from the U.S., British, and French embassies in Tokyo were appointed as members of the study society;

- b) Americans were surveyed with questionnaires (about 800) and interviews (17 researchers and organizations); and
- c) a questionnaire survey that focused on foreign researchers living in Japan (about 100 questionnaires) was carried out.

(2) In order to grasp the true nature of the quantitative balance between sending and receiving researchers,

- a) a questionnaire survey that focused on 1,500 major laboratories of industry, government, and universities in Japan was carried out;
- b) follow-up surveys to verify the results of a) in a time series were implemented.

(3) The survey results of (1) and (2) were interpreted and analyzed by the study society, and its subcommittee and working group.

**Study Society Members**

**Chairman:**

Satoshi Sugiura, vice-chairman of the Japan Society for the Promotion of Machine Industry (former AIST director)

**Member (chairman of subcommittee):**

R. Hirasawa, professor at Tokyo University Department of Liberal Arts

**Members:**

Shogo Itakura, managing director of Pasuko, Co.

Y. Takeda, managing director of Hitachi, Ltd.,

Yoshiro Tokuhisa, managing director of Mitsubishi Petrochemical Co.

Tsuneo Nakahara, vice-chairman of Sumitomo Electric Industries, Ltd.

Katsuya Nakayama, consultant to the MITI AIST Government Industrial Research Institute, Chugoku (professor at Hiroshima Institute of Technology)

Tsutomu Yamaguchi, managing director of RITE

E.M. Malloy, U.S. embassy S&T councilor in Japan

R. Hinder, British embassy S&T councilor in Japan

B. Yvetot, French embassy economic and business councilor in Japan

**3. New Findings**

**(1) Reality of the Quantitative Balance Between Sending and Receiving Researchers**

1) In the past, the "Immigration Statistics" (including statistics on long-term stays for social science, language training, and other such objectives) were the only statistics for this analysis.

According to those statistics, the ratio of researchers sent to advanced countries to those received was 10 (1988). Japan was seen as a "free rider" in the aspect of researcher exchange (the basis of the "symmetrical access" argument from the U.S. at the time of the Japan-U.S. S&T Cooperation Agreement in 1988).

2) However, with the survey this time, where 1,500 questionnaires were sent only to researchers "in natural sciences, with six-month or longer research objectives" (987 valid responses), a disparity was confirmed: that ratio is 3.3 (1990).

Table 1. Total Number of Researchers Sent/Received To/From Advanced Countries in 1990 (Unit: Person)

	Advanced countries total	Industry	Government	Universities
(A) Total sent from Japan	1,570	133	213	1,224
(B) Total received in Japan	478	51	68	359
(A)/(B)	3.28	2.61	3.13	3.41

(Notes) Total number surveyed: 1,500

(private companies: 817; national laboratories: 184; universities: 497)

Number of responses (response rate): 987 (66%)

(private companies: 457; national laboratories: 138; universities: 385; invalid questionnaires: 7)

Table 2. Researchers Sent/Received To/From Advanced Countries in 1990, By Country (Unit: Person)

	Advanced countries total	U.S.	U.K.	France	Germany
(A) Total sent from Japan	1,570	1,087	142	45	99
(B) Total received in Japan	478	184	52	47	45
(A)/(B)	3.28	5.91	2.73	0.96	2.20

(Notes) Total number surveyed and number of responses same as above.

3) From the follow-up surveys for the purpose of a time-series verification, it became clear that the ratio of the number of researchers sent to the number received improved over the years.

Table 3. Time-Series Change in Ratio of Number of Researchers Sent to Number Received in the Private Sector

Time-Series Change in That Ratio (of the 457 companies that responded that they have a record of exchange, the survey results for the top 50 companies)			
	Advanced countries total	For U.S.	Other advanced countries total
1986	3.8	6.5	1.1
1987	4.2	12.6	0.7
1988	2.9	5.9	0.7
1989	1.8	3.6	0.5
1990	2.0	4.3	0.6

(2) Reality of private companies' acceptance of researchers (survey of 200 companies that have many researchers)

- 1) Of the 116 private companies that responded that they have a record of exchange, 57 private companies (49%) have a record of accepting foreign researchers.
- 2) The objectives of private companies with a record of accepting foreign researchers centered around: (multiple responses)
  - a) "To acquire excellent minds" (74%)
  - b) "To introduce different ways of thinking" (67%)
  - c) "To secure personnel" (39%)
  - d) "To make an international contribution" (35%)
- 3) Research stage of accepted researchers:
  - a) Basic research (38%)
  - b) Applied research (36%)
  - c) Other (including a mixture of a) and b)) (26%)
- 4) More than 90% of the expenses for accepting researchers is borne by the companies that host the researchers.
- 5) The subjects of the survey centered around post-doctorate researchers (32%) and doctorate- and master-level students (32%) who are relatively young.
- 6) Concerns of companies when receiving foreign researchers
  - Related to the research
    - a) Matching the research field (16%)
    - b) Treatment of research results (10%)

c) That the research experience in Japan will not lead to improvements in the researcher's career (7%)

• Not related to the research

a) Language problems (18%)

b) Differences in customs, culture (11%)

c) The ability to find employment after returning home (5%)

**(3) Research in Japan as seen by foreign researchers residing in Japan**

1) The age group of private companies' middle-aged and young researchers (20%), post-doctorate researchers (16%), and university professors (12%) is mainly 20-30 years of age.

2) A little under 70% of the researchers want to return to Japan again after they finish their current research in Japan.

3) In that case, they predominantly want to [do research in] the laboratories of private companies (55%).

4) Their interest in Japan centers around

a) Japanese high technology (70%)

b) the R&D structures in Japan (64%)

5) Problems encountered while living in Japan

• Related to the research

a) That there are no excellent research leaders (8%)

b) That the research experience in Japan will not lead to improvements in the researcher's career (7%)

• Not related to the research

a) Communication problems (15%)

b) The high cost of living (15%)

c) Ability to find employment after returning home (12%)

**(4) What American researchers in the U.S. expect from doing research in Japan**

1) More than 70% of the responses were from educators and professors. The age group was mainly in the range from 30 to 50 years of age.

2) 84% of those want to visit Japan to do research.

3) In that case, (multiple responses)

a) 87% want to do research at national universities;

b) 79%, at national laboratories;

c) 46%, at private companies; and

d) 44%, research under a Japanese national project.

These answers differ considerably with those given in (3).

- 4) Interest in Japan's research centers on
  - a) High technology (70%)
  - b) R&D structures (56%)
  - c) Governmental industrial policies (37%)
- 5) The problems they expect to encounter while living in Japan
  - Related to the research
    - a) Research budgets (14%)
  - Not related to the research
    - a) The high cost of living (16%)
    - b) Communication problems (14%)
    - c) Their spouse's ability to find employment in Japan (10%)

#### 4. Summary

##### (1) Basic line of thinking toward new developments in researcher exchange

- 1) It is now a time where Japan should take the challenge of initiating a "technological revolution that will support the 21st century" in its R&D. It is a time when Japan should work to further augment its international contributions in R&D.
- 2) In the growing "closeness and resonance between science and technology," in activating R&D "contact with different concepts and experiences" is inevitable.
- 3) Hosting foreign researchers is an important tool for making international contributions that involve S&T.
- 4) Investments in enterprises for receiving foreign researchers are a very important international influence during the 1990s.

##### (2) Line of thinking for expanding the acceptance of foreign researchers

###### (Expectations of industry)

- 1) Industry should work toward introducing different cultures, concepts, and experiences into its research environments.
- 2) Given that many foreign researchers in Japan hope for research work at private research organizations, companies must work toward providing such researchers with the opportunities to work at their laboratories.

###### (Expectations of the government)

- 1) The government must strive for further repletion so that foreign researchers find Japan's research environments attractive, and the government must further expand the acceptance of foreign researchers.

2) In order to induce more energy into the spread of researcher exchange in private companies, the government must formulate policies so that researcher exchange is built into the activities of private companies.

**(Tie-ups with other countries' systems for sending researchers to Japan)**

When Japanese research organizations extend invitations to foreign researchers, receiving foreign researchers may be more effective and efficient if ways can be found to tie up with the researcher-dispatching programs of the universities, non-profit groups, and governmental organizations of other countries.

## Main Discourse

### I. Introduction

#### I-1. Background of Survey

##### 1. Policy Objectives

In the international community of today, economic and other activities of nations are rapidly becoming globalized and borderless. While global interdependency in economic and other activities grows stronger every day, science and technology, as a means that leads to the growth of the international community, has always had a borderless and global nature.

It has become necessary for Japan, which is expected to act as an active pulling force in the growth of the international community, to heighten its self-awareness in that role, to establish behavior that is harmonious with the international community under the idea of "co-existent competition," to actively and subjectively provide opportunities for new international exchange, and to exert its energies toward the growth of the international community.

Based on such an awareness, Japan's efforts as a technologically advanced country to internationally create, disseminate, and transfer science and technology, including that in basic fields, and its orientation toward "techno-globalism," which was put forward in the report "Industrial Science Vision for the 1990s (compiled by MITI's AIST in August 1990), are also linked to its fulfillment of its duties in the world.

Accordingly, given the recent surge in the "closeness and resonance between science and technology," the focus is on the exchange of researchers as an extremely effective and important way of providing a place for contact between different concepts and experiences so as to activate research activities. Researcher exchange is important in that it furthers mutual understanding within and outside of Japan.

Sending researchers from Japan to the advanced countries of America and Europe has been vigorous for quite a long time, and the technologies mastered in those processes have played a big role in the promotion of Japan's technology and industry.

In contrast, foreign researchers did not make use of the research opportunities and research environments in Japan in the past; for foreign researchers coming to Japan there have been constraints such as cultural and lifestyle obstacles—language and the way of living—and differences in the research environment.

Based on the perceptions described above, promoting the invitation of foreign researchers to Japan has been taken up as a measure for positively influencing the international community in the way of international contributions and in the promotion of techno-globalism. The aim is for industry, government, and

universities to find the means, in accordance with their roles, to expand invitations to foreign researchers.

## 2. Current State of Affairs

(1) According to immigration statistics, in 1989 there was approximately a 10-to-1 ratio in the number of researchers sent from Japan to advanced countries (in particular, OECD and DAC members—the United States, Britain, France, Germany (but not the former East Germany), Canada, Italy, Austria, Switzerland, Belgium, Denmark, Holland, Sweden, Norway, Finland, Australia, and New Zealand) and the number of researchers from those countries who were sent to Japan. (106,930 researchers were sent from Japan, 10,026 researchers were received in Japan). (See Reference Materials 4.)

However, these figures include researchers from fields other than the natural sciences, e.g., researchers in social sciences and language training. The situation is such that there is no way to grasp the state of exchange that is limited to researchers in the natural sciences.

(2) Viewing the situation from the government's side of things, although we still cannot say that the scale is large enough, since 1988 AIST and STA have started "foreign researcher invitation systems," and over the past two to three years the number of researchers received in Japan has tended to increase. (See Reference Materials 4.)

(3) On the other hand, in the case of industry, some electronics makers and other manufacturers maintain systems for receiving foreign researchers and show a positive understanding of the ideology expressed in government policy objectives. Companies that show a positive stance toward the acceptance of foreign researchers are also evident. (See Reference Materials 7.)

In such companies, a trend toward expanding the acceptance of foreign researchers is seen, and that is bringing about results.

Nevertheless, such examples are the exception when looking at Japan's industry in its entirety. At many companies the acceptance of foreign researchers, combined with the employment of foreigners in company staff positions, is just beginning.

### I-2 Objectives of Survey

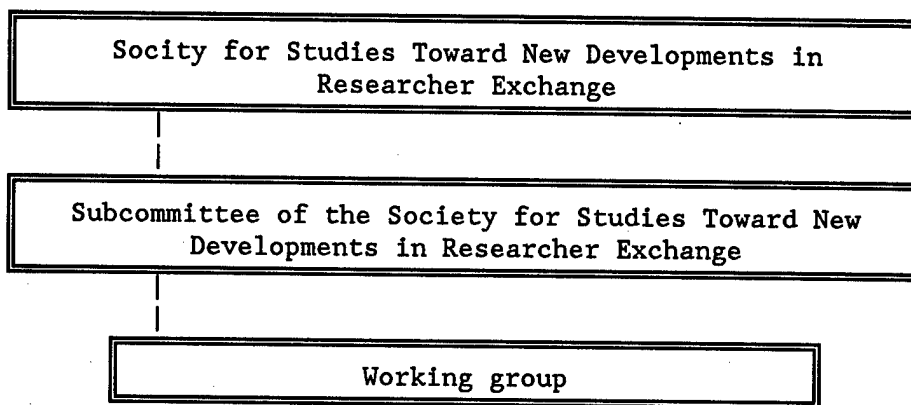
In order to facilitate the exchange of researchers between Japan and other countries, this survey is an attempt to accurately grasp the actual state of affairs involving the acceptance of foreign researchers in Japan and the dispatching of Japanese researchers overseas, with the focus on researchers in the fields of natural sciences. The survey also is meant to be a way to improve, both qualitatively and quantitatively, the environment for hosting foreign researchers by providing information about the problem points that lead to obstacles in the acceptance of foreign researchers.

### I-3 Survey Methods

The study society, subcommittee and working group shown below were set up for the purpose of achieving the survey objectives described above. A working group under the guidance of the study society and subcommittee conducted questionnaire surveys in Japan and the United States, and then interview surveys as a follow up to those. The study society and subcommittee then held discussions about the results of the surveys.

Below we will describe the structure of the committee and give an outline of the questionnaire and interview surveys.

#### 1. Structure of Committee Discussions



#### 2. Members (unordered, titles omitted)

(Society for Studies Toward New Developments in Researcher Exchange)

Chairman: Satoshi Sugiura Vice-chairman of the Japan Society for the Promotion of Machine Industry (former AIST director)

Members: Shogo Itakura Managing director of Pasuko, Co.  
Y. Takeda Managing director of Hitachi, Ltd.  
Yoshiro Tokuhisa Managing director of Mitsubishi Petrochemical Co.  
Tsuneo Nakahara Vice-chairman of Sumitomo Electric Industries, Ltd.  
Katsuya Nakayama Consultant to the MITI AIST Government Industrial Research Institute, Chugoku (professor at Hiroshima Institute of Technology)  
R. Hirasawa Professor at Tokyo University Department of Liberal Arts  
Tsutomu Yamaguchi Managing director of RITE  
R. Hinder British embassy S&T councilor in Japan

E. M. Malloy U.S. embassy S&T councilor in Japan  
B. Yvetot French embassy economic and business councilor  
in Japan

Observers: Tamotsu Mukai MITI AIST Deputy Director-General for  
Technology Affairs  
Osamu Narimiya MITI AIST International R&D Cooperation  
Division chief  
Mitsuo Takahashi NEDO Director

(Subcommittee of the Society for Studies Toward New Developments in Researcher  
Exchange)

Chairman: R. Hirasawa Professor at Tokyo University Department of  
Liberal Arts

Members: S. Kamimae Research and Industry Association business  
affairs chief  
Hiroshi Kuwahara Hitachi, Ltd., R&D Promotion Bureau  
(International Research Exchange Group)  
T. Salusbury British embassy first secretary in Japan (in  
charge of S&T)  
B. H. Encos U.S. embassy third secretary in Japan (in  
charge of S&T)  
Noriko Tominaga France Forum Committee assistant

Observers: Osamu Narimiya MITI AIST International R&D Cooperation  
Division chief  
Y. Goto MITI AIST International R&D Cooperation  
Division assistant chief

(Working group)

S. Kamimae Research and Industry Association business  
affairs chief  
Hideaki Yukawa Mitsubishi Petrochemical Co., Ltd., Tsukuba  
Research Institute Biochemistry Laboratory  
chief  
Noriko Tominaga France Forum Committee assistant  
Y. Goto MITI AIST International R&D Cooperation  
Division assistant chief  
Toshihide Hida MITI AIST International R&D Cooperation  
Division Planning Department assistant chief  
T. Mochizuki MITI AIST International R&D Cooperation  
Division general clerk

(Secretariat)

Chihiro Watanabe NEDO Industrial Technology R&D Division Chief  
R. Oketani NEDO International Research Exchange section  
chief  
S. Hida NEDO International Research Exchange Section  
acting chief

Hitoshi Mukotsubo	NEDO International Research Exchange Section acting chief
Yukio Kakita	Japan Systems Development Institute managing director
Kenji Okuma	Japan Systems Development Institute Technology Development Lab chief
Koichi Kanemura	Japan Systems Development Institute Technology Development Lab researcher
Naoko Anpo	Japan Systems Development Institute Technology Development Lab research assistant

### 3. Summary of Surveys (3 in Japan, 1 in the United States)

We conducted four types of questionnaire surveys, as shown below: three in Japan and one in the United States. The contents of those and summaries of their implementation are given below.

(1) Survey of the actual state of researcher sending and receiving (in Japan; referred to as "Survey A" below)

- 1) Content of survey:
- 2) Where surveys were sent and number sent:
- 3) Date sent and deadline:
  - Sent out, 4 October (Friday)
  - Deadline, 24 October (Thursday)
- 4) Surveys addressed to:
  - Directors of national laboratories; chiefs of general affairs departments in special corporations and public utilities corporations; chiefs of administration departments, and persons in charge of research exchange in universities; chiefs of R&D headquarters, chiefs of general affairs departments, directors of laboratories, etc., in companies.

(2) Survey of foreign researcher receiving (in Japan; referred to as "Survey B" below)

- 1) Content of survey:
  - Questions about the current state of receiving foreign researchers, problems encountered in that, etc.
- 2) Where surveys were sent and number sent:
  - 200 companies (laboratories)
- 3) Date sent and deadline:
  - Sent out, 4 October (Friday)
  - Deadline, 24 October (Thursday)
- 4) Surveys addressed to:
  - Chiefs of R&D headquarters, chiefs of general affairs departments, directors of laboratories, etc., in companies.

(3) Survey of foreign researchers' research experiences in Japan (in Japan; referred to as "Survey C" below)

- 1) Content of survey:  
Questions about the perception of problems of foreign researchers who are now conducting research at Japanese companies.
- 2) Where surveys were sent and number sent:  
100 companies (laboratories)
- 3) Date sent and deadline:  
Sent out, 4 October (Friday)  
Deadline, 30 October (Wednesday)
- 4) Surveys addressed to:  
Chiefs of R&D headquarters, chiefs of general affairs departments, directors of laboratories, etc., in companies.

(4) Survey of foreign researchers' perception of Japanese research (in the United States; referred to as "Survey D" below)

- 1) Content of survey:  
Questions about the problems researchers encounter when they live and work in Japan.
- 2) Where surveys were sent and number sent:  
Natural science researchers in universities, companies, etc.

For the actual questionnaire forms, see Reference Materials 10.

#### I-4 Responses to the Questionnaires

##### 1. Survey of the Actual State of Researcher Sending and Receiving (Survey A)

Number of responses: 987 (response rate: 987/1500=65.8%)

###### Breakdown

Private companies:	457 (response rate: 457/819=55.8%)
National laboratories, etc.:	138 (response rate: 138/184=75.0%)
National laboratories:	79
Special corporations:	11
Nonprofit corporations:	48
Universities:	385 (response rate: 385/497=77.5%)
Invalid questionnaires:	7

Percentage of questionnaires(%)

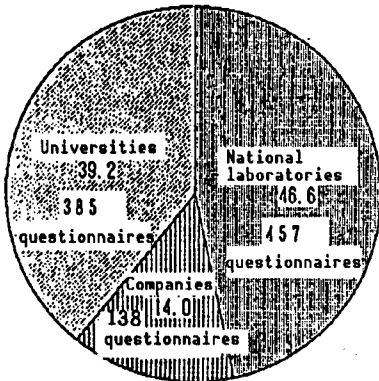


Figure I-4.1 Composition of Questionnaire Responses (N=987)

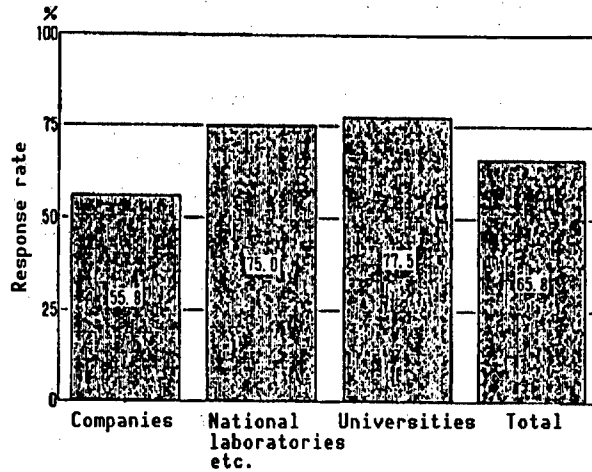


Figure I-4.2 Questionnaire Survey Response Rates

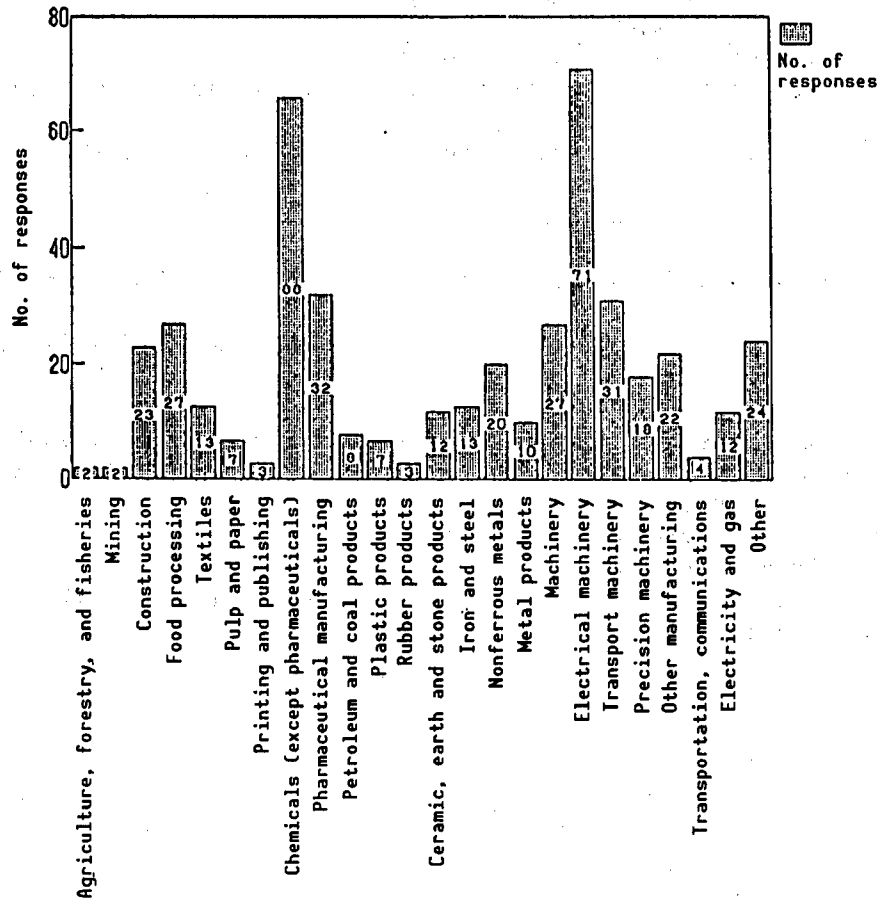


Figure I-4.3 Response Rates for Companies, by Type of Industry

## **2. Survey of Foreign Researcher Receiving (Survey B)**

Number of responses: 116 (response rate: 116/200=58%)

## **3. Survey of Japan-Resident Foreign Researchers' Research Experiences in Japan (Survey C)**

Number of responses: 83 people

## **4. Survey of Foreign Researchers' Perception of Japanese Research (United States) (Survey D)**

Number of responses: 182

### **I-5 Interview Surveys**

#### **1. Interview Surveys in Japan**

Taking into consideration the industrial classifications of and responses from the 116 companies that responded to the survey about receiving foreign researchers (Survey B), we selected 11 companies and then conducted follow-up interviews about receiving foreign researchers in companies.

#### **2. Interview Surveys in the United States**

We conducted follow-up interviews of U.S. researchers who responded to the survey about foreign researchers' perception of Japanese research (Survey D). We conducted the follow-up interviews in Washington, New York, Princeton, and Nashville.

## II. Actual State of Researcher Exchange

Here we will discuss the actual state of researcher exchange between Japan and advanced countries (16 countries that are OECD and DAC members), based on the survey about the actual state of researcher sending and receiving (Survey A).

We received separate responses for four of the 16 countries—the United States, Britain, France, and Germany (former West Germany)—and lump-sum answers for the other 12 countries. The foreign researchers' affiliated organizations are classified as either industry; national laboratories, etc.; or universities, etc. (See the materials at the end of the document for details about the survey.)

Below we will discuss the results of the questionnaire survey.

### II-1 Summary of Questionnaire Results

#### 1. Summary of Actual State of Researcher Exchange

Table II-1.1 summarizes the results obtained from these questionnaire surveys. The organizations items listed by industry show the types of industries, national laboratories, universities, and so forth, of Japan that were the subjects of our surveys. The top row shows column divisions for researchers received from the universities, national laboratories, companies, etc., of the United States, the United Kingdom, France, Germany, the other 12 advanced countries, and the total number of those, and then column divisions for researchers from Japan sent to the universities, national laboratories, companies, etc., of those countries.

Table II-1.2 shows how to read the symbols in the top row of Table II-1.1. For example, the symbol "AUR" indicates researchers received (R) from universities (U) in the United States (A). The symbol "BNB" means researchers sent (S) from Japan to national laboratories (N) in Britain (B).

This summary table provides the basis for the following discussion.

#### 2. Comparison of Industry, Government, and Universities

Table II-1.3 shows the actual numbers of researchers sent and received between the industry, government, and universities of Japan and 16 advanced countries, and the ratios of sending to receiving. From this we see that Japan sends considerably more university researchers to the universities and national laboratories of advanced countries (4.5 to 5.5 times) than it receives from those countries. The overall ratio of sending to receiving for Japan's national laboratories is 1.6, which is not that great of a disparity.

The ratio of sending to receiving for Japan's industry falls in the middle: 2.5.

We used a radar chart to make separate comparisons of the sending-to-receiving ratios (A/B) for universities, national laboratories, companies, and overall,

Table II-1.2 Summary of Actual State of Researcher Sending/Receiving

Type of industry	Cases	AUR	ANR	ACR	AUS	ANS	ACS	BUR	BNR	BCR	BUS	BNS	BCS	FUR	FNR	FCR	FUS	FNS	FCS	GUR	
Agriculture, forestry, and fisheries	2					1															
Mining	2				1		2														
Construction	23	2			8		2				3		1			1					
Food processing	27				17	1	6				1	1	1				1				
Textiles	13				10		2														
Pulp and paper	7				1						2										
Printing and publishing	3				2																
Chemicals (except pharmaceuticals)	66	4		2	30	1	12			4	1	1								2	
Pharmaceutical manufacturing	32	1			38	5	7	2			1										
Petroleum and coal products	8				2		3			1	1		1								
Plastic products	7			1			2														
Rubber products	3			1					1												1
Ceramic, earth, and stone products	12	2		1	11		3			1											
Iron and steel	13	3			17		8	2			5	1		3							
Nonferrous metals	20				12		3														
Metal products	10																				
Machinery	27				14		1				2			1							
Electrical machinery	71	48	2	5	63	1	31	6		2	9			9							4
Transport machinery	31	4		1	8		4			2											1
Precision machinery	18	2		1	6		2							1							2
Other manufacturing	22						2														
Transportation, communications	4				1																
Electricity and gas	12						1														
Other	24	1			3		1														
(Total of private firms)	457	67	2	12	244	10	91	10		8	28	3	3	14		1	1	2		2	8
National laboratories	79	18	10		41	21	2	5			4	4	2	6	4		6	3	1		3
Special corporations	11	1			1	2	1				1				1						
Nonprofit corporations	48			1	4	4	5		1			1									
(Total of national laboratories, etc.)	138	19	11	1	46	27	8	5	1		5	5	2	6	5	1	6	3	1		3
Universities, etc.	385	64	6	2	578	72	11	25	3		86	9	1	15	3	2	19	13			27
(Total of universities)	385	64	6	2	578	72	11	25	3		86	9	1	15	3	2	19	13			27
Invalid responses	7																				
(Total of invalid responses)	7																				
(Total)	987	150	19	15	868	109	110	40	4	8	119	17	6	35	8	4	26	18	1		38

Key: A: U.S.; B: U.K.; F: France; G: Germany; T: Other; K: Total; U: Universities; N: National Laboratories; C: Companies  
R: received; S: Sent; RCV: Total number of persons received; SND: Total number of persons sent [Continued]

[Continuation of Table II-1.2]

Type of industry	Cases	GNR	GCR	IGUS	GNS	GCS	TUR	TNR	TCR	TUS	TNS	TCS	KUR	KNR	KCR	KUS	KNS	KCS	RCV	SND	
Agriculture, forestry, and fisheries	2												0	0	0	0	1	0	0	1	
Mining	2												0	0	0	1	0	2	0	3	
Construction	23			1		1				1			2	0	1	13	0	4	3	17	
Food processing	27			1						4		6	0	0	0	24	2	13	0	39	
Textiles	13			1					1				0	0	1	11	0	2	1	13	
Pulp and paper	7												0	0	0	3	0	0	0	3	
Printing and publishing	3												0	0	0	2	0	0	0	2	
Chemicals (except pharmaceuticals)	66		1	2	1				2	4		1	4	0	9	37	5	13	13	55	
Pharmaceutical manufacturing	32			1	1		2			2		1	5	0	0	42	6	8	5	56	
Petroleum and coal products	8												0	0	1	3	0	4	1	7	
Plastic products	7								1				0	0	2	0	0	2	2	2	
Rubber products	3					1			1				2	0	3	0	0	0	5	0	
Ceramic, earth, and stone products	12		1			2			1				2	0	3	12	0	5	5	17	
Iron and steel	13			1				2	1	2			10	1	0	25	1	8	11	34	
Nonferrous metals	20							1	3	2			1	3	0	14	0	3	4	17	
Metal products	10												0	0	0	0	0	0	0	0	
Machinery	27			2			2		2				3	0	2	18	1	0	5	19	
Electrical machinery	71		2	1			14	2	2	3			81	4	9	77	2	31	94	110	
Transport machinery	31					2			4				5	0	5	10	0	6	10	16	
Precision machinery	18		1	1	1		2		1				7	0	2	7	1	3	9	11	
Other manufacturing	22												0	0	0	0	0	2	0	2	
Transportation, communications	4												0	0	0	1	0	0	0	1	
Electricity and gas	12												0	0	0	0	0	1	0	1	
Other	24						1			1			1	2	0	4	0	2	2	6	
(Total of private firms)	457		2	12	4	6	25	6	15	19			9	124	8	38	304	19	109	170	432
National laboratories	79		1	5	5		17	16	1	12	12		49	30	2	68	45	5	81	118	
Special corporations	11				1			1				2	1	2	0	2	5	1	3	8	
Nonprofit corporations	48							1		3	1		0	3	2	7	6	5	5	18	
(Total of national laboratories, etc.)	138		1	5	6		17	18	1	15	15		50	35	4	77	56	11	89	144	
Universities, etc.	385		1	3	49	16	1	54	12	2	11	28	185	25	9	843	138	13	219	994	
(Total of universities)	385		1	3	49	16	1	54	12	2	11	28	185	25	9	843	138	13	219	994	
Invalid responses	7												0	0	0	0	0	0	0	0	
(Total of invalid responses)	7												0	0	0	0	0	0	0	0	
(Total)	987	1	6	66	26	7	96	36	18	145	43	9	359	68	51	1224	213	133	478	1570	

(Examples) AUR: Receive a researcher from University in America; BNR: Receive a researcher from National Laboratory in Great Britain  
 AUS: Send a researcher to University in America; BNS: Send a researcher to National Laboratory in Great Britain

Table II-1.3 Actual Numbers of People Sent and Received  
(Totals for Advanced Countries)

			To/from advanced countries			
			Industry	National laboratories, etc.	Universities	Total
To/ from Japan	Industry	A Sent	109	19	304	432
		B Received	38	8	124	170
		A/B	2.87	2.38	2.45	2.54
	National laboratories, etc.	A Sent	11	56	77	144
		B Received	4	35	50	89
		A/B	2.75	1.60	1.54	1.62
	Universities	A Sent	13	138	843	994
		B Received	9	25	185	219
		A/B	1.44	5.52	4.56	4.54
	Total	A Sent	133	213	1,224	1,570
		B Received	51	68	359	478
		A/B	2.61	3.13	3.41	3.28

(Notes) I - Industry

N - National laboratories, etc.

In Japan: national research organizations, special corporations, nonprofit corporations, etc. (excluding public research organizations of other public groups) In advanced countries: national laboratories, state laboratories (in the case of federated states)

U - Universities In Japan: national universities, private universities, and the research laboratories affiliated with those; general research graduate schools and universities (National Laboratory for High Energy Physics, Okazaki National Research Institutes, etc.); the National Defense Medical College, the Meteorological College, Shimonoseki University of Fishery, etc. However, test research organizations under the MOE, such as the Institute of Space and Astronautical Science and the National Observatory, are included under "national laboratories."

for the United States, Britain, France, Germany, the other advanced countries, and all of the advanced countries. (See Figure II-1.1.)

From this figure it is apparent that many more researchers are sent to the United States from Japan's universities than from Japan's national laboratories and firms.

### 3. By Country Comparison of Researcher Exchange

Table II-1.4 shows the actual numbers of researchers sent and received between Japan and four countries—the United States, the United Kingdom, France, and West Germany—and those ratios. The ratio for the United States is 5.9:1; for the United Kingdom, 2.73:1; for West Germany, 2.2:1; and for France, 0.96:1. The ratio of the total number of researchers sent to those received for all the 16 advanced countries is 3.28:1.

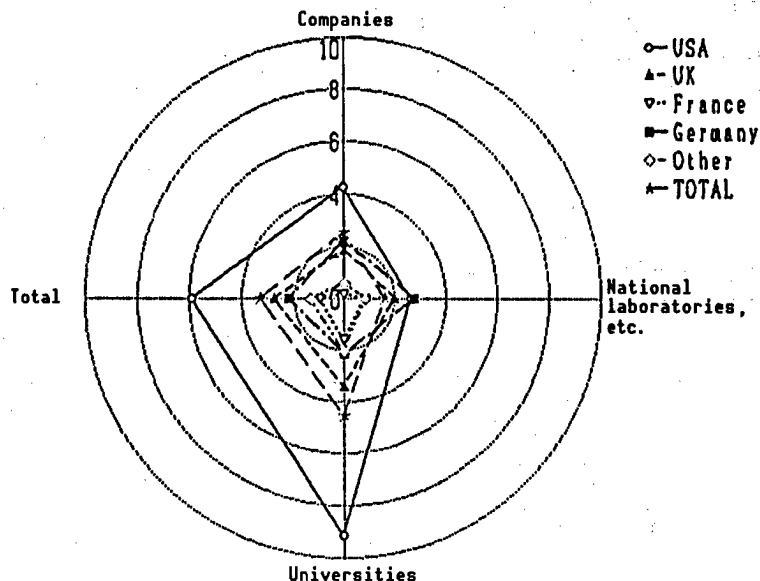


Figure II-1.1 Comparison of Ratios of Researcher Sending to Receiving, by Type of Industry (N=987)

Table II-1.4 By Country Sending and Receiving in FY90

	U.S.	U.K.	France	Germany	Advanced countries total
Sent from Japan (people)	1,087	142	45	99	1,570
Received in Japan (people)	184	52	47	45	478
Sent/received	5.91	2.73	0.96	2.20	3.28

### 4. By Industry Comparison of Researcher Exchange

Table II-1.5 shows comparisons of the total numbers of researchers sent/received to/from advanced countries for the types of industries in which there was a relatively large number of responses from companies.

From the table it is apparent that Japanese electrical machinery companies send many researchers to advanced countries, and they also receive a comparable number of foreign researchers. On the other hand, the number of researchers from advanced countries received by food companies and pharmaceutical manufacturers does not compare with the number of researchers those companies send overseas. In the middle are construction, chemicals, and machinery companies, which send four to five researchers to advanced countries for every one foreign researcher they receive.

Table II-1.5 Japanese Companies' Sending/Receiving, by Type of Industry (1990, Totals for Advanced Countries)

Type of industry	No. of responses	No. of people sent	No. of people received	Sent/received	No. of people sent per company	No. of people received per country
Construction	23	17	3	5.67	0.74	0.13
Food processing	27	39	0	--	1.44	0
Chemicals	66	55	13	4.23	0.83	0.20
Pharmaceuticals manufacturing	32	56	5	11.2	1.75	0.16
Machinery	27	19	5	3.80	0.70	0.19
Electrical machinery	71	110	94	1.17	1.54	1.32
Transport machinery	31	16	10	1.60	0.52	0.32

### 5. Changes in Researcher Sending/Receiving over Past Five Years

We conducted an additional survey on the top 50 companies that are active in receiving foreign researchers to look at the their records of sending/receiving researchers over the past five years. Responses were returned from 40 companies (80%). Those results are shown in Table II-1.6 and Figure II-1.2.

An overall trend toward improvement in the sending/receiving ratio is seen, but one must take into consideration the fact that these are responses from 40 of the top 50 companies that are active in researcher exchange. Because the actual state of affairs that excludes the 50 companies mentioned here is one where receiving foreign researchers is generally not as vigorous as sending Japanese researchers, the overall researcher sending/receiving ratio for Japan is thought to shift to a value higher than the trend seen with the 40 companies. In addition, researcher exchange overall is expanding. (See Table II-1.3.)

Table II-1.5 Changes in Sending/Receiving Researchers over Past Five Years (1990, Totals for Advanced Countries)

	1986	1987	1988	1989	1990
Sent from Japan	76	100	102	112	182
Those sent to U.S.	65	88	88	93	151
Received in Japan	20	24	35	63	89
Those from U.S.	10	7	15	26	35
Sending/receiving (advanced countries)	3.8	4.2	2.9	1.8	2.0
Sending/receiving (U.S.)	6.5	12.6	5.9	3.6	4.3

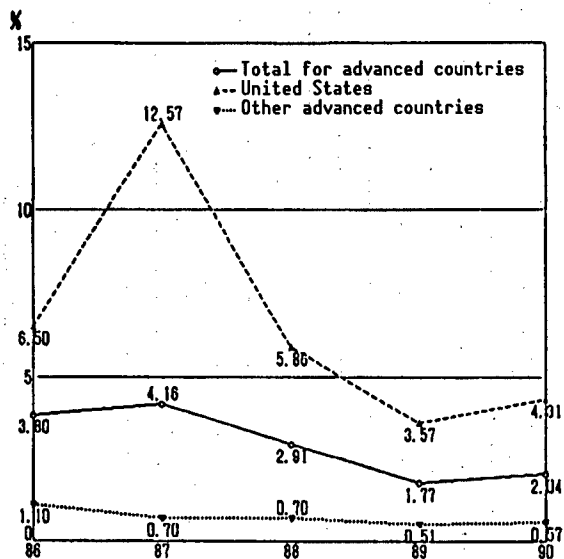


Figure II-1.2 Changes in Researcher Sending/Receiving (Totals for 40 major companies)

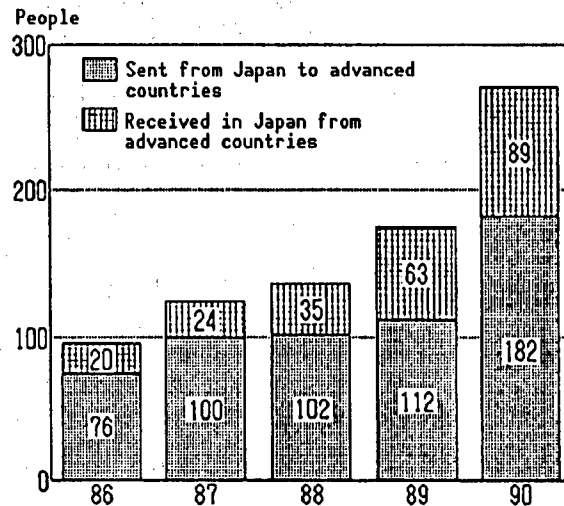


Figure II-1.3 Changes in Total No. of Researchers Sent/Received (Totals for 40 major companies)

## II-2 State of Researcher Exchange in the Natural Sciences

Accurate, quantitative indicators for the actual state of researcher exchange in the natural sciences are not available from the existing types of statistics. In fact, this also becomes an impediment in discussing the promotion of researcher exchange.

Accordingly, together with a survey to accurately grasp the problems encountered in accepting foreign researchers, we set out this time to grasp the actual state of interchange among researchers in the natural sciences that shows an interdependence among technologies. Based on the fundamental values

from the results of the surveys described above, we will analyze the actual state of interchange of researchers in the natural sciences.

(1) In order to grasp the actual state of exchange of natural sciences researchers with advanced countries, we surveyed 1,500 organizations (universities, national laboratories, and the research organizations of companies) to study the actual state of their sending and receiving for long terms (six months or longer) researchers whose goals are research in the natural sciences.

(2) The result of that survey—a 3.28:1 ratio in the total number of researchers sent from Japan to advanced countries to the total number of foreign researchers from advanced countries received in Japan—was a lower ratio than the estimate inferred from the state of researcher sending/receiving seen in immigration statistics (a ration of about 10:1).

Looking at the results of this survey by country, the ratios are 5.91:1 for the United States, 2.73:1 for the United Kingdom, 2.20:1 for West Germany, and 0.96:1 for France.

(3) Nevertheless, there are various differences among nations in the population of researchers, R&D investments, populations, GNP, and so forth. A comparison of researcher exchange that does not take these factors into consideration is not a rational comparison.

Thus, we should take into account the individual, country-specific factors described above and comprehensively evaluate them when making relative comparisons.

Here, we will use as basic indicators the number of full-time researchers, research outlays, population, and nominal GNP of Japan and four advanced countries—the United States, the United Kingdom, France, and Germany—and two relative assumptions, i.e.,

1) that the number of researchers sent increases in proportion to the size of the basic indicators, and

2) that the number of researchers received increases in proportion to the size of the basic indicators, to evaluate the sending/receiving ratios obtained for those countries from this survey.

The evaluation we will do presents the idea that the sending/receiving ratios obtained from this survey are results of the two assumptions mentioned above.

Below, we will try to make comparisons based on the individual factors for each country.

(4) Table II-2.1 shows the basic indicators for the principal countries.

Table II-2.1 Basic Indicators for Principal Countries

	Japan	U.S.	U.K.	France	Germany	Remarks
No. full-time researchers (Unit: 1,000 people)	488	806	101	109	166	1987
Research outlays (Unit: ¥10 billion)	1,091	1,826	224	305	476	1989 U.K.1987
Population (Unit: 1 million people)	123	248.2	57.3	56.1	61.3	1989
Nominal GNP (Unit: U.S.\$100 million)	29,203	52,377	8,342	10,009	12,729	1989

Note: The figures for full-time researchers and research outlays include those for social science fields.

Sources: Number of full-time researchers/FY90 S&T White Paper  
For Japan, "Survey of S&T Research" (1987)  
Research outlays/FY90 S&T White Paper  
(Japan only, FY91 publication)  
Population, nominal GNP/ World Bank, ATLAS 1990

- 1) Sending ratios that take the above indicators into account (one of two: assuming that the number of researchers sent increases in proportion to the size of the basic indicators)

The sizes of the indicators above, such as the number of full-time researchers, are the driving force for sending researchers overseas. That is, assuming that the number of researchers sent increases in proportion to the size of the indicators above, the theoretical values of the number sent vs. the number received become the values show in parentheses in Table II-2.2. For example, the theoretical value of the number sent vs. the number received between Japan and the United States based on the number of full-time researchers is  $486/806=0.61$ .

And, when the indicators are assumed to be 1:1 (e.g., the number of full-time researchers in Japan and the United States are equal), the survey results, as ratios of the values in Tables II-1.4 and II-2.1, are corrected to the upper values in the columns of Table II-2.2.

For example, the correction for exchange value between Japan and the United States based on the number of full-time researchers is:

$$(1,087/184) \div (488/806) \approx 5.91 \div 0.61 \approx 9.76$$

Table II-2.2 Sending Ratios that Take Indicators Into Account  
 (First of two: assuming that the number of researchers sent increases in proportion to the size of the basic indicators)

	To U.S.	To U.K.	To France	To Germany
Survey results	5.91	2.73	0.96	2.20
Correction due to ratio of number of full-time researchers (Note)	9.76 (0.61)	0.57 (4.83)	0.22 (4.48)	0.75 (2.94)
Correction due to ratio of research outlays (Note)	9.87 (0.60)	0.56 (4.87)	0.27 (3.58)	0.96 (2.29)
Correction due to population ratio	11.91 (0.50)	1.27 (2.15)	0.44 (2.19)	1.10 (2.01)
Correction due to nominal GNP ratio	10.58 (0.56)	0.78 (3.51)	0.33 (2.92)	0.96 (2.92)

Note: Figures for full-time researchers and research outlays include those for social science fields.

From this result we can say the following:

A) As for the United States, in a simple comparison of the numbers, Japan has an "excess of sending" that is 5.9 times the number of researchers sent from the United States

However, when the factors mentioned above that are unique to the United States are added in, a relative assessment of the state of sending between Japan and the United States gives the result that Japan sends 10-11 times as many researchers, which is an even broader revision of the "excess of sending" than the disparity expressed in the simple comparison.

→ Enthusiasm for sending: United States less than Japan

B) As for the United Kingdom, in a simple comparison of the numbers, Japan has an "excess of sending" that is 2.7 times the number of researchers sent from the United Kingdom

However, when the factors mentioned above that are unique to the United Kingdom are added in, a relative assessment of the state of sending between Japan and the United Kingdom gives the result that Japan sends 0.5-1.3 times as many researchers, which numerically revises the disparity expressed in the simple comparison to a "nearly balanced" situation."

→ Enthusiasm for sending: United Kingdom greater than or equal to Japan

C) As for France, in a simple comparison of the numbers, Japan has an "excess of sending" that is 0.96 times the number of researchers sent from the France

However, when the factors mentioned above that are unique to France are added in, a relative assessment of the state of sending between Japan and France gives the result that Japan sends 0.2-0.4 times as many researchers, which numerically revises the disparity expressed in the simple comparison toward an "excess of sending" to Japan.

→ Enthusiasm for sending: France greater than or equal to Japan

D) As for Germany, in a simple comparison of the numbers, Japan has an "excess of sending" that is 2.2 times the number of researchers sent from the Germany.

However, when the factors mentioned above that are unique to Germany are added in, a relative assessment of the state of sending between Japan and Germany gives the result that Japan sends 0.8-1.1 times as many researchers, which numerically revises the disparity expressed in the simple comparison to a "nearly balanced" situation."

→ Enthusiasm for sending: Germany greater than Japan

Table II-2.3 Sending Ratios That Take Indicators Into Account

(Second of two: assuming that the number of researchers received increases in proportion to the size of the basic indicators)

	To U.S.	To U.K.	To France	To Germany
Survey results	5.90	2.73	0.96	2.20
Correction due to ratio of number of full-time researchers (Note)	3.57 (1.65)	13.19 (0.21)	4.30 (0.22)	6.47 (0.34)
Correction due to ratio of research outlays (Note)	3.53 (1.67)	13.30 (0.21)	3.43 (0.28)	5.04 (0.44)
Correction due to population ratio	2.92 (2.02)	5.86 (0.47)	2.10 (0.46)	4.41 (0.50)
Correction due to nominal GNP ratio	3.29 (1.79)	9.56 (0.29)	2.80 (0.34)	5.05 (0.44)

Note: Figures for full-time researchers and research outlays include those for social science fields.

2) Sending ratios that take the indicators above into account (second of two: assuming that the number of researchers received increases in proportion to the size of the basic indicators)

The sizes of the indicators above, such as the number of full-time researchers, are the driving force behind foreign researcher receiving. That is, assuming that the number of researchers received increases in proportion to the size of the indicators above, the theoretical values of the number sent vs. the number received become the values show in parentheses in Table II-2.3.

And, when the indicators are assumed to be 1:1 (e.g., the number of full-time researchers in Japan and the United States are equal), the survey results are corrected to the upper values in the columns of Table II-2.3.

From this result we can say the following:

A) As for the United States, in a simple comparison of the numbers, the United States has an "excess of receiving" that is 5.9 times the number of researchers received from Japan.

However, when the factors mentioned above that are unique to the United States are added in, a relative assessment of the state of Japanese researchers received in the United States gives the result that the United States receives 2.9~3.6 times as many researchers, a correction towards narrowing the disparity expressed in the simple comparison. Nevertheless, the United States still has an "excess of receiving."

→ Efforts toward receiving: United States greater than Japan

B) As for the United Kingdom, in a simple comparison of the numbers, the United Kingdom has an "excess of receiving" that is 2.7 times the number of researchers received from Japan.

However, when the factors mentioned above that are unique to the United Kingdom are added in, a relative assessment of the state of the United Kingdom's acceptance of researchers from Japan gives the result that the United Kingdom receives 5.9~13.3 times as many researchers, a correction towards a significant broadening of the disparity expressed in the simple comparison.

→ Efforts toward receiving: United Kingdom greater than Japan

C) As for France, in a simple comparison of the numbers, France receives 0.96 times the number of researchers that Japan receives from France, which is a "nearly balanced" situation.

However, when the factors mentioned above that are unique to France are added in, a relative assessment of the state of France's acceptance of researchers from Japan gives the result that France receives about 2~4.3 times as many researchers, a correction towards a broadening of the disparity expressed in the simple comparison.

→ Efforts toward hosting: France greater than Japan

D) As for Germany, in a simple comparison of the numbers, Germany has an "excess of receiving" that is 2.2 times the number of researchers that Japan receives from the Germany.

However, when the factors mentioned above that are unique to Germany are added in, a relative assessment of the state of Germany's acceptance of researchers from Japan gives the result that Germany receives about 4.4-6.5 times as many researchers, a correction towards a broadening of the disparity expressed in the simple comparison.

→ Efforts toward hosting: Germany greater than Japan

### III. Current State of Researcher Exchange and Problems

Here we will discuss the current state of researcher exchange in Japanese firms and the problems that become obstacles in receiving foreign researchers. The discussion will center around the "Survey of Foreign Researcher Receiving" (Survey B), which was carried out on 200 companies in Japan, and, as a follow-up to that, the interview survey of 11 companies. As we go along, we will also make comparisons with the survey of Japan-resident foreign researchers' experiences doing research in Japan (Survey C) and the survey of foreign researchers' perception of Japanese research (United States) (Survey D).

#### III-1 Host Firms' Perception of Accepting Foreign Researchers

The results of the questionnaire survey of 200 large Japanese companies about the current state of their hosting foreign researchers and the problems encountered therein were that 57 (49%) of the 116 companies that responded (58%) had records of hosting foreign researchers (see Figure III-1.1).

Based on the responses from those 57 companies, we will analyze the objectives and problems of accepting foreign researchers.

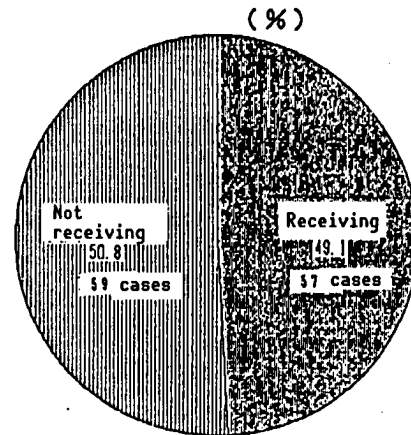


Figure III-1.1 Whether or Not Companies Receive Foreign Researchers (N = 116)

#### (1) Accepting Foreign Researchers and Problems in That

##### 1) Objectives of accepting foreign researchers (multiple responses possible)

- (a) To advance research activities by accepting researchers with superior intelligence (73.7%)
- (b) To activate the research environment by introducing different ways of thinking (66.7%)
- (c) To secure personnel (38.6%)
- (d) To make an international contribution (35.1%)
- (e) Investment for the future (14.0%)
- (f) For mutual exchange with an affiliated firm (12.3%)
- (g) To improve the company's image (8.8%)
- (h) To alleviate trade, technology friction (7.0%)
- (i) Accepting foreign researchers is not necessary, but it helps to increase the number of people who understand the company (5.3%)

About 67% of the companies see foreign researchers as necessary for "contact with different ideas and experience"; about 35%, "contribution to the international community"; and more than 74%, "because foreign

researchers can be immediately effective in their work, without the need for training." (See Figure III-1.2.)

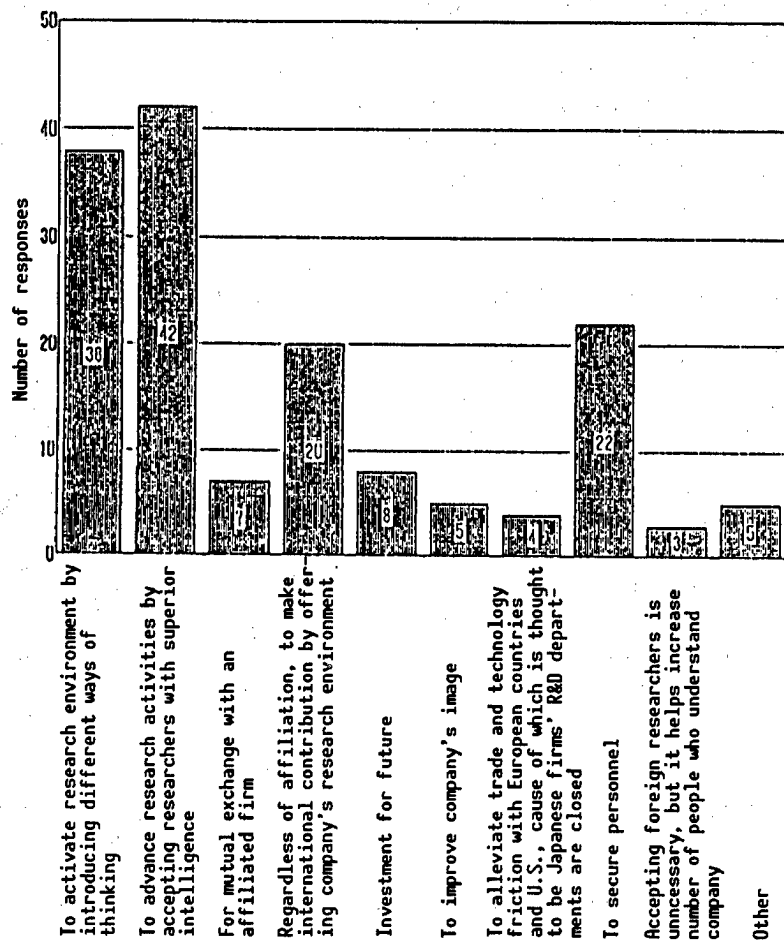


Figure III-1.2 Objectives of Hosting Foreign Researchers

2) Most of the foreign researchers that were accepted were post-doctorate-level researchers (32.1%) and doctorate- or master's-level university students (32.1%), followed by researchers from private research institutes (15.5%) and researchers from public research institutes (7.3%). (See Figure III-1.3.)

Most of the expenses for the foreign researchers accepted in Japan were borne by the receiving company (see Figure III-1.4), but examples are also seen where mainly the United States, the United Kingdom, and France have set up programs for sending researchers from those countries to Japan. (See Reference Materials 8.)

Incidentally, most of the foreign researchers hosted in Japan signed two- to three-year employment contracts.

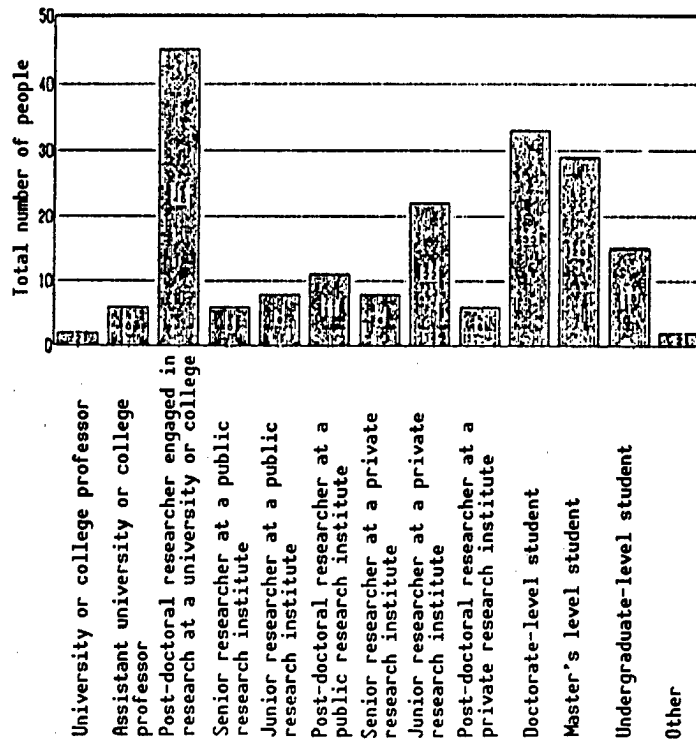


Figure III-1.3 Previous Posts of Researchers (193 people total)

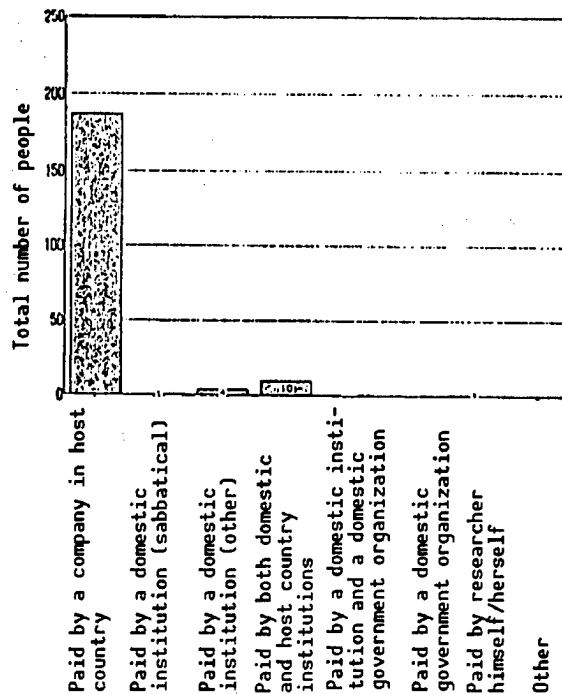


Figure III-1.4 How Expenses Were Paid for Researchers' Overseas Research (203 people total)

### 3) Problems that firms fear in accepting foreign researchers

- Problems related to the research (48.0%)
  - (a) Matching the research field (15.8%)
  - (b) Treatment of research results (10.0%)
  - (c) That the research experience in Japan will not lead to improvements in the researcher's career (7.0%)
  - (d) Differences in ways of thinking that will impede the effectiveness of the research (6.4%)
  - (e) Lack of research leadership (5.8%)
- Problems not related to the research (52.0%)
  - (a) Problems communicating in English or Japanese (18.2%)
  - (b) Inconveniences forced upon foreign researchers because of differences in customs, culture (10.8%)
  - (c) The foreign researcher's ability to find employment after returning home (5.2%)
  - (d) Cannot sufficiently ensure a good lifestyle for the foreign researcher because of the high cost of living in Japan (4.8%)
  - (e) Cannot ensure education for the foreign researcher's children (3.5%)

(See Figure III-1.5)

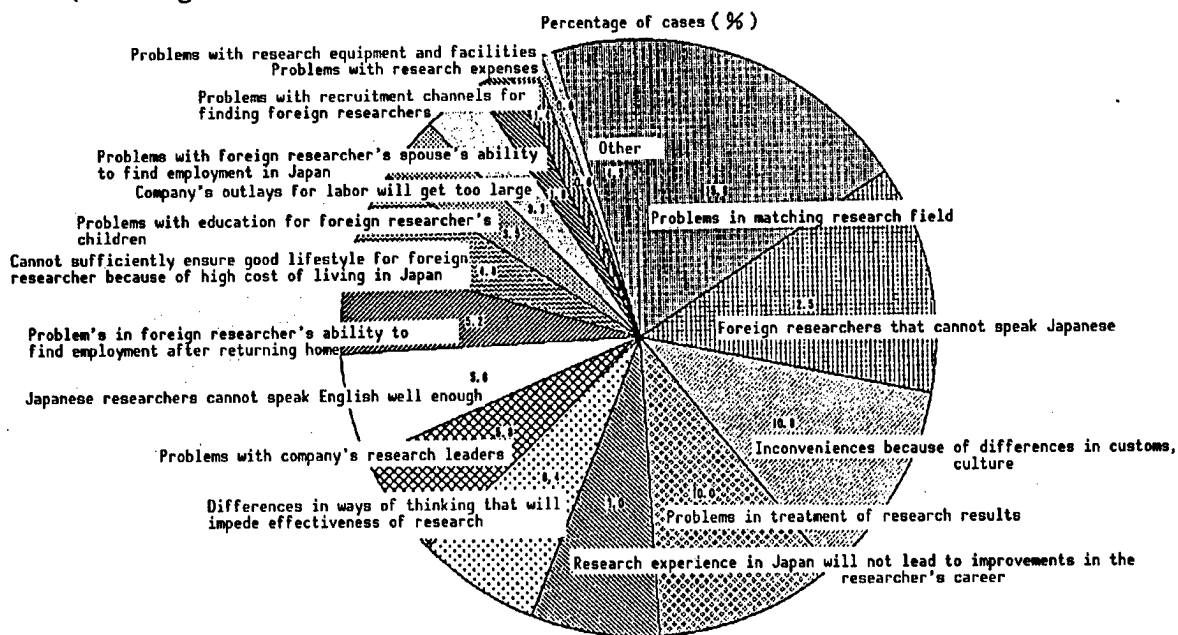


Figure III-1.5 Concerns in Accepting Foreign Researchers (N = 57)

(2) Reasons for Not Accepting Foreign Researchers

The result of investigating the reasons why 59 companies do not accept foreign researchers was that 21 companies (35.6%) said that the time was not ripe yet, and 21 companies (35.6%) said that, in view of the scale of their research, there was no need. There were 25 other responses, most of which were that the research themes the companies deem necessary are not the kinds of themes that foreign researchers want. (See Figure III-1.6.)

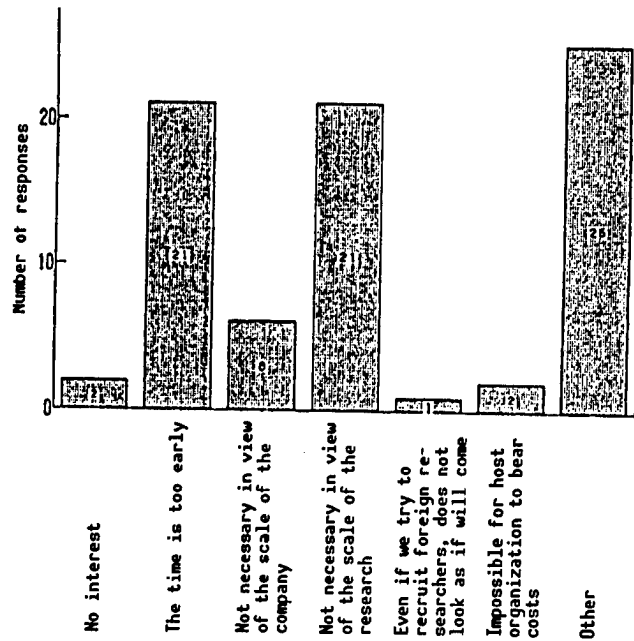


Figure III-1.6 Reasons for Not Accepting Foreign Researchers

(3) Preferred Support Measures from the Government, etc.

The responses to the question about what kind of government and other support measures are preferred can be divided into six categories. The pie chart below shows the order of the views most frequently expressed. Incidentally, for those cases where multiple suggestions were given in a single comment, we counted each suggestion separately.

1) That related to recruiting channels (see Figure III-1.7) (Recruiting centers, setting up centers for information about researchers and research themes, formulating standards for assessing the levels of researchers)

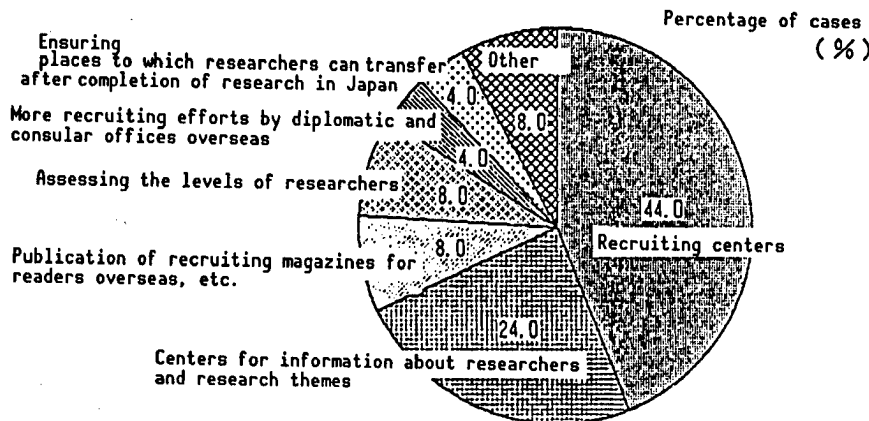


Figure III-1.7 Support Measures To Ensure Recruiting Channels (Total of 25 cases)

2) Promoting better understanding of Japan and Japanese firms (see Figure III-1.8) (publicity about Japan and Japanese firms, training facilities and programs for understanding Japan, creation of publicity videos, etc.)

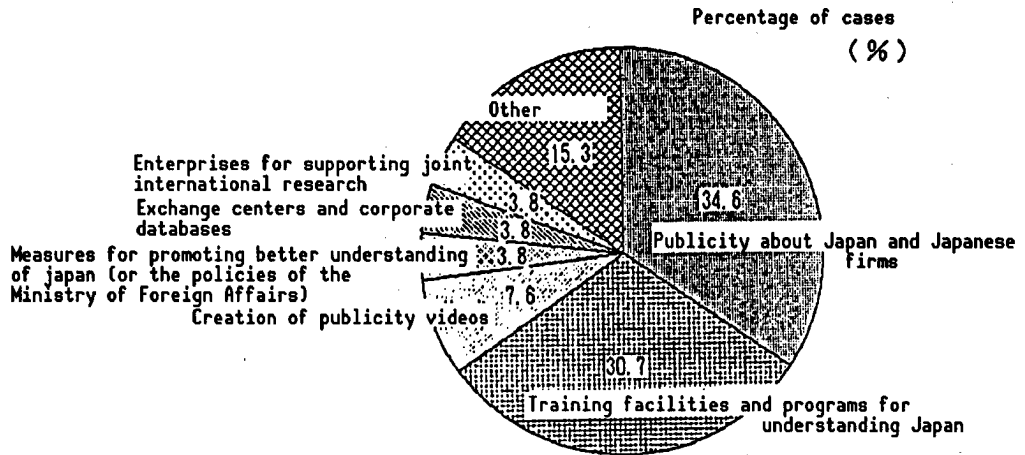


Figure III-1.8 Support Measures for Promoting Better Understanding of Japan and Japanese Firms (Total of 26 cases)

3) That relating to the costs of hosting foreign researchers (see Figure III-1.9) (assistance with outlays for researchers' travel, living expenses, etc.; simplification of tax treatment, tax exemption measures, etc.)

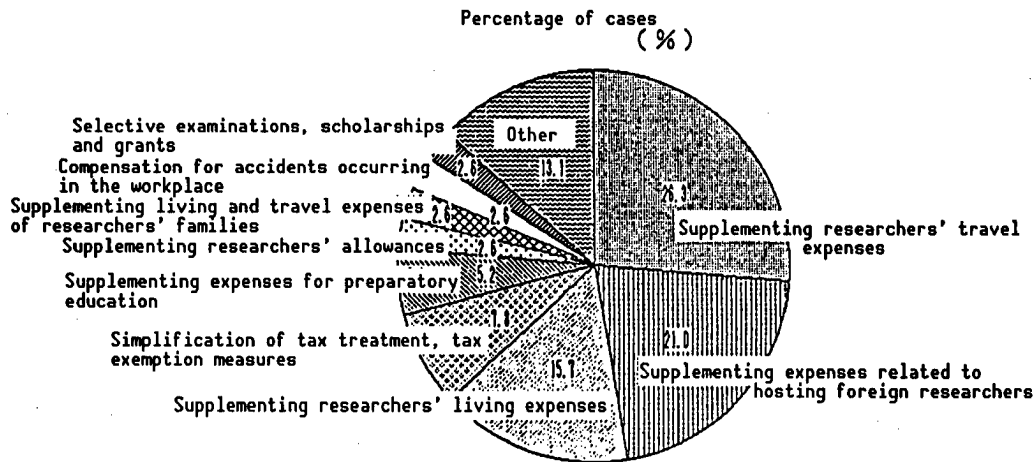


Figure III-1.9 Measures for Assistance With Outlays for Hosting Foreign Researchers (Total of 38 cases)

4) Measures for facilitating communication (see Figure III-1.10) (Japanese-language training facilities, Japanese-language training programs, budget measures for Japanese-language training, etc.)

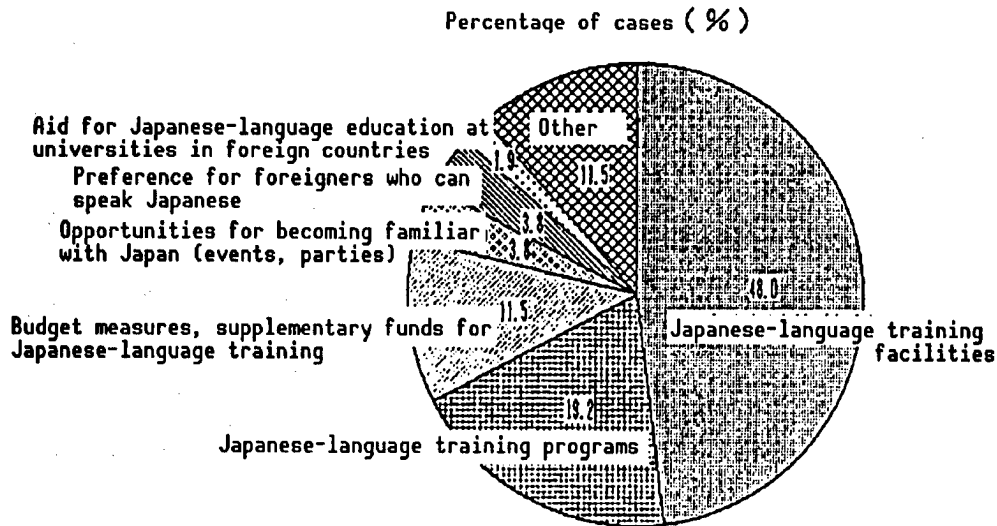


Figure III-1.10 Measures for Facilitating Communication  
(Total of 52 cases)

5) Assistance measures relating to foreign researchers' lifestyles (see Figure III-1.11.) (providing housing for foreign researchers, assistance with housing expenses, providing facilities for educating the children of foreign researchers, providing comprehensive local training centers, etc.)

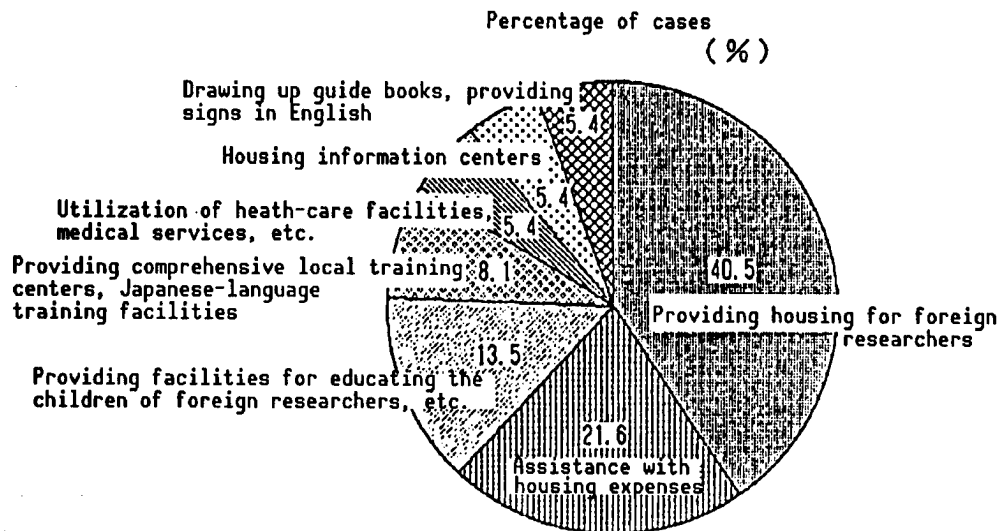


Figure III-1.11 Assistance Measures Relating to Foreign  
Researchers' Lifestyles (Total of 37 cases)

6) Assistance measures for facilitating foreign researchers' entry into Japan. (See Figure III-1.12.) (simplification of visa procedures, speeding up visa screening, simplification of long-term visa screening, simplification of short-term visa procedures, simplification of visa extension procedures, etc.)

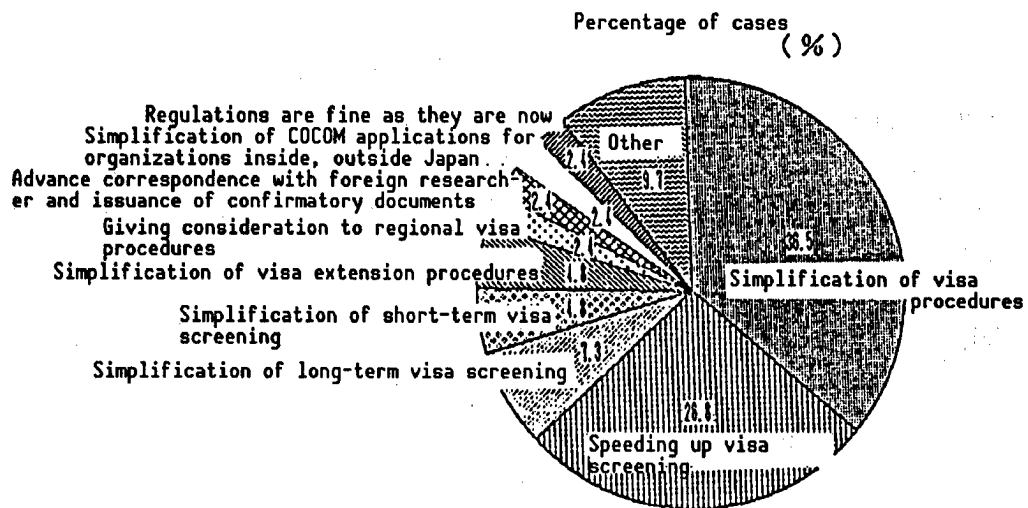


Figure III-1.12 Assistance Measures for Facilitating Foreign Researchers' Entry Into Japan (Total of 41 cases)

### III-2 Survey of Foreign Researchers' Research Experiences in Japan

The survey of foreign researchers who are now conducting research in the top 100 Japanese companies ranked according to size of R&D investments (Survey A) netted valid responses from 83 foreign researchers about their research experiences in Japan.

The purpose of this survey was to investigate the problems, as viewed by foreign researchers residing in Japan, encountered when foreign researchers are accepted at Japanese firms.

#### 1. Experiences of Foreign Researchers Residing in Japan

(1) The characteristics of the researchers centered around middle-aged and young (19.8%) researchers working in private companies whose previous positions were university professors (12.3%), post-doctorate researchers from universities and private companies (16.0%), doctorate-course students from universities (13.6%), or master's-course students (18.5%). (See Figure III-2.1.) As for the age spread, most of the researchers were in their late twenties or early thirties (61.4%). (See Figure III-2.2.)

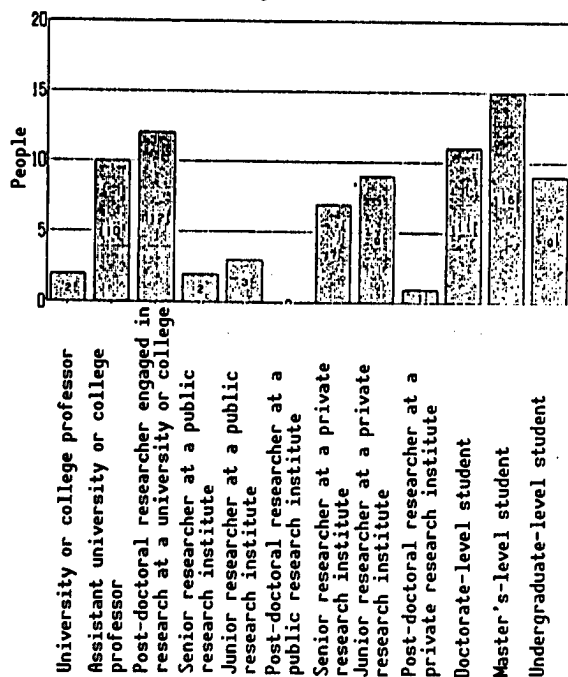


Figure III-2.1 Previous Posts of Researchers (N = 81)

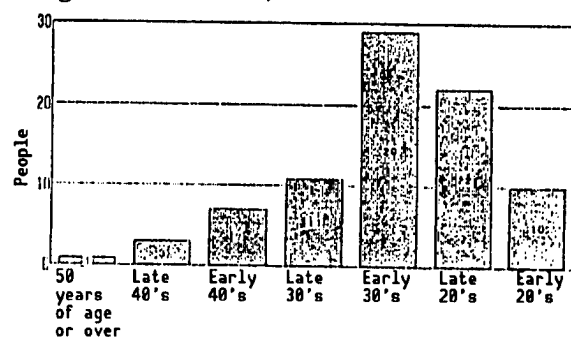


Figure III-2.2 Age Distribution of Respondees (N = 83)

(2) Of the researchers who had research experience outside of their home country (35.8%), most had done research in the United States (34.0%).

1) In response to the question as to whether or not the researcher wants to do research in Japan again after his current research work ends, 67% of the researchers indicated that they have such a desire. (See Figure III-2.3.)

For that case, the overwhelming majority of researchers (75.0%) want to do research in the laboratory of a private company. (See Figure III-2.4.)

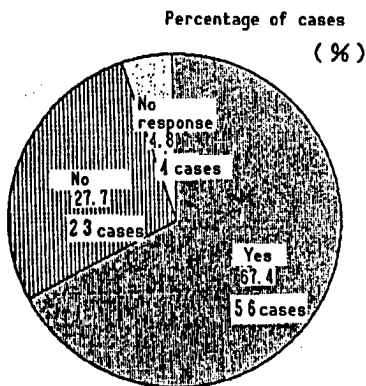


Figure III-2.3 Desire To Do Research in Japan Again (N = 83)

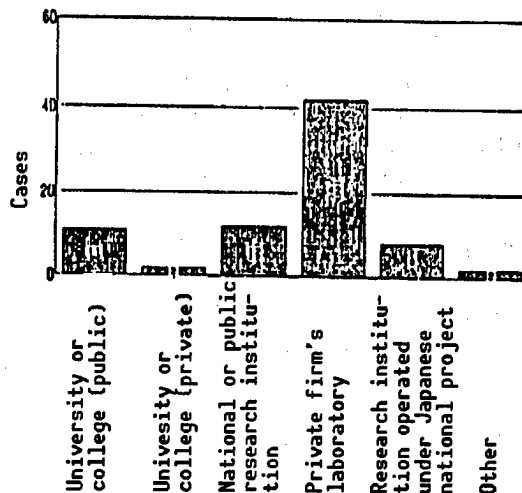


Figure III-2.4 Japanese Research Organizations Where Researchers Want To Do Research Again (N = 56)

2) Almost all of the foreign researchers residing in Japan (97.6%) have an interest in Japan. (See Figure III-2.5.) Many showed an interest in Japanese high technology (70.4%) and in the R&D structures of Japanese companies. (See Figure III-2.6.)

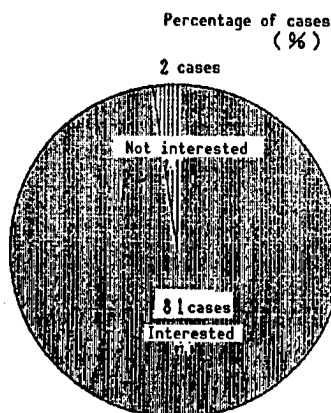


Figure III-2.5 Interested or Not in Japan (N = 83)

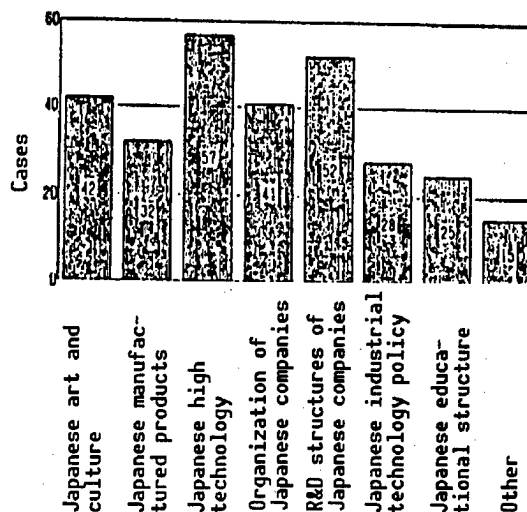


Figure III-2.6 Interest in Japan (N = 81)

## 2. Perception of the Level of Research in Japan

(1) In response to the question about the how the researcher views the level of research in Japan in his own field, many researchers who see Japan's research as being at a high level are working in the fields of electrical machinery (31.1%), automobiles and other transport machinery (17.7%), construction (17.7%), and iron and steel (15.5%). Conversely, the few researchers who do not view Japan's research as being at a high level are working in the fields of chemical engineering (2.2%), metal products (2.2%), and mechanical engineering (4.4%). (See Figure III-2.7).

(2) When we examined the average views of foreign researchers, 37.3% see the United States as having the highest level of research, and Japan as having the second highest level of research.

Incidentally, 22.6% see Japan as having the highest level of research. (See Figure III-2.8.)

(3) In response to the question about whether or not the researcher agrees with the statement that "Japan enjoys a free ride in basic research," only 18 of the 83 researchers affirmed that view, while 42 researchers, corresponding to half, indicated the view that "it depends on the area of the research."

On the other hand, only 3.6% of the researchers see that criticism as something that "has only an emotional appeal." (See Figure III-2.9.)

### 3. Problems Encountered While Doing Research In Japan

(1) Problems foreign researchers said that they encountered while living and doing research in Japan (see Figure III-2.10):

- Not related to the research
  - a) Problems communicating in Japanese (15.4%)
  - b) The high cost of living in Japan (15.3%)
  - c) Ability to find employment after returning home (12.1%)
  - d) Inconveniences due to differences in customs and culture (8.9%)
- Related to the research
  - e) Lack of competent research leaders in Japan (8.4%)
  - f) Research experience gained in Japan may not necessarily lead to an improvement in the researcher's career (7.1%)
  - g) Inadequate research facilities and equipment (6.5%)

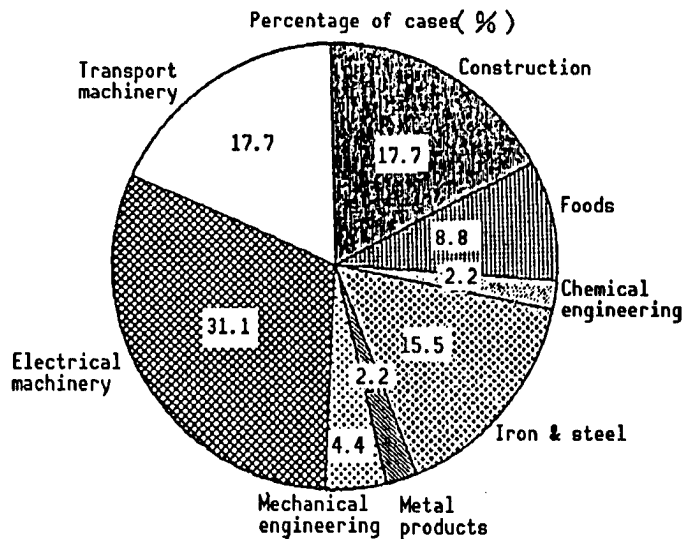


Figure III-2.7 Industries of Researchers Who Rank Japan's R&D Level as Highest or Second-Highest (N = 45)

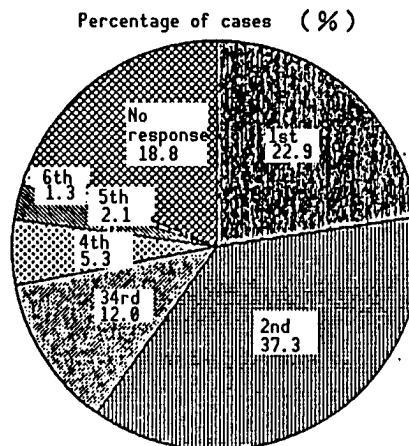


Figure III-2.8 Ranking of Japanese R&D (Regardless of field)

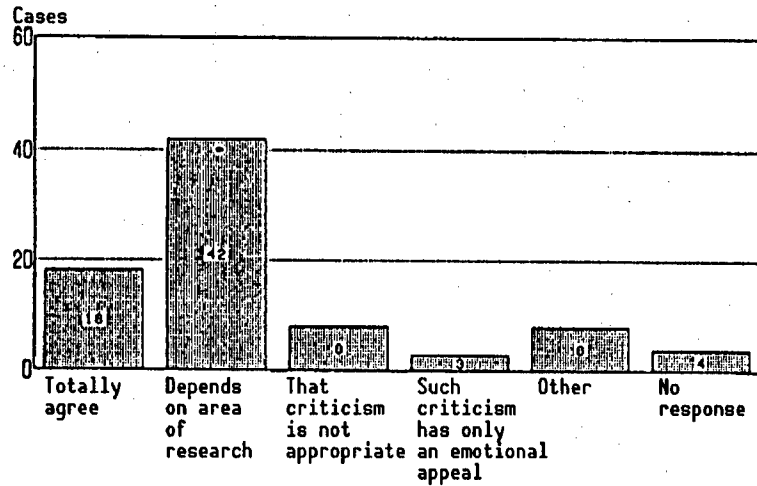


Figure III-2.9 Opinions About Japan Enjoying a Free Ride in Basic Research (N = 83)

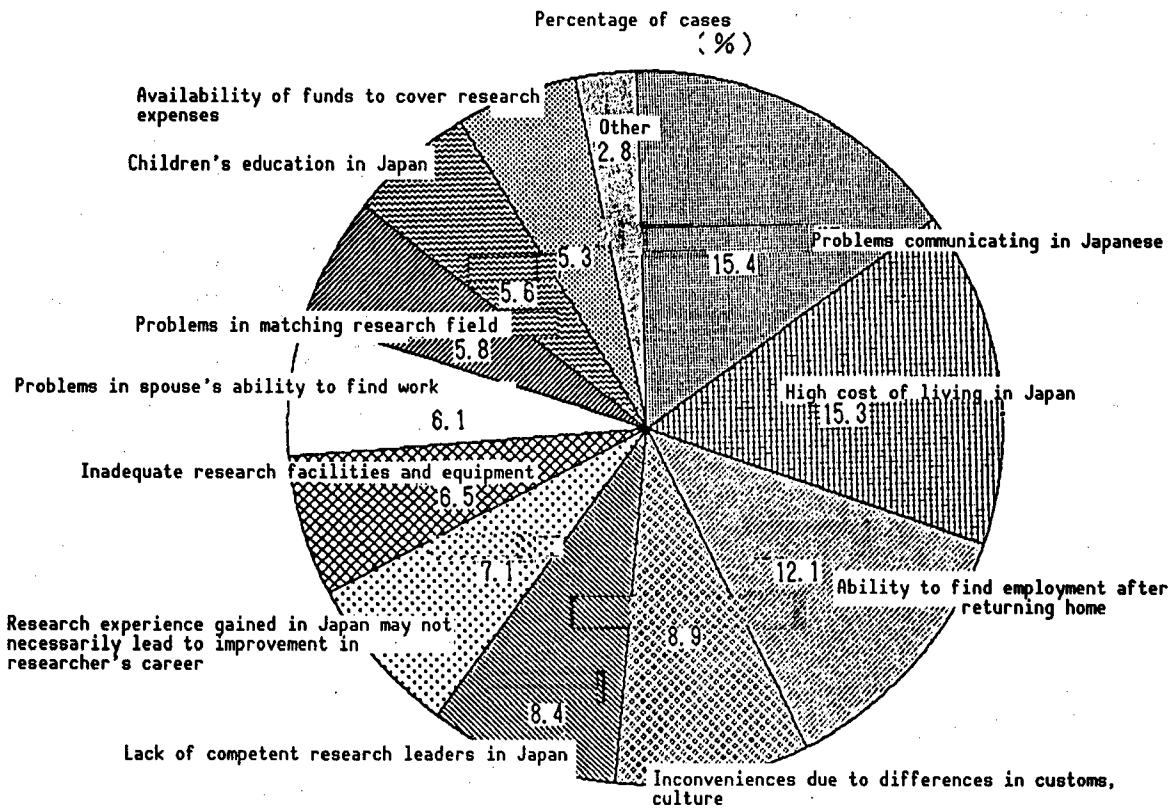


Figure III-2.10 Problems Foreign Researchers Encountered While Living and Doing Research in Japan (N = 75)

(2) Many of the researchers expressed concern about being able to find employment after returning from Japan to their home country. One factor in that is thought to be that many of the respondees were post-doctorate- or master's-level students.

(3) Incidentally, at a meeting of the "Japan-U.S. Scientific Cooperation Agreement Fourth Joint Working Committee," the main impediment was said to be "the differences in language and culture," and it was confirmed that there are no other hidden barriers in America's access to Japan.

(Note) According to the examples given by the AIST Electrotechnical Laboratory, "communicating in the Japanese language" has not been a big problem for foreign researchers. Rather, the foreign researchers at the laboratory attempt to learn and speak Japanese, and the Japanese researchers try to practice using English.

### III-3 Interview Survey of Japanese Firms

From the 116 companies that provided valid responses to the "Survey of Views on Accepting Foreign Researchers," we selected 11 of the companies that are the most active in accepting foreign researchers and interviewed them individually. Table III-3.1 gives a summary of those interviews.

#### 1. Summary of Results of Interview Survey

(1) There were very few cases where foreign researchers were accepted as one-year-long visiting researchers under "exclusive" programs for hosting foreign researchers. We only came across some high-ranking firms in electrical machinery, electronics, and other industries in Japan that predominantly deal with foreign countries. (See Reference Materials 7.)

According to the NEDO "Survey to Gather Information on Researcher Exchange Systems Relating to International Research Exchange" that was carried out in FY90, of the 120 valid responses (a recovery rate of 28%) 65 organizations, or 54%, are firms that have some sort of research exchange system, even if an "exclusive" system is not in place. (See Reference Materials 6.)

(2) However, as seen in the results of these current surveys, in many firms talented foreign researchers are often employed because they are immediately effective in their work and do not require training. There are many cases where the foreign researchers sign two- to three-year-long contracts.

In those situations the foreign researchers tend to receive more favorable treatment in terms of their posts, housing benefits, etc., than Japanese researchers.

(3) Hosting foreign researchers is viewed by both the foreign researchers and the receiving firms as having merit.

In particular, the foreign researchers accepted by electrical machinery and electronics makers tend to be confident that their research experience in Japan will lead to improvements in their careers as researchers.

Table III-3.1 Summary of Interview Surveys of Japanese Firms

Type of industry	System for accepting foreign researchers in place?	Current state of accepting foreign researchers	Objectives	Criteria for countries from which foreign researchers are accepted	Criteria for selecting researchers	Advantages (A) and disadvantages (D) in accepting foreign researchers	Future plans (targets)	Remarks
1. Food	Yes	7-8 people constantly received every year	<ul style="list-style-type: none"> <li>Secure competent researchers with specialized knowledge</li> <li>Pure scientific exchange</li> <li>Improve image of the firm</li> </ul>	No particular criteria for countries	<ul style="list-style-type: none"> <li>That they are competent and have specialized knowledge</li> </ul>	<p>A: Competent researchers will lend fighting power to work D: None</p>	Continually accepting about 10 people (about 1/30 of the 320 researchers)	
2. Food	No	Nothing organized	<ul style="list-style-type: none"> <li>Find workers with broad talents</li> <li>No particular interest in foreign researchers</li> </ul>	No particular criteria for countries	<ul style="list-style-type: none"> <li>depends on research capabilities</li> <li>English-speaking</li> <li>Better if researcher can speak a little Japanese</li> </ul>	<p>A: Researchers can immediately contribute R&amp;D D: Communication problems; researchers who only speak English are useless</p>	Find workers with broad talents No particular numbers set as targets	Firm's autonomy is important in accepting foreign researchers
3. Fibers and chemicals	No (can deal with employment of foreign researchers with usual systems)	Few foreign researchers accepted for short, 3-4 month periods	<ul style="list-style-type: none"> <li>Globalization of firm and its R&amp;D</li> <li>Activation of research</li> </ul>	No particular criteria for countries	<ul style="list-style-type: none"> <li>Researchers with high-level capabilities, e.g., those with PhD's</li> </ul>	<p>A: It activates company's R&amp;D department Will add strength in development of software</p>	No firm targets, but 4-5 researchers, including some who stay in Japan for short periods	
4. Chemicals (paints)	Yes (handled by a staff of 1)	2-3 researchers every year (2-3 year short-term employment contracts)	<ul style="list-style-type: none"> <li>Globalization</li> <li>Later to employ researchers hosted in Japan at R&amp;D bases overseas</li> </ul>	N. America and Europe (aim to send researchers to corporations there)	<ul style="list-style-type: none"> <li>Someone to pull on weight as researcher</li> <li>Researchers who completed master's or doctorate work</li> </ul>	<p>A: Can secure competent, intelligent researchers Introduction of different ways of thinking activates research dept.</p>	As of now, 2-3 people every year	

5. Pharmaceutical manufacturing	Yes	System begun in 1987 (2-3-year short-term employment contracts)	• Stronger research	Europe and U.S. (centering on U.S. and U.K. due to contacts in countries)	• Excellent researchers with PhDs. • Research areas: (biology, chemistry, fermentation, allergies, inflammatory diseases, etc) • Researchers with specific levels of capabilities • Matching research area is essential	A: Research improves with introduction of competent, talented researchers	11 foreign researchers in a group of 710 researchers (1/70) To raise to about 10% at the central laboratory	Not systematic. Foreign researchers recruited by individual channels of laboratory director
6. Iron and steel	Yes	System begun in 1989 (commission contracts that are revised each year)	• Because laboratory is closed group, will be activated by infusion of new blood • Impetus to basic research (science)	Not limited to any particular countries. Centering around Europe and U.S.	• Researchers with specific levels of capabilities • Matching research area is essential	A: Will activate R&D activities through introduction of different cultures (creativity, sub-jectivity) D: Mismatches with Japanese social customs and company's culture	About 5 researchers every year in mid-term plan (1992-95) for employing foreign researchers	In departments other than research, there are about 30 foreign workers with commission contracts
7. Electrical machinery, electronics	Yes	Began mandatory acceptance of foreign researchers in FY90 (2-year employment contracts)	• Part of R&D globalization • Bring foreign-ers different ways of thinking	Not limited to any particular countries (advanced regions better, though)	• Superior talents • Basic research fields in which new breakthroughs being made • Talented people needed for fields in which company doing research	A: Activation resulting from cultural exchange Breakthrough contributions D: Few long-term researchers to sign contracts longer than initial 2-year contract	Gradually increase number of foreign researchers from 25 now working in 8 laboratories which include at least 2 foreign researchers	Our branch offices in U.S. employ non-Japanese researchers via U.S. universities; number of non-Japanese accounted for in yearly R&D budget
8. Electrical machinery, electronics	Yes (not systemized)	Changes yearly, average of 10 foreign researchers (1-year short-term contract)	• Introduce creativity • Synergistic effect with different cultures • Improvements in research result		• Researchers whose results in their field are valued • Master's level satisfactory	A: Mutual benefit to researcher and company Raises level of company D: Sometimes incidental work relating to globalization increases	No firm targets, but have about 14-15 researchers	Insofar as possible, acceptance of foreign researchers left to research managers; not systematic

9. Electrical machinery, electronics	Yes	System begun in 87 Receiving foreign researchers regularly in 1988 (3-year, short-term employment contracts)	<ul style="list-style-type: none"> <li>Globalization (introduction of creativity based on different ideas)</li> <li>Securing necessary personnel for R&amp;D bases in Europe and U.S.</li> <li>Form a vein of international people</li> </ul>	Advanced countries centering on Europe and U.S. Plans for expansion to include Asia	<ul style="list-style-type: none"> <li>English-language ability (better if can communicate in Japanese)</li> <li>Match between specialized skills and company's needs</li> <li>Flexibility to adapt to work in company</li> </ul>	A: Technical workers whose work immediately effective Management skills expand to include international viewpoint D: Trouble result from inadequately equipped infrastructure	14 foreign researchers, but target is to have 30 foreign researchers, resulting in about 2.8% of our 1,060 researchers	Yearly employment plans; In FY92 plan to employ 10. Have 2 foreign researchers to 1 office. Having only 1 foreign researcher not effective
10. Automobiles	Yes	Started accepting foreign researchers 5 years ago	<ul style="list-style-type: none"> <li>Introduce advanced, specialized knowledge</li> <li>Foster technical fields that not thrived in Japan</li> </ul>	No particular criteria for countries	<ul style="list-style-type: none"> <li>Emphasis on advanced, specialized capabilities</li> <li>At least have master's or PhD</li> </ul>	A: Conductive to technological growth Forms pipeline to U.S. and Europe D: Management costs increase	About 10 foreign researchers for 1-year stays	Personnel plans surveyed annually. Recruitment through overseas companies, individual networks. Employment periods not fixed.
11. Shipbuilding and heavy machinery	No (but there is system for sending Japanese workers to foreign countries)	Not accepting foreign researchers at present	<ul style="list-style-type: none"> <li>Open up new fields</li> <li>Employ people effective in their work immediately</li> </ul>	Shipbuilding: China and Korea (Japanese university graduates) New fields: Europe and U.S.	<ul style="list-style-type: none"> <li>Career researchers</li> <li>Researchers effective in their work immediately</li> </ul>	A: Introduction of different cultures, ideas will activate departments (e.g. foreigners able to grasp whole picture)	When consensus has been established and in-house systems and guidelines set up	Not necessary now in view of scale of company and its research. Labor conditions (e.g. wages, housing, pensions)

(4) However, in industries such as food, chemicals, and pharmaceuticals, much is expected of the foreign researchers yet they seem to be concerned about whether or not their research experience in Japan will lead to improvements in their careers.

## 2. Contents of Individual Interviews

The following describes the individual contents of the interviews with the 11 companies.

(Interview with Company A, a food manufacturer)

(Current state of the company's research system and acceptance of foreign researchers)

We have about 320 researchers, and we regularly receive seven or eight foreign researchers.

(What the company thinks about accepting foreign researchers)

We have two objectives in accepting foreign researchers: to improve the image of our company by promoting pure scientific exchange for the purpose of nurturing young scientists, and to advance our research by securing talented, competent workers with specialized knowledge.

There are no restrictions as to the countries from which we accept researchers. If the researcher is a talented, competent worker with specialized knowledge, the researcher's nationality does not matter. The advantage in accepting foreign researchers is that talented, competent workers will make significant contributions to our R&D. At present, there are no disadvantages.

Our present goal is to regularly employ about 10 foreign researchers every year. This corresponds to about 1/30 of the total number of researchers in our company.

An important point in accepting foreign researchers is how to find excellent researchers. We now scout for foreign researchers through professors at universities overseas with whom we have connections and through other such routes that our company has opened up. In that, it is essential that we uphold the principle of "give and take" with those universities.

(What the company would like the government to do)

As for what we want from the government in connection with accepting foreign researchers, we would like to have a public organization that obtains and supplies data for ascertaining the capabilities of foreign researchers. In addition, we would like deductions in corporation taxes for expenses incurred in accepting foreign university students, repletion of Japanese language education, assistance with housing,

etc. Immigration procedures are just fine as they are; a certain degree of regulation is necessary. Even if the paperwork is complicated, we have been able to deal with it from our experience with problems.

One additional comment is that it is essential to publicize to a broad range of people in various countries the fact that Japan actively receives foreign researchers.

(Interview with Company B, a food manufacturer)

(Current state of the company's research system and acceptance of foreign researchers)

We have about 360 researchers, and we now accept foreign researchers from fields that are related to our main business and from new fields that are opening up.

(What the company thinks about accepting foreign researchers)

As for our objectives in accepting foreign researchers, it is not for the reason that we want foreign researchers in particular; in looking for researchers with broad talents, we sometimes find foreign researchers. We do not embrace the high-handed idea that accepting foreign researchers is a way to make an international contribution.

The advantage in accepting foreign researchers is that the exchange of different ideas activates research. There are no restrictions as to the countries from which we receive researchers. As far as possible our selection depends on the capabilities of the researcher. As for language abilities, we want researchers who speak English and can communicate a little in Japanese. It is important that the researcher not only speaks English but also has both research capabilities and good communication skills.

Our present goal is to regularly employ about 10 foreign researchers every year. This corresponds to about 1/30 of the total number of researchers in our company.

A general problem in accepting foreign researchers is the difficulty in suddenly being required to accept foreign researchers because we employ both foreign and Japanese researchers with our personnel planning. In addition, we assume that a foreign researcher will stay in Japan for two to three years and then renew his contract every year, but it ends up being a cold, businesslike affair when the researcher's term expires and he is likely to be worried about where he will work next.

(What the company would like the government to do)

As for support measures that we would like from the government in connection with accepting foreign researchers, we would like the

government to establish public recruiting centers that would facilitate the recruiting of researchers; the recruiting centers would provide a list of researchers from which we could select researchers according to their research objectives.

Furthermore, it would be nice if the recruiting centers could help us find new positions for the researchers who finish their research terms in Japan.

Because communication with foreign researchers is an important issue, we would also like the government to make Japanese-language training more replete.

As for housing, there is no problem in getting foreign researchers to live in our company housing because it is comparatively complete. Other than that, we can deal with health and welfare matters to a certain extent, but the government should help supplement that for small manufacturers.

(Interview with Company C, a chemical manufacturer)

(Current state of the company's research system and acceptance of foreign researchers)

We have about 120 researchers, and we started accepting foreign researchers in 1987. We have employed seven foreign researchers thus far; excluding those who returned home after their contracts expired, there are now three foreign researchers working at our company.

(What the company thinks about accepting foreign researchers)

The objectives in accepting foreign researchers are globalization within our laboratories, and to secure the personnel needed for our expansion overseas. Because Japan is comparatively advanced in this field, we do not necessarily need foreign researchers, and there is no problem with the research capabilities of Japanese researchers. There is great advantage, however, in the aspect of research activation as a result of the introduction of different ways of thinking.

The researchers we accept are semi-company-employees with term-limited contracts that last two or three years. They receive the same treatment as Japanese employees. The researchers we accept are unmarried, relatively young, competent people with at least a master's or doctorate degree. After being accepted, they can go on to work at our central laboratory.

The countries from which we accept researchers are the United States, Canada, European countries, and NIES countries. In the case of the latter, we often employ foreign researchers from the ranks of foreign students at Japanese universities. In those cases, there is advantage in that the researchers can speak Japanese.

Our objective in accepting foreign researchers is that it will support our R&D. In addition, after the researchers complete their research terms in Japan, we hope that they will stay on with the company and work in our overseas corporations in the U.S. and NIES countries, and thereby continue to act as a pipe to within those countries. So, there is also the reason of securing personnel for those overseas corporations.

At present, one person handles all of the procedures related to accepting foreign researchers. The contract formats and the English-language documents, e.g., various regulations, are almost all complete now.

The target is to accept two or three foreign researchers every year.

As for scouting for foreign researchers, we would like to be able to systematically list up researchers.

(What the company would like the government to do)

We would like the government to set up public recruiting centers, which would sound out companies on accepting foreign researchers and act as a go-between, and speed up immigration procedures. For example, we want the Ministry of Justice to computerize the Immigration Offices, and speed up and simplify immigration procedures so that firms who have already received foreign researchers do not have to submit a company profile, proof of tax payment, business report, quarterly reports, company registration and other such documents each time they want to accept a foreign researcher.

(Interview with Company D, a fibers and chemical manufacturer)

(Current state of the company's research system and acceptance of foreign researchers)

We have about 700 researchers, and we are now accepting a very small number of foreign researchers for long periods of research (six months or longer). However, every year we receive a number of foreign researchers for short terms of three to four months. Because of these circumstances, we do not yet have a system in place for accepting foreign researchers.

(What the company thinks about accepting foreign researchers)

We strongly feel the need for accepting foreign researchers, and our policy is to accept excellent researchers from all over the world and to promote globalization within the company. In doing that, we would like to advertise for researchers in new development fields.

We especially need personnel that will contribute in the research and development of software, an area in which Japanese workers are not very strong. Nevertheless, we are somewhat worried about whether or not the

researchers we turn up will have the kind of talent and skills that we expect.

Although we do not have a firm target now for the number of foreign researchers, every year we receive four or five researchers, including those who stay for short terms. We are still in a trial-and-error stage.

(What the company would like the government to do)

We would like government assistance in the form of a foreign researcher introduction center. In addition, Japanese-language training facilities for foreign researchers would be nice in accommodating the foreign researchers.

(Interview with Company E, a pharmaceutical manufacturer)

(Current state of the company's research system and acceptance of foreign researchers)

We have about 900 researchers, including research assistants, and we started accepting foreign researchers in 1987. This was realized through a proposal made by the laboratory director; there are few pharmaceutical manufacturers whose acceptance of foreign researchers is based on a company-authorization system.

(What the company thinks about accepting foreign researchers)

One objective in accepting foreign researchers is to increase our R&D strength. Usually a two-year employment contract is signed with the foreign researcher, and the contract can be extended. The countries from which we accept researchers are mainly the United States, the United Kingdom, and other countries where advances have been made in the development of new drugs. This is also due to the fact that we are primarily dependent on the laboratory director's network of personal contacts and on public organizations for our recruiting sources.

We look for excellent, doctorate-level researchers. We are interested in researchers whose work has been in the fields of biology and chemistry, and particularly those in fermentation pharmacology and organic synthetic chemistry, and research areas such as the circulatory system, neuroscience, allergies, and inflammatory diseases. Among the researchers whom we have accepted, there are some who have become research group leaders and significantly contribute to increasing the laboratory's development strength. The company has measures for giving these researchers somewhat more favorable treatment.

In general, an advantage in accepting foreign researchers is that it leads to an activation of our research because it enables research based on concepts that are different from those of Japanese researchers.

As the future target for accepting foreign researchers, personally, I would like 10% of the laboratory's entire research staff to consist of foreign researchers every year.

(What the company would like the government to do)

We would like government assistance in organized Japanese-language training and in dealing with the housing problems for foreign researchers who come to Japan with their families. In addition, we would like to ask the government to simplify and speed up visa and other procedures.

(Interview with Company F, an iron and steel producer)

(Current state of the company's research system and acceptance of foreign researchers)

We have about 950 researchers, and we started accepting foreign researchers in 1989. The foreign researchers are on commissioned contracts that are renewed on a yearly basis.

(What the company thinks about accepting foreign researchers)

One objective in accepting foreign researchers is to activate our laboratory by introducing different blood because our laboratory tends to become a closed group.

We would also like to shift the content of our research, which tends to lean toward applied research, a little more toward basic research (science).

There are no restrictions as to the countries from which we accept researchers, but the choice will probably center on European countries and the United States

The criteria in selecting researchers is that they have a certain level of research capabilities (if possible, doctorate-level, or at least somebody with a master's degree); matching their research field is important.

The advantage in accepting foreign researchers is that research is activated as a result of the introduction of foreign researchers' creativity and subjectivity. There are disadvantages in that various mismatches arise because of the differences in Japanese and foreign mentalities, and because foreign researchers have a difficult time adapting to Japanese customs and the company culture. However, this is not that serious of a problem.

As for the future target for accepting foreign researchers, guidelines for employing foreign researchers are indicated in the company's mid-term plan (1992-5), and we plan to accept about five foreign researchers every year. Based on the total number of employees, 20 foreign

researchers at most? That would be about one-twentieth of the 400 and some researchers in the laboratories directly controlled by our company.

Scouting for researchers takes a form where we accept students and graduates from American and British universities with which we have done joint research; we accept the students for one to three months as summer trainees. We select foreign researchers for employment from the researchers that pass a one-time screening at our overseas corporations in the United States and the United Kingdom

The problem in cases where we accept foreign researchers as contract employees is that the researchers do not stay at the company very long. Although we want them to stay for at least two years, many return to their home countries after about one year. Consequently, we cannot let the foreign researchers choose long-term research topics, so matching their research themes is difficult.

In addition, in dealing with foreign researchers, it is important to be specific about job descriptions and expected output and then to be scrupulous about compensating them accordingly.

(What the company would like the government to do)

We would like the government to help by constructing databases with information for recruiting foreign researchers, and then opening those databases to general firms. We would also like the government to simplify the procedures for acquiring visas.

(Interview with Company G, a general electrical machinery manufacturer)

(Current state of the company's research system and acceptance of foreign researchers)

We have about 1,500 researchers, and we started accepting foreign researchers in 1990. (What the company thinks about accepting foreign researchers)

We accept foreign researchers for two reasons. One is that, because national borders are disappearing now in R&D, we are looking for a broad range of excellent, talented people from all over the world. That is, we think that it is a time when the company employees who are hired mid-way in their careers are occasionally foreign researchers.

The second reason is that, because creative concepts are constantly needed in R&D, by accepting foreign researchers of different cultures we can activate our research.

We sign short-term employment contracts with foreign researchers, initially for two years; when we want to extend the contract further, we do so every time.

We now have several laboratories throughout Japan, and our goal is to have at least two foreign researchers at each laboratory.

As a rule, we do not devise special budget measures for accepting foreign researchers; accepting foreign researchers is implemented within the range of the yearly budget apportioned to a given research department.

At present, our criteria for selecting researchers is that they have the talent needed for the research fields in which our company is involved. Although we do not restrict our selection to researchers from certain countries, we want researchers from regions that are advanced in those areas of research.

From time to time we employ foreign researchers. The decisions as to which people we will accept are based on use of dispatching programs of U.S. universities; employment through local agencies overseas, U.S. universities with which have had relations for a long time, foreign students at Japanese universities, introductions made through foreign embassies and consulates; etc. In principal, however, acceptance depends on whether or not the person has good character.

(What the company would like the government to do)

We would like the government to help by establishing public recruiting centers for screening foreign researchers; equipping an infrastructure in which foreigners, and not just foreign researchers, can work easily; equipping an infrastructure relating to housing, education of children, etc.; and revising the systems for pensions, employment insurance, etc.

(Interview with Company H, an electrical machinery and electronics manufacturer)

(Current state of the company's research system and acceptance of foreign researchers)

We have about 1,060 researchers. In 1987 we set up a system for accepting foreign researchers and started accepting foreign researchers in 1988. We now have 14 foreign researchers.

(What the company thinks about accepting foreign researchers)

One objective in accepting foreign researchers is globalization within our company; in particular, technical development that is rich in creativity and is based on different concepts will activate our research efforts. Another important issue is preliminary investments for future cultivation of international people, or securing personnel for our future R&D bases in Europe and the United States We sign employment contracts with foreign researchers; initially we aim for a three-year contract (which is revised every year, in principal).

Our criteria for selecting researchers is that they can communicate in English (if they have Japanese abilities, all the better), that their specialized skills match our company's needs; and that they have plenty of flexibility so that they can adapt to working in a Japanese company.

The countries from which we accept foreign researchers are now the advanced countries, centering on the United States and the United Kingdom, but in the future we plan to broaden that frame to include Asian countries.

The advantages in accepting foreign researchers are that they can directly contribute to our R&D immediately after they enter the company, and that they indirectly contribute to expanding the international point of view in the departments where they are accepted and the management skills of their managers.

There is a disadvantage in that extra time must be allocated to investigate the policies (wage standards, employee qualifications, research assessment standards, etc.) for preventing troubles, before they occur, that arise because the infrastructure relating to foreign researchers' daily lifestyles within and outside of the company is still inadequate.

Employment of foreign researchers takes a form in which we formulate a yearly plan, then we recruit and interview people according to the yearly schedule shown in Figure III-3.1, and then bring foreign researchers into the company every September. A point of consideration in employing foreign researchers is that there should be at least two foreign researchers in a given research department. That is because it is difficult to achieve globalization within the company, which is the objective in accepting foreign researchers, if there is only one foreign researcher in a research department.

Our present target is to accept up to 30 foreign researchers, which would correspond to just under 3% of the total number of researchers in our company.

(What the company would like the government to do)

We would like the government to make it easier to accept foreign researchers by facilitating COCOM applications. It would also be nice if the government provided assistance with Japanese-language education, requisitioning housing and company housing, and so forth.

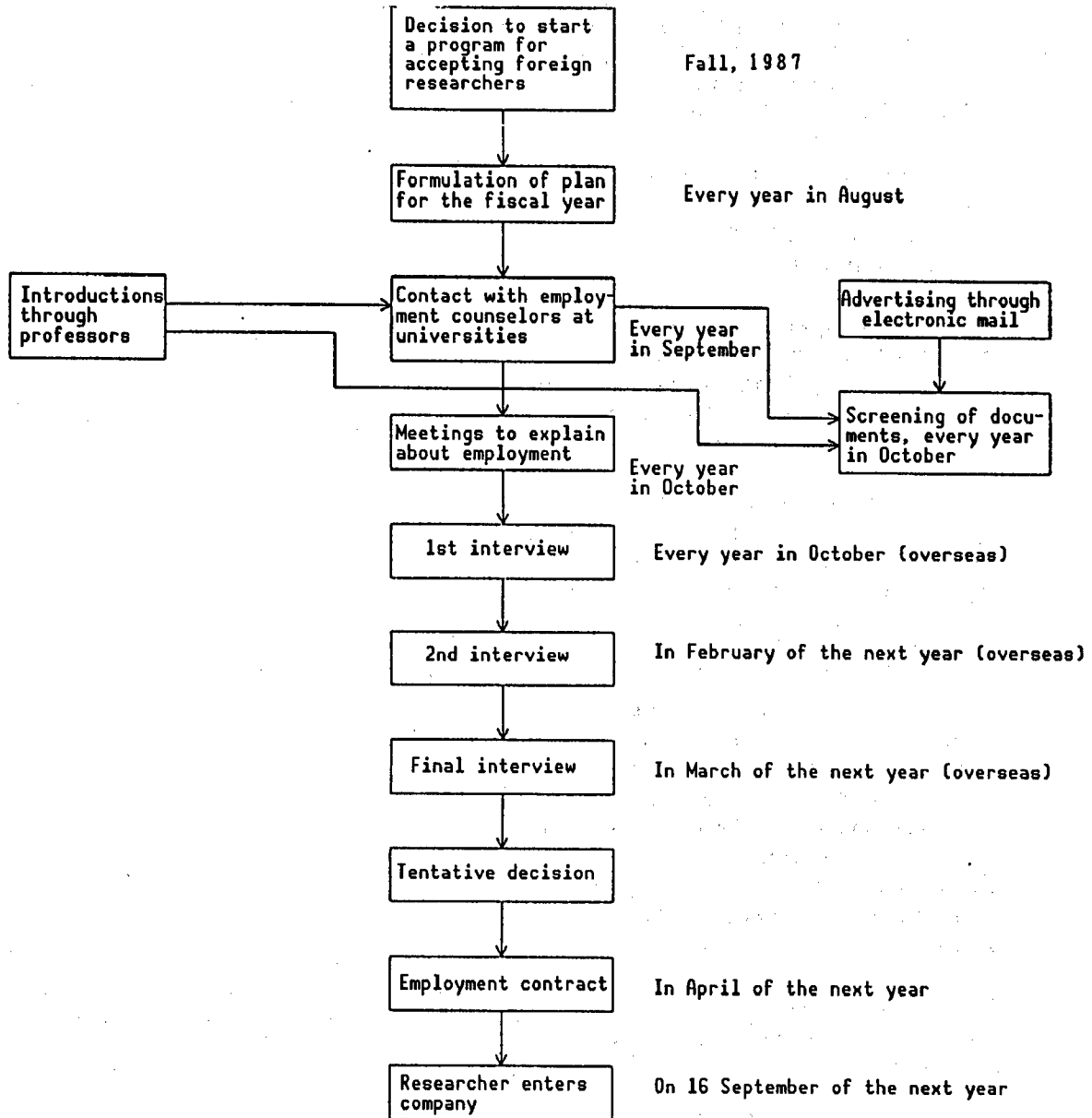


Figure III-3.1 Example of Procedure for Accepting Foreign Researchers at Company H, an Electrical Machinery and Electronics Manufacturer

(Interview with Laboratory J, a computer and information processing laboratory)

(Current state of the company's research system and acceptance of foreign researchers)

Our laboratory has about 1,000 researchers. We send many researchers overseas, but we also accept foreign researchers on an almost equal basis. Although there is a system for accepting foreign researchers, employing foreign researchers is not done systematically or as part of our fiscal year planning. If the manager of a research department expresses a desire to bring in researchers from overseas and if such a desire is expressed by the research department, foreign researchers are received so as to answer that request. Consequently, the number of foreign researchers received every year varies a lot. In FY90 we accepted 14 foreign researchers; the yearly average is about 10 people. A foreign researcher's status is that of a one-year- contract employee.

(What the laboratory thinks about accepting foreign researchers)

If we consider the laboratory in its entirety, the objectives of accepting foreign researchers are the introduction of creativity, the synergistic effects resulting from contact with different cultures, and to have foreign researchers contribute to improving the laboratory's research.

We do not place any restrictions on the countries from which we accept researchers. We give preference to people whose results in their field of specialty are valued; university graduates and people with master's degrees are OK. The research manager of a department evaluates their research results. The research management department handles the overall coordination of the laboratory.

The advantages in accepting foreign researchers are that it is mutually beneficial to both the researcher and to the company, and it raises the level of the company.

The disadvantage is that sometimes incidental tasks increase because globalization is still in a mid-way stage of development in our laboratory.

As far as possible, foreign researchers are accepted in accordance with the wishes of research managers, and there is no set target for the number of foreign researchers accepted every year. To be more definite, we would like to have about 14-15 foreign researchers.

(Interview with Company K, an automobile manufacturer)

(Current state of the company's research system and acceptance of foreign researchers)

Automobile manufacturers usually have a research department and a development department. The research department focuses on researching the technological seeds for the future. The development department researches and develops product technologies for the next model and production technology.

Our company has about 620 researchers in the research department. We started accepting foreign researchers in 1987; we accept about four or five foreign researchers per year. The development department also began accepting foreign researchers in 1991.

(What the company thinks about accepting foreign researchers)

The reasons for accepting foreign researchers are to open up fields of technology that have not thrived in Japan; to activate our research efforts by introducing different ways of thinking; to have mutual exchange with subsidiary firms; and to make an international contribution by providing our company's research environment to others, whether they are affiliated with our company or not.

The majority of the foreign researchers we accept become employees.

We do not place any restrictions on the countries from which we accept researchers. Our criteria in selecting researchers are that they have advanced, specialized capabilities and have at least completed master's or doctorate courses.

The advantages in accepting foreign researchers are that they contribute to our company's technological growth; it forms a bigger pipe to the United States and Europe; it helps to broaden our research network; and it contributes to globalization within the company. Concretely, because communication is difficult, research managers get to practice organizing their ideas more clearly in order to accurately convey their intentions, and leaving behind documentation on each and every research plan, etc., becomes a habit.

There are disadvantages in that special measures must be devised with respect to salaries, benefits, etc., that are different for non-Japanese employees, and personnel management costs increase. However, that is a short-term problem that should be resolved in the future.

Also, because foreign researchers stay at our company for short periods of two to three years, the lack of continuity is somewhat of a concern.

Every spring we survey each department's personnel plans, then we recruit foreign researchers through our overseas corporations or through

the personal networks of the heads of research departments. We screen resumes and conduct interviews, but the interviews take place when department heads go on business trips overseas, or, the personnel managers of our overseas corporations handle the interviews. Consequently, the employment periods are not fixed. As for our future targets for accepting foreign researchers, we are aiming at about 10 foreign researchers.

(What the company would like the government to do)

We would like the government to get better training facilities and instructors for teaching foreign researchers about the Japanese language and Japanese lifestyle and culture. We would also like the government to simplify the procedures for changing the visas of foreign researchers who work for more than a year in Japan.

We now provide about one hour per week of Japanese-language training in the company, but improvements to that are now being studied. However, if more foreign researchers are accepted, there is a limit to what a single company can do.

With regard to housing, too, we get the foreign researchers to move into our dormitories for unmarried employees and the company apartments, but they are cramped quarters. Even if there is a bit more cost involved to meet the needs of foreign researchers, we are now preparing roomier housing that is better furnished.

(Interview with Company L, a shipbuilder and heavy machinery manufacturer)

(Current state of the company's research system and acceptance of foreign researchers)

Our company has about 200 researchers in the research department. At present, we do not accept foreign researchers. In addition, we do not send our researchers overseas for long periods of time.

(What the company thinks about accepting foreign researchers)

Our reasons for not accepting foreign researchers are that no strong need to do so is felt now in view of the scale of the company and its research, and that there is no system within the company for that. When the social consensus of foreign researchers is established and in-house systems and guidelines are set up, we would like to accept foreign researchers.

If we do start, accepting foreign researchers for work in two areas will be considered: to open up new fields, and to employ them in shipbuilding-related areas where foreign researchers can be effective in their work immediately.

As for the countries from which we would accept foreign researchers, in shipbuilding-related areas we would accept people from China and Korea who are graduates from Japanese universities; in new fields, Europe and the United States. As the criteria for selecting researchers, we would want career researchers who can be effective in their work immediately.

The advantage in accepting foreign researchers would be that the introduction of different cultures and ideas would activate our research departments. We think that foreign researchers have better ability than Japanese researchers to put their ideas together systematically.

(What the company would like the government to do)

We would like the government to help by setting up a center at which both foreign researchers who want to be accepted and companies who want to accept foreign researchers could register. In addition, we would like the government to set up organizations for providing minimum-level Japanese-language education, and to simplify the screening process in the visa procedures for people who aim to do research in Japan for two to three years.

### III-4 Perceptions of Japanese Research Seen in Overseas Surveys

We received 182 responses to our survey of researchers in the U.S. (researchers at universities, national laboratories, and corporate laboratories) in which we asked about their perceptions of research in Japan. Most of the returned questionnaires were from researchers affiliated with universities.

#### 1. Research Experiences of Researchers, etc.

(1) 72.5% of all the researchers who sent back valid responses were professors or assistant professors of universities and colleges; 40.7% were over 50 years of age and 43.8% were in their thirties. (See Figures III-4.1 and III-4.2.)

(2) Overall, many of the responses were from a fairly high level of researchers, in terms of both age and post. Thus, the point that these were responses from researchers who also have a great deal of research experience must be kept in mind.

In addition, 78.0% responded that they have done research overseas; 76 of those researchers (53.5%) answered that they have had the experience of doing research in Japan.

From the fact that the researchers who showed interest in this survey have such attributes, we can say that they were able to fully comprehend the content of the survey (Figures III-4.3 and III-4-4).

(3) As for the research fields of those who responded, many were working in basic research, which also relates to the fact that many responses came from university researchers.

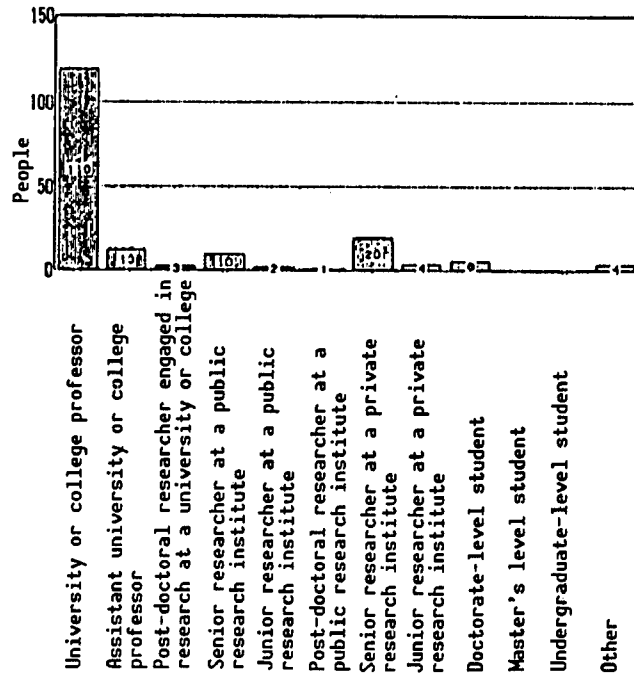


Figure III-4.1 Attributes of Respondees (N = 182)

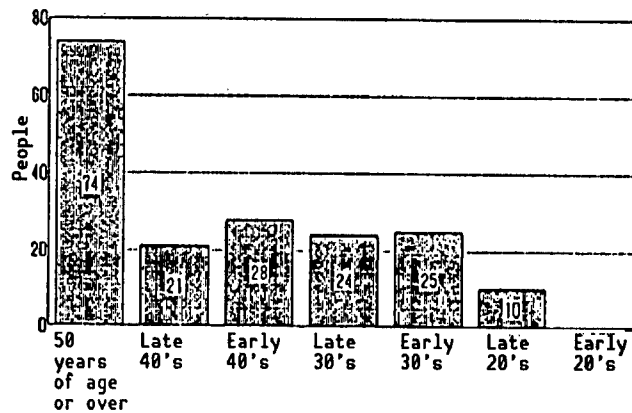


Figure III-4.2 Age Distribution of Respondees (N = 182)

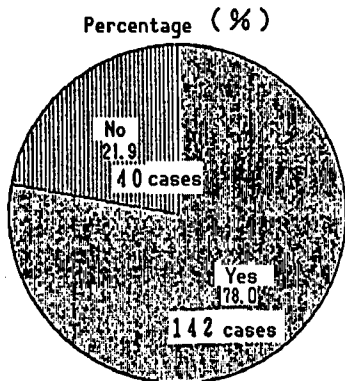


Figure III-4.3 Research Experience Overseas (N = 182)

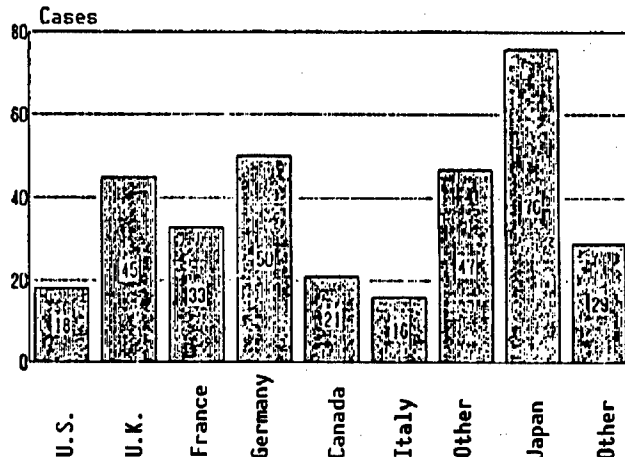


Figure III-4.4 Countries Where Researchers Had Overseas Research Experience (N = 142)

## 2. Research Fields and Perception of Japan's Research Level

(1) Overall, few researchers thought that research in Japan is at a high level

The areas in which Japan's research is thought to be superior are solid-state physics in connection with electronics, and robotics in connection with industrial robots. These responses reflect the fact that many of the researchers who responded work in basic research, and many are associated with universities.

(2) In regard to the U.S. government's criticism that asserts that "Japan enjoys a free ride in basic science research conducted by other countries," 37.9% of the researchers clearly disagreed: 52 researchers (28.6%) responded that "such criticism has only an emotional appeal," and 17 researchers (9.3%) said that they "totally disagree." If we add the other 71 researchers (39.0%) who expressed the opinion that "it depends on the area of research," the overwhelming majority of the researchers (76.9%) showed "level-headed opinions."

Incidentally, there were only six researchers (3.3%) who expressed a negative attitude and said that they "totally agree." (See Figure III-4.5.)

This reflects the attributes of the researchers who sent in valid responses, i.e., that many of the responses were from relatively mature researchers who had a rich variety of research experiences. If we look at the differences in opinions about "Japan getting a free ride in basic research" according to whether or not the researchers had research experience in Japan, a high percentage of those "with research experience in Japan" (76 people) said that "it depends on the area of research." In contrast, almost equal numbers of researchers "without research experience in Japan" (66 people) responded that "it depends on the area of research" and that "such criticism has only an emotional appeal." (See Figure III-4.6.)

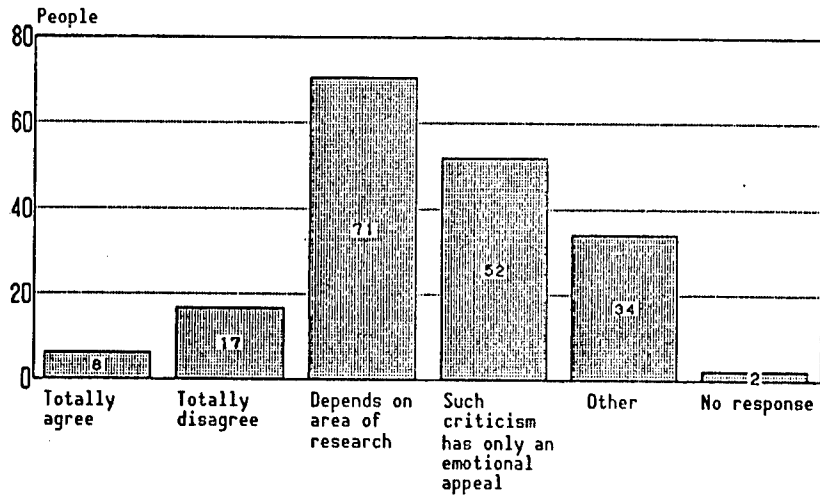


Figure III-4.5 Opinions About Japan Enjoying a Free Ride in Basic Research (N = 182)

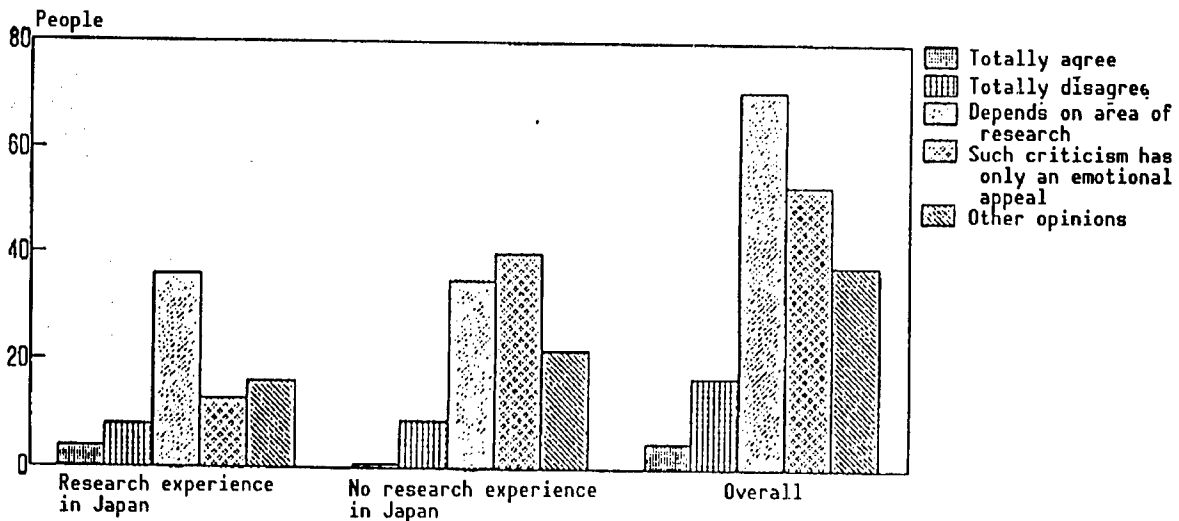


Figure III-4.6 Differences in Opinion About Japan Enjoying a Free Ride in Basic Research, Depending on Whether or Not Researcher Had Research Experience in Japan (N = 142)

If we compare this to the opinions about "Japan getting a free ride in basic research" seen in Section III-2 (Survey of Foreign Researchers' Research Experiences in Japan), the component ratios for the response items differ greatly.

(3) Interest in Japan was uniformly high (98.3%) among the researchers who responded to the survey. Of the 179 who responded that they are interested in Japan, if we exclude those who are interested in Japanese art and culture (67.0%), there was a high degree of interest in Japanese high technology (70.4%), the R&D structures of Japanese companies (56.4%), and Japanese industrial technology policy (36.9%). (see Figures III-4.7 and III-4.8.)

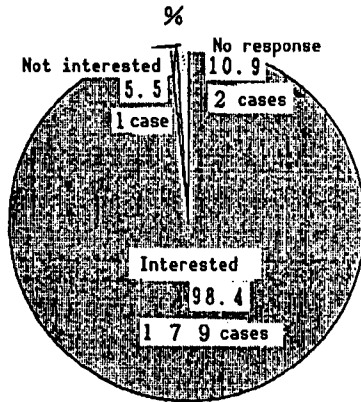


Figure III-4.7 Are U.S. Researchers Interested in Japan? (N = 182)

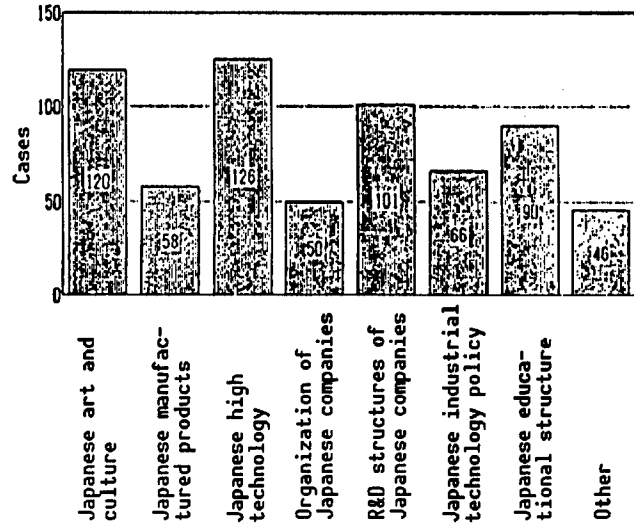


Figure III-4.8 Types of Interest in Japan (N = 179)

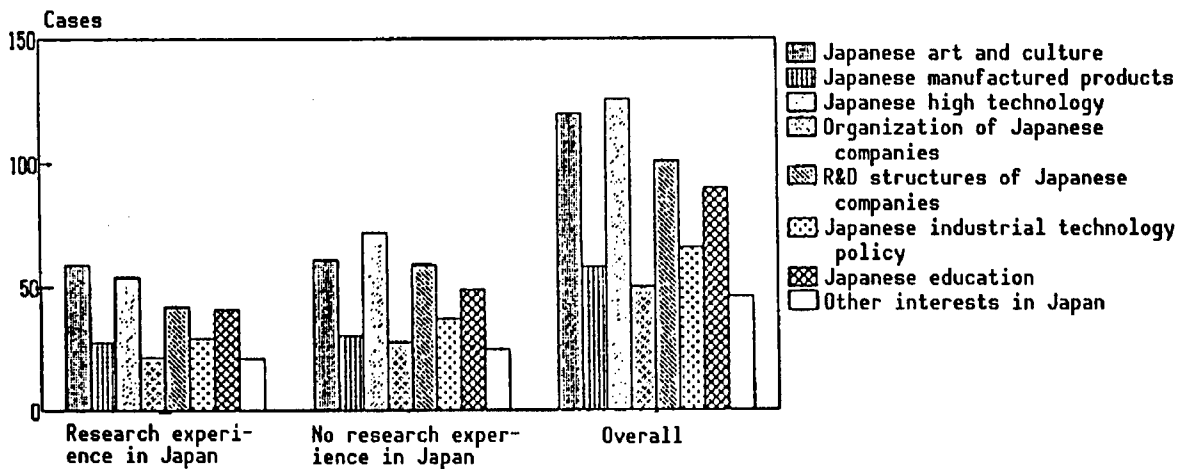


Figure III-4.9 Differences in Types of Interest in Japan (Depending on whether or not researcher had research experience in Japan)

(4) In addition, 84.0% of the researchers indicated interest in conducting research in Japan. (See Figure III-4.10.) Of those, 133 people (86.9%) indicated interest in conducting research at a public university or college; 121 (79.1%), at a national or public research institution; 67 (43.8%), at a research institution operated under a Japanese national project (multiple responses to the question were allowed). From this we can assume that there is a high degree of interest in research that concerns the Japanese government in some form or another. With regard to research at corporate laboratories, as well, 70 researchers (45.8%) indicated a high degree of interest. (See Figure III-4.11.)

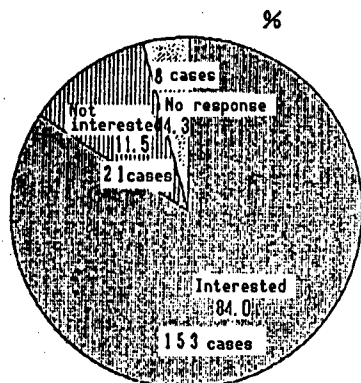


Figure III-4.10 Interest in Conducting Research in Japan (N = 182)

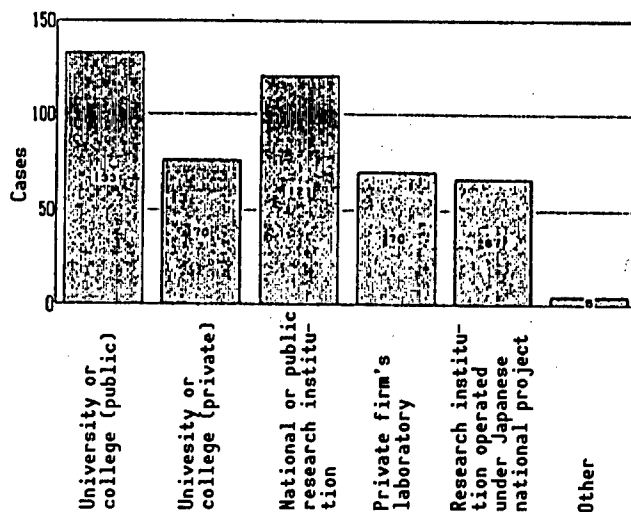


Figure III-4.11 Type of Japanese Institution Where Researchers Would Like To Conduct Research (N = 153)

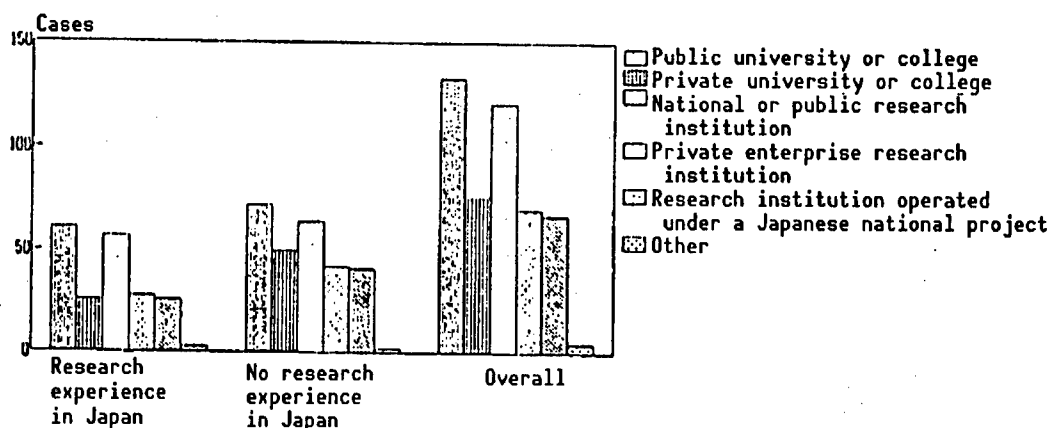


Figure III-4.12 Type of Japanese Institutions Where Researchers Would Like

To Conduct Research (Depending on whether or not researcher had research experience in Japan) (N = 153)

When we tried to compare the differences according to whether or not the researchers had research experience in Japan, as in the previous question, we found that among the researchers who had research experience in Japan, private and public universities and colleges were rated low, but national or public research institutions were very popular. In contrast, there were few differences among the researchers without research experience in Japan. The two types of researchers both showed interest in working at universities and national research institutions. This is thought to be due to the fact that many of those surveyed were university researchers.

### 3. Problems in Conducting Research in Japan

As in the results of the interviews with foreign researchers residing in Japan, many of the problems anticipated in living and working in Japan, e.g., "the high cost of living in Japan" (15.8%) and "language barriers with Japanese researchers" (14.1%), are not directly related to research.

A comparatively large number of researchers (10.3%) indicated concern about their spouse's ability to find work.

There were also many concerns about the availability of funds to cover research expenses (13.7%). (See Figure III-4.13.)

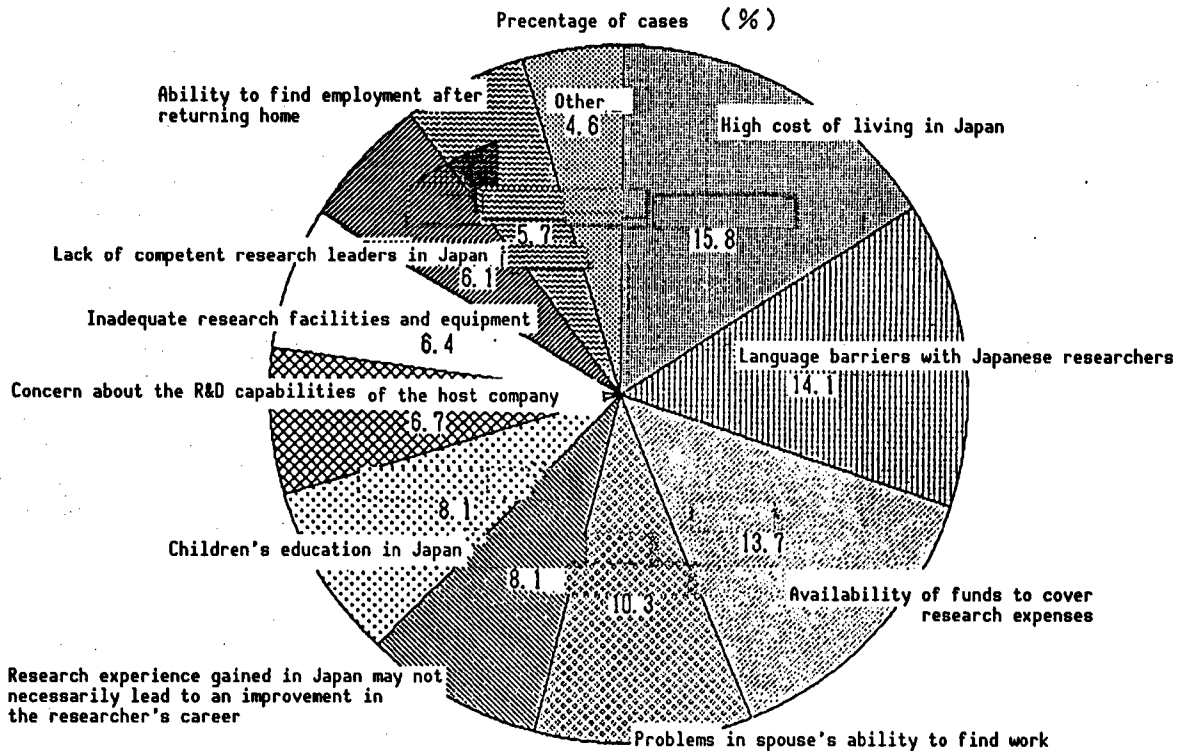


Figure III-4.13 Concerns If Researcher Were To Conduct Research in Japan

This is thought to be affected by the facts that there were a comparatively large number of responses from researchers who had showed an interest in conducting research at national or public research institutions, and that the responses were from researchers who are thought to be somewhat knowledgeable about circumstances surrounding Japanese R&D.

In addition, not that many differences due to research experience in Japan or marital status were seen in this survey. (See Figures III-4.14 and III-4.15.)

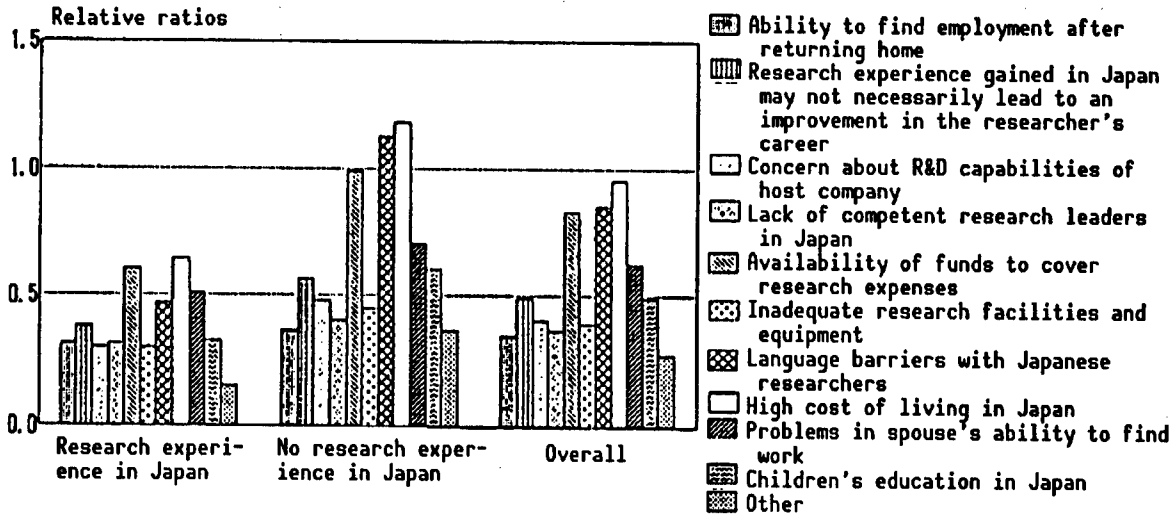


Figure III-4.14 Concerns If Researcher Were To Conduct Research in Japan (Depending on whether or not researcher had research experience in Japan)

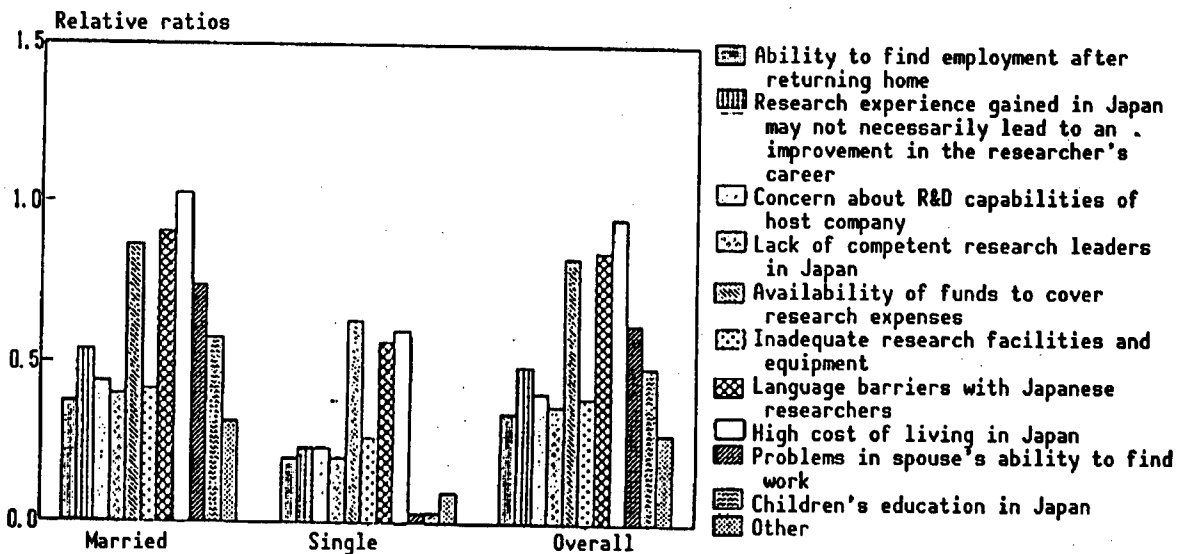


Figure III-4.15 Concerns If Researcher Were To Conduct Research in Japan (Depending on researcher's marital status)

### III-5 Interview Survey of American Researchers

#### 1. Summary of Survey Implementation

##### (1) Survey period

10 March 1992 (Tuesday)-18 March 1992 (Wednesday)

##### (2) Survey areas

Washington, New York, Princeton, Nashville

##### (3) Subjects of the survey

1) In the three areas other than Nashville, we selected interview subjects from the American researchers who responded to our questionnaire survey, giving consideration to attributes such as their post, age group, and whether or not they had research experience in Japan.

2) In Nashville, we interviewed researchers from Vanderbilt University, which is implementing the U.S. DOD's U.S.-Japan Program in Management of Technology.

##### (4) Content of interviews

We asked about the researchers's research experience at Japanese research organizations (universities, national laboratories, companies, etc.) and problems that become an impediment when researchers conduct research in Japan.

##### (5) How the interviews were carried out

We gathered the survey subjects together at interview places we set up in hotels and other such meeting places, gave presentations on the results of the questionnaire surveys in Japan, and then interviewed the researchers in groups.

##### (6) Survey dates, areas; attributes of the people interviewed

The dates on which we carried out the interviews and the attributes of the interviewees are shown in Table III-5.1.

#### 2. Results of the Interviews

The problems that become an impediment when researchers conduct research in Japan were clarified with the questionnaire and interview surveys in Japan, and those problems and concerns were also discussed in committees and working groups. However, what became clear from the interview surveys in the U.S. was which points should be stressed.

Table III-5.1 Survey dates and Attributes of the People Interviewed

Date	Area	No. of people interviewed	Attributes of people interviewed			
			Post	Age group	Research fields	Experience in Japan
11 March (Tuesday)	Washington	5	University (3) National laboratory (1) Firm (1)	Early 30's~50's	Math, solid-state physics, fiber optics, polymer chemistry	Yes 2 people No 3 people
12 March (Thursday)	New York	5	University (5)	Early 30's~50's	Metallurgical engineering, communications, chemical engineering, civil engineering, resources engineering (geology)	Yes 1 person No 4 people
13 March (Friday)	Princeton (Princeton University)	4	University (4)	Late 20's~early 40's	Computer architecture, chemical engineering, plasma physics	No 4 people
16 March (Monday)	Nashville (Vanderbilt University)	3	University (3)	Late 20'~early 30's	Robotics, computer software, robot vision	No 3 people
Total		17				Yes 3 people No 14 people

The ideas brought up in the interviews are discussed separately below.

(1) About the functions of a clearinghouse

Some points emphasized in the interviews were the functions of a clearinghouse for coordinating the needs foreign researchers' needs with the needs of hosting destinations (firms, universities, national laboratories).

Concrete proposals pertaining to such a clearinghouse were as follows:

- 1) It would provide information about both sides' needs in the form of a database.
- 2) It would provide consultation to applicants.

(Example: in the government and the local agencies of government-related organizations, there would be functions for providing various kinds of advice to researchers from the U.S. who want to conduct research in Japan.)

- 3) It would form a network through foreign researchers who have experience doing research in Japan, and a system would be in place for them to provide advice and consultation to researchers who have not had the experience of doing research in Japan.

4) The Humbolt [phonetic] Foundation is an example of how to make the functions of the clearinghouse more replete.

- a) It has functions for matching research themes.
- b) The foundation offers funding for foreign researchers' research in foreign countries.
- c) This function covers the entire world.
- d) Researchers who have had overseas experience because of the Humbolt Foundation periodically hold alumni meetings where they exchange information and deepen their friendships.

5) It would be a way to centralize existing information about researcher exchange inside and outside of the U.S.

(Example: it would provide information so that researchers can understand the contents and relevancy of the AIST Fellowship, STA Fellowship, the Japan Society for the Promotion of Science, the NSF MIT-Japan Eagle Program, etc.)

6) In that, it would be nice to have volunteers from private foundations.

There is a fear that information would not be disseminated if there were partiality toward some public office.

## (2) Better presentation of Japan's researcher invitation programs

Overall, Japan's researcher invitation programs are not adequately presented overseas. In these interviews, too, there were hardly any researchers who knew about the AIST Fellowship and the STA Fellowship.

Except for a Princeton University professor whose friend had by chance used the Hitachi Research Visit Program (HIVIPS), few researchers were strongly aware of the existence of the system and had only heard about it. Overall, there is a lack of PR.

Some relevant proposals were:

1) By all means, posters that draw people's attention, like the one for the MIT-Japan Program, should be posted.

Efforts should be put into better publicity: distributing posters to the major universities overseas, and displaying the posters in places where academic society meetings are held.

2) Prospectuses advertising researcher exchange should be more detailed, and they should be published in the academic journals typically read by people in the field of research.

(JOURNAL OF THE AMERICAN PHYSICS SOCIETY, PHYS-REV. PHYSICS TODAY, JOURNAL OF THE AMERICAN CHEMICAL SOCIETY, IEEE journals, etc.)

(Example: Advertising in Scientific American and Nature is not enough. Those publications are not read much by specialized researchers.)

3) Publicity should be expanded by displaying posters when scholars and researchers assemble for international conferences, trade shows, and so forth, and by distributing recruitment leaflets.

4) Posters, pamphlets, leaflets, etc., should be distributed to places where international conferences related to Japan's S&T are held (e.g., the JICST-sponsored conference in the United States).

5) Where applicants can make inquiries should be clarified, and more consultation should be provided for questions (e.g., better consultation should be provided at the overseas offices of organizations that handle researcher exchange matters.)

6) Carefully thought out methods should be found for presenting articles about foreign researchers' research experiences in Japan to the organizations to which the researchers belong and other nearby research institutes.

7) Vanderbilt University, which has the U.S.-Japan Program, and other such organizations should be used as bases for promoting researcher exchange with Japan.

8) E-mail should be used for publicity. Japan is late in using electronic mail. An E-mail network will have to be set up.

### (3) In connection with facilitating PR about Japan itself

To Americans, Japan is further away than any of the EC countries, and many Americans do not know much about Japan.

Researchers who have not had research experience in Japan are highly interested in Japanese culture and arts, whereas researchers who have had research experience in Japan show a strong interest in Japan's high tech, the Japanese government's industrial technology policies, and the research structure of Japanese companies.

Accordingly, increasing the opportunities for foreign researchers to get to know Japan is an important issue that was pointed out long ago.

Proposals related to this issue include:

1) Setting up overseas package tours for students (i.e., students that will become researchers someday) so that they can observe Japan's research organizations (universities, national laboratories, companies).

2) Facilitating the acceptance of R&D personnel from foreign companies at Japanese companies (e.g., acceptance of foreign researchers that also carries with it the meaning of "returning the favor" for the many Japanese engineers that learned in U.S. firms 30 years ago)

#### (4) Maintenance of Systems for Receiving Foreign Researchers

Another point in addition to the functions of a clearinghouse that was emphasized in these interviews was the problem of maintaining the conditions for receiving foreign researchers.

##### 1) Maintenance of general conditions

a) Careful consideration of measures relating to foreign researchers' length of stay and housing in Japan

Careful consideration must be given for both researchers who come to Japan alone and researchers who come with their families.

b) Careful handling of medical insurance and medical care for foreigners (e.g., doctors and nurses who understand English) (e.g., eliminating difficulties in applying for medical insurance overseas).

(One example heard in the interviews was that of a researcher who submitted a claim to his insurance company for medical service he received in Japan, but the forms were in Japanese so the procedure took a long time.)

c) Shortening the time needed for acquiring a visa (e.g., creating an arrangement whereby the time needed for the Immigration Office's review can be shortened by means of a letter of recommendation from the host organization).

d) Creating a handbook for making daily life in Japan more convenient (e.g., a book that compiles information about conveniences and inconveniences actually encountered in foreign researchers' stays in Japan based on actual accounts. Not just a how-to book, but a cleverly thoughtout handbook).

Cf., there already is a handbook for researchers who come to the 16 AIST laboratories.

e) Utilizing the ranks of the wise older researchers who are rich in experience (e.g., relying on older researchers who have done research in Japan as consultants, and getting them involved in advising young researchers about research and life in Japan.)

##### 2) Maintaining conditions for receiving senior researchers

Unlike post-doctorate-, doctorate-, and master's-level researchers, senior researchers with a wife and children find the biggest bottleneck in doing research and living in Japan is family problems. Generally, foreign researchers who stay overseas for a long period of time bring their families with them, so continuing their previous lifestyle patterns is important.

If senior researchers with families, and not just young researchers, are to be received in Japan, maintaining conditions for that is inevitably important.

Concrete problems in this regard include:

a) Securing work for the researcher's spouse (e.g., influence to help the researcher's spouse find work during the stay in Japan.)

b) Dealing with the problem of children's education. (Although no concrete proposals were heard, we got the impression that the problem of children's education during the researcher's stay in Japan is something of very great concern to researchers.)

3) Maintaining conditions for preparations before researchers come to Japan Maintenance of the conditions described in 1) and 2) above are problems after a foreign researcher comes to Japan, but various assistance measures in the preparation time before the foreign researcher comes to Japan are also important.

These are measures for minimizing the culture shock of the foreign researcher and his family after they come to Japan.

Some proposals in this regard were:

a) A handbook for making living in Japan more convenient. The contents would include:

i) basic Japanese for day-to-day living; ii) customs in Japanese living, especially the differences with Western customs; iii) the cost of living in Japan; iv) how to use public transportation in Japan, etc.

b) An expressive textbook of basic Japanese. There are few good textbooks in the United States for learning the Japanese language. Those that are available are said to be difficult.

There is a very strong demand for easy-to-understand Japanese-language textbooks.

c) Video programs for learning Japanese. Video programs are a shortcut in learning Japanese; there is a strong demand for easy-to-understand Japanese-language educational videos as well as for textbooks.

#### **(5) Problems Relating to Applied Research and Development Research**

Foreign researchers are often accepted for work in departments where basic research is conducted (especially in firms). Accepting researchers in the applied research and development research departments further downstream is difficult because those departments are involved with company secrets.

One of the proposals in this category was:

Collaboration with post-competitive researchers (e.g., exchange among directors of the world's corporate laboratories) (e.g., compiling the personal stories from 40 key people in the R&D sections of Japanese industry about their post-war R&D successes and failures)

(6) Other Ideas (At Random)

1) There is a need to create laboratories that will be perceived by foreign researchers as leading to improvements in their careers.

That is, the formation of so-called centers of excellence.

2) At present, the caliber of researcher under whom a foreign researcher works is a more important factor in his future career advancement than the caliber of university, laboratory, or company with which he is affiliated.

3) The researchers who have done research in Japan tend to be clearly divided into two types: those who say that research work in Japan was a good experience, and those who say that it was terrible. In all probability, that is due to the researchers' way of coping with his surroundings more so than direct discontent with the receiving arrangements. By taking more care in their systems for receiving foreign researchers, Japanese research organizations can move toward reducing the number of researchers who say that they had a terrible experience in Japan.

4) We heard many comments about the inadequacy of E-mail networks in Japan and the frustration that American researchers feel when they cannot freely exchange mail.

5) From a senior researcher with a family who has a home in the U.S. we heard the comment, "When I thought about my own lifetime plan, going to Japan and interrupting all that I have accumulated thus far does not necessarily seem like such a good choice."

For example, family life is hampered in various ways, and when a researcher who owns a home relocates overseas, he worries about his home while he is gone. The value in the experience of working at a Japanese research institution is not enough.

6) The opinion of a researcher in the field of computer architecture was, "Japanese universities and national laboratories are not attracted to joint research. Japanese firms, though, value joint research. That is, because of the excellent hardware that Japanese firms have, my ideas will be realized."

7) A researcher from Dupont made a clear distinction between the terms "basic research" and "fundamental research." He thinks that Japanese

companies have the perception that their research is not basic research in scientific fields, but is fundamental research that is as mission-oriented as possible. In that sense, he uses the term "fundamental research."

8) The impression we got from these interviews was that whenever research exchange was mentioned the American researchers thought that "researcher" meant a post-doctorate or higher-level researcher, and that it is odd that doctorate- and master's-level researchers, let alone students, are treated as researchers.

(Notes)

1) In the opinions about the presentation of the results of our survey in Japan, we heard that the argument about the researcher-sending-receiving ratio is not an important matter.

2) When talking about accepting or receiving researchers in English, "receive" is a more appropriate word than "accept."

#### IV. Summary

##### IV-1 Basic Line of Thinking

Based on the results of the surveys discussed above, the "Society for Studies Toward New Developments in Researcher Exchange" has been studying ways to expand the acceptance of foreign researchers in Japan. Japan should make the kind of international contribution that corresponds to its position in the international economy and community. Accepting foreign researchers is one way to do that.

To summarize the proposals of the Society for Studies Toward New Developments in Researcher Exchange, we will present the point of view for expanding researcher exchange, especially expanding the acceptance of foreign researchers in Japan. This point of view is based on the following "basic line of thinking" that was incorporated into the government policy objectives in the opening paragraphs of this report.

(Basic line of thinking toward new developments in research exchange)

(1) That which is perceived as the biggest issue in Japan's industrial technology R&D is Japan's initiative in taking on the challenge of a "technological revolution that will support the 21st century." It is now a time for Japan to vigorously promote international contributions that make the most of the process, results, and spillover effects of that technological revolution.

(2) In the front line of basic research fields in Japan today, there is a rapid surge in the growing "closeness and resonance between science and technology." In those R&D fields, "contact with different concepts and experiences" is inevitable in the activation of research in the natural sciences.

(3) Hosting foreign researchers is an important tool for making international contributions involving S&T. Now that international contributions that match Japan's national strength has become an urgent issue, expanding the acceptance of foreign researchers in national laboratories as well as in private firms is critical in Japan's fulfillment of its obligations.

(4) Investments in enterprises for accepting foreign researchers are regarded as a very important way to achieve international influence during the 1990s.

##### IV-2 Line of Thinking for Expanding the Acceptance of Foreign Researchers

In recent years, basic research and applied research are not regarded as distinct categories in scientific and technical R&D areas.

This "closeness and resonance between science and technology," which is more strikingly apparent in advanced, intensely activated R&D fields, will be seen increasing more from now on.

In this surge in the "closeness and resonance between science and technology," if researchers working in advanced, intensely activated R&D fields come into "contact with different concepts and experiences," that will have an immeasurable impact on the direction and content of their research.

From the surveys we conducted, there are indications that in some firms awareness of the importance of researcher exchange is becoming real.

And, a nation's ability to attract excellent young scientists indicates the height of that nation's S&T activity. That also holds for individual research organizations.

There is an urgent need for Japan, as a "scientifically and technologically advanced nation" whose current prosperity results from S&T developments, to positively open up some of its research environment to foreign researchers and to fulfil an active role in the advancement of the international community. In order to be more confident about the aforementioned awareness that is appearing in Japan's research environment and the trend in companies' behavior, we must actively implement the lines of thinking and policies discussed in the following section, "Expectations of Industry and Government."

And, given the strong demands for Japan's "international contributions," actively promoting the acceptance of foreign researchers is the road that Japan should take. It will significantly affect the activation of R&D, even at the level of individual companies, and it is also an effective way to deepen mutual understanding

**(Expectations of industry and government)**

1. Industry should positively understand the merits in accepting foreign researchers: that it is a very important and effective tool in Japan's fulfillment of its obligations to the international community, and that it introduces different cultures, concepts, and experiences into industry's research environments. Industry should utilize that tool for expanding and activating its research activities.

For example, as seen thus far, many foreign researchers who now conduct research in national laboratories would like to conduct research at a private Japanese research organization if they get the chance. An effective method to assist them would be for the research organizations of private firms to accept foreign researchers as visiting researchers and give them the opportunity to work on research lasting one to two years; the researchers would be selected from a list of foreign researchers who have worked at national laboratories. In addition, publicity about companies' programs for accepting foreign researchers should be promoted.

2. The government is expected to put effort into making the national laboratories and university laboratories more replete so that foreign researchers find the level of research and the research environment attractive, and to concentrate effort on maintaining a basic environment for expanding the acceptance of foreign researchers.

In addition, the government should formulate policies that would be built into companies' economic activities; by bringing out the energy from the government's contact detonation with the tendency of private firms to actively engage in researcher exchange, researcher exchange in the natural sciences should take root as a more definite trend.

In these surveys, many items expected from the government were pointed out, and it became clear that there is a strong need to maintain the environment for accepting foreign researchers.

In that regard, implementing on a priority basis policies for developing model organizations that can become bases in Japan for accepting foreign researchers and bases to which the major advanced countries can send researchers, and setting up a clearinghouse organization are also thought to be effective methods. The government should also actively disclose information in response to private firms' requests for the aforementioned lists of researchers.

Furthermore, an urgent problem that we heard about from people both inside and outside of Japan is the need for simplifying immigration screening in the sending and receiving of foreign researchers. In connection with that problem, measures must be adopted so that the immigration screening can be eliminated for people whose status as a researcher has been verified by proper authorities.

3. As shown in these surveys, in the industrial sector there are some firms that maintain programs for accepting foreign researchers. (See Reference Materials 7.)

On the other hand, in other advanced countries there are also public organizations that focus their sights on sending researchers to Japanese research institutes.

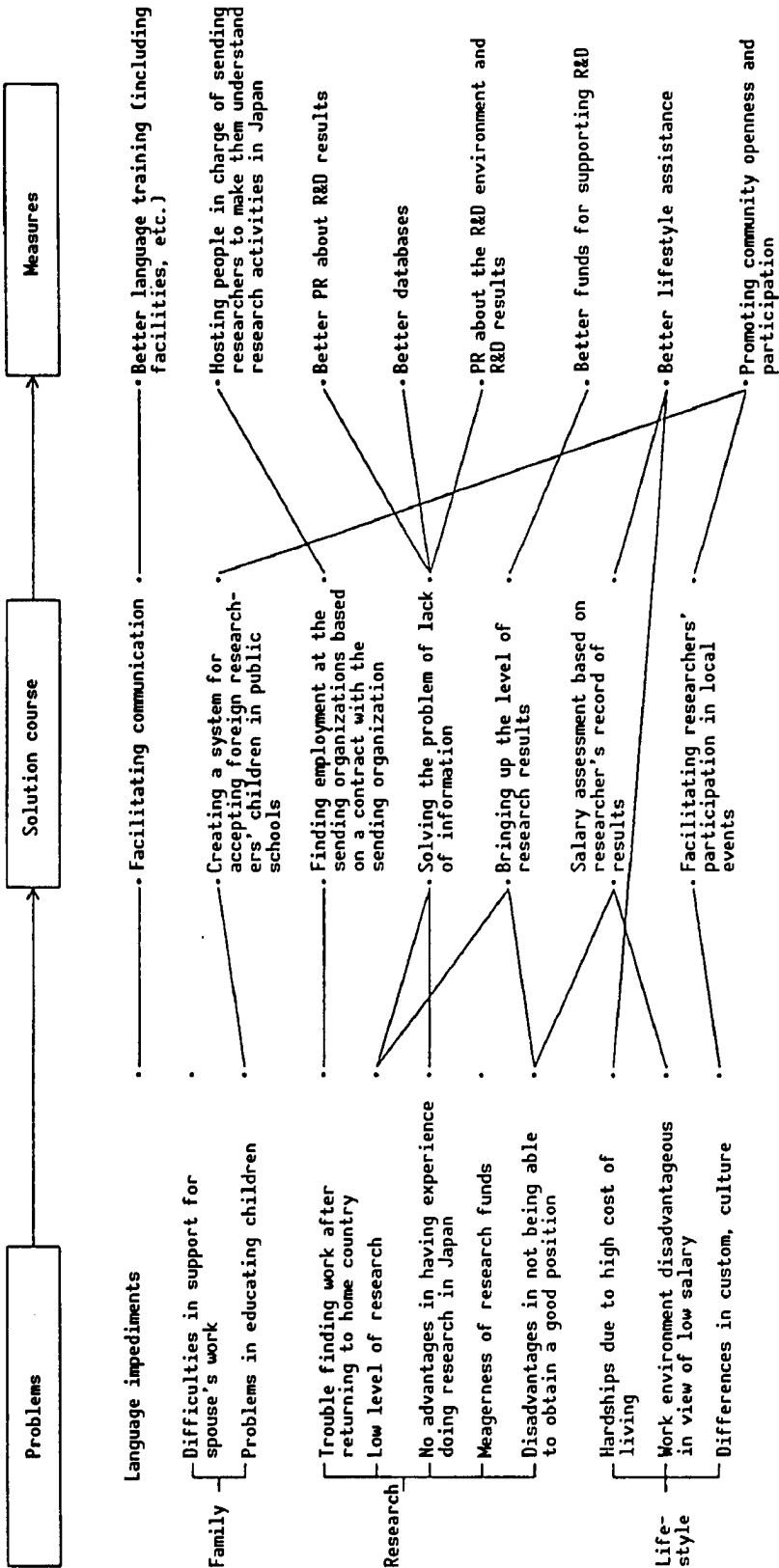
For example, in the United States there are programs such as the NSF Japan Program and the U.S.-Japan Program in Management Technology that is in place at MIT, Wisconsin University, and Vanderbilt University; in the United Kingdom, the British Engineer Japan Training System of the Department of Trade and Industry; and in France, the France-Japan Industrial Technology Committee (a forum committee).

In Japanese industry, government, and university laboratories, the government's positive influence to push for tie-ups with such programs of other countries, and the incorporation of those functions in an invitational system, would be the way to receive the maximum benefit from expanding researcher invitations to the laboratories.

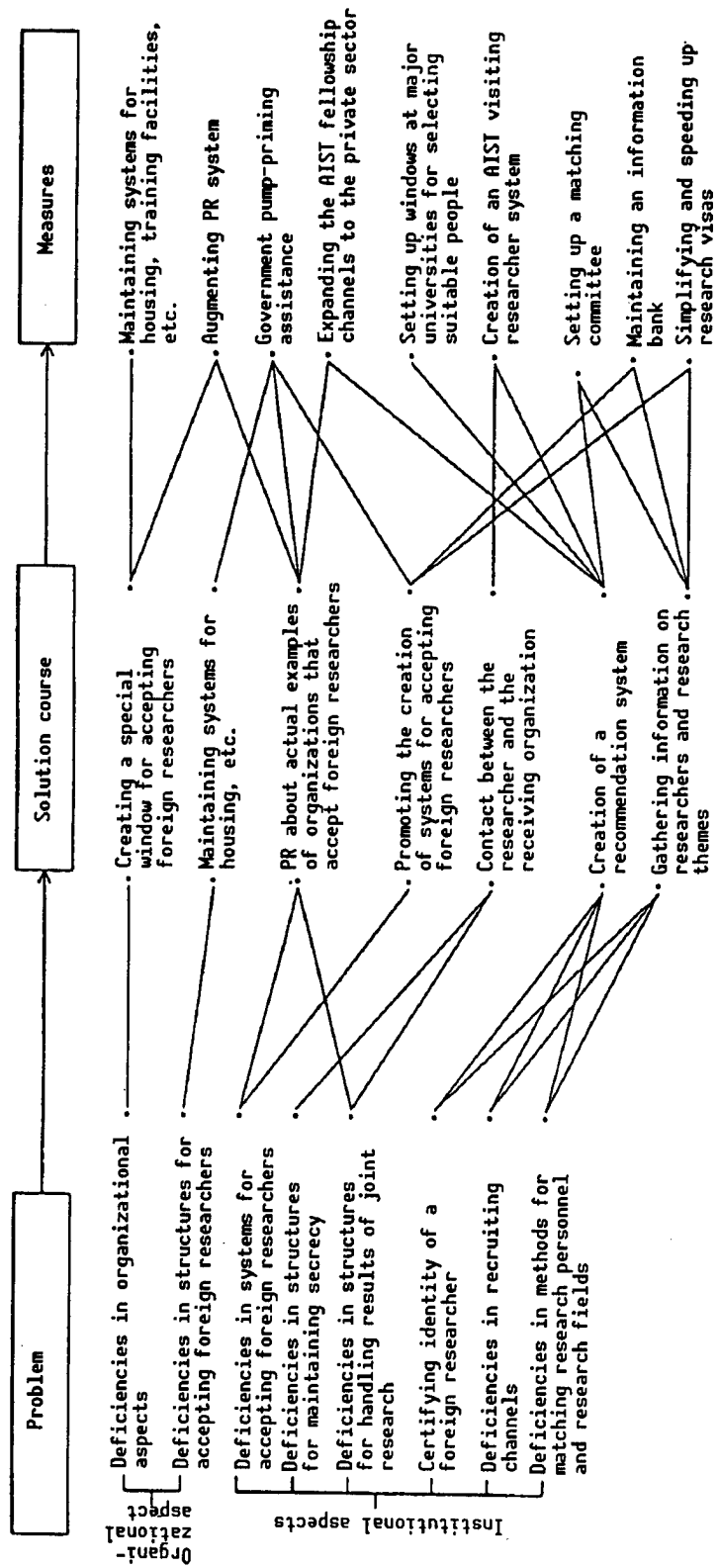
We add the following diagrams to summarize the line of thinking about the problems that were brought out in these surveys and measures for coping with those problems.

(Note) Concrete proposals about facilitating researcher exchange were received in a letter from Dr. Hinder, a member of the Society for Studies Toward New Developments in Researcher Exchange. (See Reference Materials 9.)

Problems in Promoting Laboratories' Acceptance of Foreign Researchers, and Measures That Should Be Considered



Problems in Promoting Laboratories' Acceptance of Foreign Researchers, and Measures That Should Be Considered



## Reference Materials

1. Current State of International Research Exchange at AIST
2. Summary of "Survey of Satisfaction with Hosting Conditions," the subjects of which were researchers residing in Japan, taken from the Survey of International Research Exchange
3. Summary of the U.S. National Science Foundation's survey, "Japanese Research Institutes that Accept U.S. Researchers"
4. Records of Personnel Exchange between Europe and the U.S., and Japanese National Laboratories (1989)
5. Tone of Comments on Researcher Exchange Seen in Existing Documents
6. Survey to Gather Information on Researcher Exchange Systems Relating to International Research Exchange (excerpts)
7. Publicized Researcher Invitation Systems of Private Firms (Hitachi HIVIPS, NEC, NTT)
8. Examples: U.S. National Science Foundation's Japan Program, the British Department of Trade and Industry's British Engineer Japan Training System, the France-Japan Industrial Technology Committee
9. Proposals from Dr. Hinder of the British Embassy
10. Actual Numbers of People Sent and Received (summary tables)
11. Questionnaire Forms
  - (1) Survey of the Actual State of Researcher Dispatching and Hosting (Survey A)
  - (2) Survey of Foreign Researcher Hosting (Survey B)
  - (3) Survey of Japan-Resident Foreign Researchers' Research Experiences in Japan (Survey C)
  - (4) Survey of Foreign Researchers' Perception of Japanese Research (U.S.) (Survey D)

Reference Materials 1

Current State of International Research Exchange at AIST --Summary of FY89 and FY90 "Survey of International Research Exchange"

1. Current state of international research exchange activities, and assessments

(1) International research exchange activities, based on the premise of accepting foreign researchers at the 16 AIST laboratories, have been going on since FY88.

\* Changes in numbers of researchers received from advanced countries:

FY88 14 names	FY90 15 names	FY91 19 names
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\*\* All expenses relating to living and conducting research in Japan were covered. Average costs of accepting one researcher (yearly, in 1,000's of yen):

• Round-trip airfare	300 x 2	=	600	}	5,585	}	6,185
• Living expenses	9 x 365 days	=	3,285				
• Housing allowance	100 x 12 months	=	1,200				
• Moving fees	200 x 2	=	400				
• Travel expenses for trips within Japan			100				
• Family allowance	50 x 12 months	=	600				

\*\*\* Researchers accepted from industry, government, or universities.

FY90 examples:

University	Government lab	Private firm	Total
12 names	5 names	2 names	19 names

(2) Activities to support international research exchange have been going on since FY89

- 1) Japanese-language training: training in basic conversation needed for living in Japan
- 2) Providing housing: renting privately owned living quarters, leasing furniture, etc.
- 3) Japanese social and cultural studies: courses to deepen understanding of Japan's history, culture, economy, etc.
- 4) Observation of industrial conditions: field trips to see Japan's industry, culture, etc.

- 5) Promoting human exchange: promoting exchange among foreign researchers and laboratory employees
- 6) Lifestyle advice: in response to troubles, doubts, etc., relating to living in Japan, consultation for the purpose of facilitating research activities.

(3) These efforts contribute significantly to a balanced expansion in the researcher exchange at AIST laboratories.

Summary of "Survey of Satisfaction with Hosting Conditions," the subjects of which were researchers residing in Japan, taken from the Survey of International Research Exchange

(1) Summary of "Survey of International Research Exchange Promotion"

The "Survey of International Research Exchange Promotion" has been implemented since FY89 with the aim of improving efforts to accept foreign researchers. The main survey results thus far are as follows.

1) Survey of "Satisfaction with Hosting Conditions," the subjects of which were researchers residing in Japan (carried out in August and December 1990)

a) The majority of the researchers were satisfied with the living and research conditions

"Enjoying a lifestyle like that of a prince living in a castle"

b) Accepting foreign researchers contributes to an increased understanding of Japan's R&D system

"I was able to get a glimpse of the secrets behind Japan's efficient R&D system, which is not understood in my home country."

"There is no wonder that my colleagues who have not done research in Japan misunderstand Japan."

c) The researchers are unanimous in wanting more quantitative expansion of hosting activities

"The results of openly recruiting many researchers and giving them the same kind of experience as we have had would be outstanding."

"I felt very lucky, like I won the lottery, to be selected for research in Japan."

"After this stay is over, I would like to come back to Japan to continue more research, but in the present frame I cannot help but be pessimistic. I would definitely like to see radical expansion in Japan's acceptance of foreign researchers."

d) Big hopes about access to private laboratories

"I would like to see the system expanded so that foreign researchers are accepted at private laboratories, and not just the AIST laboratories."

"With my status as a visiting researcher at an AIST laboratory, I have been met with kindness by private laboratories. I do not think there are any intrinsic barriers, so it would be great if the acceptance of foreign researchers were expanded to private laboratories."

e) A few demands for improvements to the system "I would like to continue research for another year, but because it is difficult in principle, I am disappointed. Somehow or another I would like to continue research."

"Frankly speaking, the librarian system is bad. In addition to my handicap of not being able to read Japanese, accessing documents, data, and information is difficult for that reason."

2) Survey of what researchers want from the organizations responsible for sending them to Japan

a) Quantitative expansion (b) Expansion of programs to include private laboratories as hosting organizations

"Several of Japan's centers of excellence are private laboratories. Accepting foreign researchers at those laboratories would be the most highly valued contribution from Japan." (U.S. NSF)

"The private sector defrays 80% of Japan's R&D expenditures. Therefore, making the private sector actively accept foreign researchers is essential to international cooperation from now on." (U.S. NSF)

"This undertaking is an excellent system, but the numbers are too small. If the numbers were to be increased, there would be a nonlinear, dramatic increase in results. The recruitment and selection of researchers to be sent could also be done more systematically." (British Department of Trade and Industry)

"I heard that the budget for this enterprise is ¥200 million of MITI's ¥250-billion budget for R&D. Simply raising that from 0.08% to 0.2% would bring about excellent results. It is odd that prudent MITI does not make such a policy choice." (British Department of Trade and Industry)

"In the U.K. we have created a system for sending researchers to private laboratories in Japan. By all means, the acceptance of foreign researchers at Japan's private laboratories should be encouraged, e.g., by combining our system with the AIST acceptance program. By doing so, the world's view of Japan would suddenly change." (British Department of Trade and Industry)

"In France there is strong interest in fellowships at Japanese private firms. If the AIST program were to include the acceptance of foreign researchers at private laboratories, the value in utilizing the program would increase dramatically." (French Nuclear Energy Committee, Compiègne University of Industry and Science)

3) What is needed from Japanese private firms in researcher exchange

a) Given the globalization of markets and the tendency toward "closeness and resonance between science and technology" in promoting industrial technology R&D, a rapid rise in the trend toward researcher exchange at the level of private firms.

b) More activated efforts at the company level and at the industrial structural level (e.g., Hitachi HIVIPS, Japan International Science and Technology Exchange Center, Research and Industry Association)

Survey of "Japanese Research Institutes that Accept U.S. Researchers" (NSF 1985, 1990)

1. 1985 Survey

Questionnaires were sent to 305 private companies that have 30 or more researchers and are listed in the "National Register of Test Research Organizations"; 252 companies responded.

1) 42 companies responded that they "now (the time of the questionnaire) accept foreign researchers" (includes 19 companies that accept researchers through JICA).

2) 150 companies responded that they "would like to accept foreign researchers now (the time of the questionnaire) or in the future."

3) 123 companies responded that "Americans would be fine in the case of 2)" ("would like to accept foreign researchers now, in the future").

4) 81 companies gave the following kinds of answers in response to the question, "What kind of advice would you give to the government about facilitating the acceptance of foreign researchers?"

- a) About the desire for subsidies (airfare, living expenses, housing expenses, etc.) (35 responses)
- b) About establishing/promoting policies for accepting foreign researchers (22 responses)
- c) About supplying information on foreign researchers that are to be accepted (11 companies)
- d) About Japanese-language education when a company accepts foreign researchers (6 responses)
- e) About simplifying visa procedures (5 responses)
- f) About treatment of research results and maintaining secrecy (5 responses)
- g) About promoting the acceptance of foreign researchers at universities and public organizations (4 responses)
- h) About taxes (tax exemptions) relating to accepting foreign researchers (3 responses)
- i) Other advice (7 responses)

(Because there were multiple responses, the total number of responses is more than 81.)

2. 1990 Survey (questionnaires sent to 553 private companies that have 30 or more researchers and are listed in the "National Register of Test Research Organizations")

Of the 284 companies that responded, 154 companies said that they "would like to accept foreign researchers."

## Records of Personnel Exchange between Europe and the U.S., and Japanese National Laboratories (1989)

Type of record	Category	Total for U.S., Europe	Remarks
Records of personnel exchange according to Immigration Statistics	Exits Entries Entries/ exits	106,903 10,026 0.094	The periods of stay of those entering Japan were 3 months or more
Records of personnel exchange in national laboratories (excluding MOE laboratories)	Sent Received Received/ sent	1,592 310 0.195	Both long-term and short-term stays considered for counting numbers of people entering Japan. Of the 310 people received, 119 people were technical engineers (28 long-term, 91 short-term)
Records of personnel exchange in laboratories under the umbrella of AIST	Sent Received Received/ sent	39 35 0.897	Those entering Japan stayed long-term (6 months or more)
Records of personnel exchange in laboratories under the umbrella of the STA	Sent Received Received/ sent	7 16 2.29	Those entering Japan stayed long-term (6 months or more)

- (Notes) 1. Of the 130 people that were STA fellows in 1989, 90 people went to advanced countries.
2. The Ministry of Education does not publicize its records of personnel exchange.
3. The totals for the number of people sent from Japan are for those traveling overseas for academic research studies, studies at universities, and technical training, including the social sciences and language studies.
4. The totals for the number of people accepted in Japan are for those who come to Japan for study at universities, training, activities as a professor, artistic and academic activities, or to provide advanced technology.
5. "Advanced countries" means the 16 nations that are members of the OECD Development Assistance Committee: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Holland, New Zealand, Norway, Sweden, Switzerland, the United Kingdom, and the United States.

Trends in Researcher Exchange between AIST Research Institutes and Advanced Countries (1985-1989)

		1985	1986	1987	1988	1989
Total (4 countries)	Sent	28	42	39	37	36
	Accepted	3	5	8	14	28
	Accepted/sent	0.11	0.12	0.21	0.38	0.78
United States	Sent	19	31	25	23	29
	Accepted	1	2	0	5	10
United Kingdom	Sent	4	4	5	3	1
	Accepted	0	0	2	3	5
France	Sent	2	1	0	2	3
	Accepted	2	2	5	5	6
West Germany	Sent	3	6	9	9	3
	Accepted	0	1	1	2	7

Note: Exchange of researchers with a duration of more than 6 months of stay.

**Tone of Comments on Researcher Exchange Seen in Existing Documents**

**Trends and Topics in Industrial Technology (October 1988, MITI)--The challenge of initiating a "technological revolution that will support the 21st century," and international contributions**

**Section 2. Current State of International Exchange**

**3. Researcher Exchange**

- Only about 15% of the foreign researchers accepted in Japan are from the U.S. and European countries. (The accepted/sent ratios are 0.14 for the United States, 0.26 for the United Kingdom, 0.16 for France, and 0.14 for West Germany.)
- Researchers from the U.S. and European countries have had a strong perception of Japan as not being a place for interesting research.
- In addition to the problem of Japan's peculiar language and customs, a big impediment is that Japan lags behind the United States and Europe in its standards of housing and other such lifestyle-related support.

**(Supplementary) Records of Researcher Exchange**

Records of personnel exchange based on the "Annual Report of Immigration Statistics"

Records of personnel exchange in AIST laboratories

**Section 3. Trends and Topics in Japan's Industrial Technology**

**(2) Further Promotion of International Exchange and International Cooperation**

- Taking the initiative in promoting joint international projects that focus on the key technologies common to all of mankind, as seen in the Human Frontier Science Program, and cooperating with other countries that make the same kind of efforts
- Strong promotion of industrial cooperation and Japan's experience in transferring the results of scientific and technological R&D to the industrial sector

**Trade and Industrial Policy Vision in the 90s (July 1990, MITI)--Building Human Values in the Global Age--**

**Part 2. Itemized Discussion**

**Section 1. Contributions to International Society and Promotion of Self Reform**

**3. Improving Japan's Transparency and Increasing Mutual International Exchange**

**10. Promotion of Technopolises**

- Augmenting information transmission functions and promoting international exchange - Actively assisting, even as the government, in matters relating to private economic groups' promotion of international exchange

- Promoting broader exchange between businessmen and foreign students in Japan

- Each nation's efforts to cooperate for the purpose of invigorating creative activities and distribution/ transfer activities at the international level.

- Japan must redouble its efforts for promoting S&T, based on a global point of view befitting a large economic nation with advanced technologies.

- Appropriately dealing with that which impedes distribution and transfer.

- New advancements in S&T are born out of encounters among people with different cultures and different concepts.

- Advancements in S&T will be critically endangered by situations in which S&T distribution and transfer are limited.

**12. Cooperation Among Advanced Countries**

- Conducting studies on measures for utilizing the Japan-EC Industrial Cooperation Center and other such organizations for facilitating exchange at the industrial level.

**Section 3. Ensuring the Base for Long-Term Economic Development**

**3. Promotion of S&T and Informationalization**

- The introduction of a system for sabbatical researchers who want to go abroad or who study abroad for long periods of time should be studied.

**Industrial S&T Vision in the 90s (August 1990, MITI AIST)--Intellectual Challenge Toward an Abundant, Livable World--**

**Section 2. Technoglobalism From a Global Perspective**

**Paragraph 2. Promoting Technoglobalism**

1. Worldwide S&T Creation Activities
2. Promoting Worldwide S&T Distribution and Transfer

**(1) Promoting S&T exchange among advanced countries**

- Facilitating S&T exchange among advanced countries
- Information exchange, researcher exchange, and so forth are carried out under frameworks for periodic exchange, e.g., bilateral S&T cooperative accords and industrial cooperative councils, but those are only symbolic efforts to promote friendship and mutual understanding with other countries.
- International symposiums, workshops, etc., should be actively sponsored in Japan from the standpoint of providing places for information exchange.

**Section 3. Promoting R&D in which Science and Technology are Balanced**

**Paragraph 2. Promoting Creative Basic R&D**

1. Establishing Bases for Basic Research and Exchange By Means of Industry, Government, and University Tie-ups

- The importance of fierce competition among researchers that will enable scientific and technological innovation; qualitatively high-level contact with different cultures, characteristics, concepts
- Promoting international exchange: accepting foreign researchers, implementing international joint research, etc.
- Accepting a suitable number of foreign research personnel, including research managers

**2. The Role of National Laboratories**

**(2) Further promotion of research exchange within and outside of Japan**

- Various measures for activating research exchange within and outside of Japan have been promoted (research exchange systems for fluid research, joint research, international research exchange, etc., have been set up), but those measures, particularly international research exchange, should be expanded, and studies should be done on systems in which concentrated joint research can be carried out in various dimensions (e.g., among national laboratories that work in different fields; among industry, government, and universities; and internationally).

#### 4. Activating Basic Research in the Private Sector

- In some large firms, a trend toward actively promoting basic research is evident (e.g., appropriating a fixed portion of R&D outlays for basic research).
- Basic research in the public sector as well as in the private sector, which supports the foundation of Japan's R&D, must be actively promoted in order to raise the overall potential of Japan's basic research; the time has come where more effort is expected from private firms.
- In the United States, various research foundations make significant contributions to raising the overall level of basic research in the United States. In Japan, too, the government should assist in the establishment of foundations that carry out basic research and encourage young scientists' research through large-scale grants.

Report of Survey Committee on Trends and Topics in New Industrial Technology  
(May 1991, Japan Society for the Promotion of the Machine Industry's Economic  
Research Institute and the Japan System Development Research Institute  
(non-profit corporations))

"The Advance of Globalization, and Industrial Technology" International  
Exchange, Joint International Research, etc.

- Japan's researcher exchange with other countries, and mainly the U.S. and European countries, is still in a state of imbalanced.
- The greatest factor that gives rise to that imbalance is the structural differences between Japan, and the U.S. and European countries: whereas most basic research in the United States and Europe is conducted at universities and is published internationally, the research in Japan's universities is relatively meager. In addition, a considerable portion of Japan's basic research that is seen by the United States and Europe as having value is conducted by private firms.
- Furthermore, the poorness of the housing situation in Japan and other such conditions for accepting foreign researchers also become an obstacle when American and European researchers come to Japan.
- From now on, striving for quantitative expansion in international exchange will be essential. In view of the indications that private firms are starting to get involved on their own in international research exchange, mustering the power of the private sector in research exchange is a big issue.

Wisdom of U.S. S&T Diplomacy

(The Pulse of Japanese Engineers, 1989, pp 214-216, Nihon Keizai Shimbun)

- On the basis of this report (the Young Report), the United States has made strong claims against Japan--the argument that Japan is getting a free ride in basic research, symmetrical access to researchers and information, and so forth.
- E. Block, director of the National Science Foundation, said, "Both information and researcher exchange are not equal. Japan used the basic research results of other countries as capital for its economic development."
- Democratic Senator J. Rockefeller pointed out, "Japan only sends researchers. It is unreasonable that Japan does not accept U.S. researchers." The Dole-Rockefeller legislation that came into existence in 1985 applied pressure to disallow the acceptance of Japanese researchers at U.S. national laboratories.

S&T and the U.S. Economy, U.S. Presidential Economic Report (abridged translation)

(S&T and the U.S. Economy, 265, March 1989, pp 78-79, STA Research Division's abridged translation)

- The U.S. government plans to provide information about R&D opportunities overseas, increase funding for international research, and expand foreign-language education and training. Those efforts will bring profit to the United States because American researchers will further utilize the continually improving S&T capabilities of other countries.
- Foreign students play a significant role in education at U.S. graduate schools
- In 1987, 30% of the people who obtained doctorate degrees in the physical sciences and engineering were foreigners (21% in 1978); 65% of those who obtained doctorate degrees in engineering were foreigners. Two-thirds of those were students from Asia; the higher-level education system of the United States has become a place for the cultivation of international talent.

R&D Issues Viewed Historically (Makoto Kikuike, director and head of Sony's central research laboratory)

(Technology and Economics, 265, April 1989, pp 23-26)

- At that time there were deep, warm feelings toward the United States, which acted toward Japan as an elder friend. That is why I feel like returning the favor, somehow or another.
- Pressured for symmetrical access
- A set of questions from the NSF were distributed through the U.S. embassy to the laboratories of 305 firms. In response to the question, "Is your laboratory accepting foreign researchers?" 16% answered that foreign researchers "are already working here," and 60% said that they "are ready to accept foreign researchers."
- In response to the question, "What kinds of research do you do—basic, applied, or development research?" 67% said "basic research," 92% said "applied research," and 94% said "development research." Americans seemed surprised at those answers.
- Because the category that Americans call "basic research" is often considered more academic and university-oriented than what Japan calls "basic research," it has been said that some people did not believe that 67% of the laboratories do basic research.
- The American view was: "U.S. universities open their doors to anyone. And, in tie-ups with firms they conduct precompetitive (the stage before competing with other firms) basic research. The firms donate a

considerable amount of money to support that research. Many foreign students from Japanese firms now go to those kinds of universities. But, if you think about it, those students get a peek at the basic research of technologies that U.S. firms support because they may use those technologies in the future. On the other hand, there is nothing that corresponds to that in Japanese universities. Isn't that unfair? We would like to see some changes so that there can be more symmetrical access."

- "The United States makes its universities open. If there is no such counterpart in Japanese universities, Japanese firms should open their doors."

- "That is the same as a situation where, if the room is warm, I take my jacket off, so you take your pants off. Removing one's jacket does not mean the same thing as removing one's pants. Thinking of universities and firms in the same way and interchanging the conditions worries me."

**New Advancement in R&D in the Age of Globalization (T. Nitta, director and head of Matsushita Electric Industrial Co.'s Central Research Laboratory)  
(Technology and Economics, 268, June 1989, pp 45-46)**

- Joint research and the acceptance of foreign researchers as international exchange of people are necessary.

- We set up a system for sending young company personnel to the key departments of top-class American universities, such as the University of Illinois, MIT, and Stanford, based on our company's overseas study system; we also set up a system for accepting guest researchers from overseas. At present, researchers from the United States and Europe are now conducting research at our laboratory.

**Exploratory Basic Research (Kenichi Mori, assistant director of Toshiba's General Planning Section)  
(Technology and Economics, 270, August 1989, pp 76-77)**

- Although private laboratories are involved in exchange, exchange with other countries' laboratories must also be more vigorous. In the beginning, there were various gaps such as language problems and lifestyle problems at Toshiba's laboratory, so we worried. But, the fear is worse than the danger. The very first time we were surprised because it was so difficult to get visas.

- Twenty years ago, inviting foreign researchers to Toshiba's laboratory was proposed for the first time. At that time, there was no consensus yet in Japan about employing foreign workers for the purpose of research. Although there were several examples of foreign engineers coming to Japan to teach workers how to use the new technologies being introduced at the time, there were concerns about what the output would be if foreigners were to do research work. Because there did not seem to be any precedents, it was a lot of trouble until the visas came through.

**Report of Results of a "Questionnaire Survey on R&D Policies"**  
(Economic Data, No. 356, December 1989, Keidanren)

**II-2 About Private Firms' International Contributions in R&D**

- As for maintaining the environment [for accepting foreign researchers], in addition to securing housing, giving consideration to children's education, and writing manuals in foreign languages to explain regulations, there are calls for including foreigners in social insurance programs.
- As for easing regulations and simplifying and speeding up procedures, there are calls for easing COCOM regulations and simplifying the procedures involved, and simplifying and speeding up the visa acquisition procedures for foreign researchers (which may take 4-5 months, depending on the researcher's country).
- As for making the system more replete and adding new facilities, there are calls for a better public invitation system for accepting researchers from advanced countries, setting guidelines on jurisdiction over research results, and setting guidelines so that a researcher's research achievements in Japan can be assessed after he returns to his home country.

**Proposals Based on Results of the Technology Development Globalization System Inquiry Commission**

(Technology and Economics, 278, April 1989, p 101)

(12th investigation, from end of October to first half of November 1989)

(Head of the commission: Hiroichi Kobayashi, chairman of the S&T and Economics Association (a corporation))

- Striving for international cooperation not only economically but also in aspects of technology, culture, and lifestyle
- Let's promote Japan's basic research and put more effort into bringing forth results.
- Mutual cooperation in further activation of university research and in the basic research of private firms

**R&D Globalization (September 1990, S&T and Economics Association)**

**Technology Management Council, Special Committee on R&D Globalization)**

- Despite having reached the stage where nations should be making the most effective use of their R&D resources, i.e., human talent, as seen in Japan's lag in "globalization within," the present situation is such that a revolution in the consciousness of all firms is just getting underway. The revolution in consciousness is because of the general strategy, as a nation or as a company, that is aimed at global developments. 1. The need for a basic doctrine that is directed toward the globalization of R&D activities

- Open-type globalization within Japan
- Short-term contract employees and guests are the mainstream. - Long-term, regular employees are mainly foreigners who were hired directly after graduating from a Japanese university. - Globalization efforts tend to be concentrated in comparatively eminent companies. - Short-term-contract type and guest-type - It is not yet the time to make assessments. - The degree of foreign researchers' satisfaction is generally high.

## Part I. Globalization of R&D Activities

### Section 1. Current State of and Problems in R&D Globalization

- Of the foreign researchers accepted in Japan, 84.5% are from developing countries, and they account for 50% of the foreign researchers accepted by private firms. The acceptance of foreign researchers, which is still limited to some private firms, continues to gain attention.
- Given the facts that Japan still receives an overwhelmingly smaller number of researchers from advanced countries than it sends, and that most of the researchers Japan sends go to universities, in this time of increasing friction with other countries, R&D globalization viewed from the aspect of researcher exchange is an issue that private firms must increasingly deal with from now on.

### Section 3. Views on How Laboratories Grow Overseas

- Every year many researchers from Japanese firms are sent to the United States and Europe for "studies abroad" or for work as a "visiting research associate."
- Japan receives far fewer researchers from those countries.
- This has become a very important issue as the problems of technology disputes and cooperation between Japan and the United States and Europe become more real.
- The number of people Japan sends to the United States and Europe is about six times the number of people it receives from those countries.
- More than 95% of the foreign researchers in Japan are satisfied with their stay here.
- This increase in the number of foreign visitors to Japan's laboratories is also important in globalizing research within Japan (both the content of the research and the infrastructure, i.e., environment and management).
- Taking the basic stance of actively promoting research cooperation with foreign researchers is critical

• Measures for coping with the problems in inviting foreign researchers:

• 1) Housing: Without insisting on "company housing," listening to the researchers about their situations, and carefully coping. To a certain extent, some "assistance" may have to be provided.

• 2) Language: Basically, English is good (especially in connection with work), but Japanese-language proficiency is very helpful in forming good relationships with Japanese people.

• 3) Research environment: The research environment in Japan, e.g., computers, workstations, and networks, is inferior in comparison with that in the eminent universities and laboratories in the United States. That significantly lowers the research efficiency of researchers.

• 4) Differences in perception: Inevitably, differences in "perception" occur between Japanese researchers and foreign researchers. The most suitable measures for thoroughly understanding and coping with those differences is critical.

• 5) Salary and perks: Special treatment just because a researcher is from another country is not necessary. However, that is necessary for outstanding, distinguished researchers.

• 6) Possession of intellectual property rights and results: Depending on whether a foreign researcher is treated as a company employee, is simply accepted as a long-term dispatcher, or is treated as a trainee, there are fundamental differences in his ownership of intellectual property rights and results. At any rate, that point must be clearly noted in a contract.

• 7) Early establishment of human relations: Although this is not necessarily limited to foreign researchers, building a relationship of basic trust "as human beings" early on through communication appears to be the greatest factor in success.

**Part II. Current State of R&D Globalization in Japanese Firms, From a Humanistic Viewpoint**

• Japan's acceptance of foreign researchers in R&D fields is still not very big in terms of numbers. The realities are that the majority of foreign researchers in Japan are employed as short-term contract employees or guest researchers and are put in previously determined jobs for durations that were decided upon beforehand. Japanese firms have a strong perception that R&D globalization essentially means that there should be more foreign researchers employed as regular employees in the future.

• At the actual sites, the phenomenon of "being flooded with foreigners" occurs because there are usually no objectives or preparations. If only expectations could be satisfied. Instead, the situation ends up producing negative effects.

• The realities are that, instead of having a specific objective and subjectively searching for people, Japanese firms employ apparently suitable foreigners whom they select from the foreigners who passively land at the firms' doorsteps by chance.

- At the firms that have gained worldwide acclaim for their technology, foreigners take part in R&D. But, few foreigners take part in R&D at firms whose technological value has not yet been determined.

#### Technopolitics (M. Uchida, Nikkan Kogyo Shimbun Co.)

- There is a huge imbalance in the research exchange between Japan and the United States
- There has come to be great concern about the one-way flow of scientific and technical ideas between Japan and the United States now that Japan has become a major power.
- Every year 16,000 Japanese scientists and engineers visit the United States, but only 2,000 American scientists and engineers come to Japan.
- "The Acceptance of foreigners at Japanese universities and government laboratories may help to improve the situation, but that will not completely solve the imbalance."
- "What the United States would like to receive from Japan in payback is to be able to make the best use of Japan's applied research."
- "Researchers from Japan's biotechnology firms conduct research at the NIG [as published], so American researchers should also be able to conduct research at Japan's biotechnology firms."
- In comparison with the openness of R&D in the United States, Japan's R&D, which mainly takes place in the private sector, is not necessarily open. As a result, an imbalance forms in researcher exchange and the mutual use of information. That is perceived as being linked to Japan's predominance in high-tech trade.
- The participation of American researchers in Japan's research activities, including those in private firms, and access to Japan's information must be facilitated.

#### Technical Cooperation--as the Requisite for Competitive Partnerships (Harold Brown)

- In Japan, the best laboratories are in private firms. Those kinds of laboratories conduct most of Japan's applied research. Recently, those laboratories' share in Japan's basic research is growing. Such a difference makes it difficult to realize symmetrical access in both types of R&D activities.
- Japan should heighten that accumulation of knowledge, and it should make contributions that match its R&D resources, high level of education, and scientific and technological capabilities.

**The Interchange of Researchers and Engineers Between Japan and Other Countries  
A Study Based on the "Annual Report of Immigration Statistics," "Statistics on  
Foreigners Staying in Japan," and "Annual Report of Statistics on Japanese  
Nationals Overseas"**

(March 1991, Akio Nishimoto and Hajime Nagahama of the Second Policy-Oriented  
Research Group, National Institute of Science and Technology Policy (NISTEP),  
Science and Technology Agency)

- Both the sending of Japanese researchers and engineers overseas and the receiving of researchers and engineers from other countries started rapidly increasing after 1985.
- The increase in the sending of researchers and engineers from Japan is a force that surpasses the receiving of researchers and engineers from other countries
- Looking at the changes in the exchange ratio (sending/receiving), the exchange ratio for advanced countries was 8.41 over the past five years and 5.93 over the 15 years before 1985.
- The rise in the exchange ratio for advanced countries is particularly noticeable. The criticism of Japan from the advanced countries, primarily the U.S, is thought to be related to this rise in the exchange ratio.
- Looking at the numbers of Japanese researchers residing overseas according to the country, 23,159 Japanese researchers stayed in the United States (54.5% of the total number staying overseas), accounting for more than half. That is followed by the United Kingdom, with 4,761 people (11.2%), and France, with 3,990 people (9.4%).
- Looking at the numbers of foreign researchers residing in Japan according to the country of their origin, China (including Taiwan) had 19,533 people in Japan (47.5% of all the foreign researchers and engineers staying in Japan), thus accounting for almost half. Next come Korea, with 7,166 people (17.4%), and Thailand, with 2,330 people (5.7%).
- Looking at the numbers of Japanese researchers staying in other countries, 38,657 people (91.0% of the total number residing overseas) stayed in advanced countries.
- Looking at the numbers of foreign researchers and engineers residing in Japan, ... there were 4,284 people (10.4%) from advanced countries. ... Thus, 90% of Japanese researchers and engineers overseas stay in advanced countries, and 90% of the foreign researchers and engineers in Japan come from developing countries.
- 76.4% of the researchers sent overseas from Japan in 1989 went to advanced countries.

- 12.2% of the foreign researchers and engineers received in Japan were from advanced countries.
- The countries to which Japan sends the most researchers are those from which it receives the most researchers and engineers. Of the advanced countries, the United States is overwhelmingly Japan's most vigorous exchange partner, accounting for more than half of Japan's total exchange (both sending and receiving) with advanced countries.
- Four out of every five Japanese researchers and engineers that are sent overseas go to advanced countries.
- Four out of every five foreign researchers and engineers received in Japan are from developing countries.
- The exchange ratio for advanced countries is the highest (7.16). ... The exchange ratio for North America is the highest (7.23)....
- In the exchange of researchers and engineers there is a strong tendency for the sending countries' researchers and engineers to gain knowledge and technical skills from the receiving countries through education and guidance.
- In comparison to the number of researchers and engineers sent to foreign countries for the purpose of acquiring knowledge and technical skills, there are few researchers and engineers sent to foreign countries for the purpose of offering knowledge and technical skills by means of "Teaching Activities" and "Offering Advanced Technology." That trend has been intensifying lately.
- This situation should not be viewed as a sudden increase in the number of Japanese researchers and engineers sent to foreign countries, but should be seen as a decline in the number of foreign researchers and engineers received in Japan.
- Japan should provide attractive research environments, while at the same time it should seek to get other countries interested in Japan and deepen their understanding of Japan.
- Japan must shift its center of gravity in the direction toward offering advanced countries our results.
- (The statistical data of the Ministry of Justice and the Ministry of Foreign Affairs)...is inadequate for adding detailed analyses of human interchange in specific areas, such as the exchange of researchers and engineers.

Survey to Gather Information on Researcher Exchange Systems Relating to International Research Exchange (excerpts)

2.2 Results of Questionnaire Survey in Japan

2.2.1 Distribution, Collection of Questionnaire Forms

As shown in Table 2.2.1-1, questionnaires were sent to about 400 organizations selected from the government and municipal agencies and groups in Japan, and TSE Section 1 and 2 firms. 120 questionnaires were returned, which was a recovery rate of 28%. The usual recovery rate for questionnaire surveys averages between 25-30%, so this survey is considered to be quite a success.

2.2.2 Content of Survey, Results of Analysis

(1) International Researcher Exchange Systems

As shown in Table 2.2.2-2, about 60% of the organizations that gave valid responses have some sort of system in place for international researcher exchange. About 42% of those systems are for accepting foreign researchers; 13.9%, for employing foreign researchers; and 43.5%, for sending Japanese researchers overseas. About 60% of the private firms surveyed, and about 50% of the universities, laboratories, etc., have some sort of exchange system. The time periods for sending and receiving are generally six months or longer.

As seen in Table 2.2.2-3, which shows the comments from the organizations that do not have researcher exchange systems, some organizations are involved in international researcher exchange even if they do not have a formal system.

(2) Records of International Researcher Exchange Systems Thus Far

The records of exchange over the past few years of firms, research support groups, etc., that answered that they do have an "exchange system" are shown in Table 2.2.2-4. From these results we see that in the past private firms tended to "receive fewer foreign researchers and send more Japanese researchers overseas" than other organizations. In addition, about half of the private firms' "receiving" is in the form of employment.

(3) Future Plans for International Researcher Exchange Systems

Table 2.2.2-5 shows information about the future plans of private firms and other organizations that have "exchange systems." From these results we can see that in private firms there is a positive trend toward expanding programs for accepting foreign researchers. Still, however, there tend to be twice as many plans for employing foreign researchers than there are for accepting foreign researchers

In many organizations, the framework for accepting foreign researchers is under study; expansion of that framework is thought to be possible if some sort of measures are implemented. At any rate, early realization of existing programs is essential.

Table 2.2.2-1 Recovery of Questionnaires

Where questionnaires were sent	Number distributed	Number recovered	Recovery rate
TSE Section 1 and 2 firms (laboratories, R&D sections)	291	59	21%
Research support groups (including private foundations)	44	15	34%
Municipal laboratories	16	12	75%
Special corporations, nonprofit corporations	72	29	40%
University laboratories and centers (national, public and private)	23	5	22%
Total	436	120	28%

Table 2.2.2-2 International Researcher Exchange Systems

	Valid re-sponses	No system in place	System in place	Number of systems			
				Receiving-related	Receiving	Employment	Sending
Private corporations	59	23	36	29	18	11	28
Research support groups (private foundations)	15	8	7	6	6	-	6
Municipal laboratories	12	8	4	4	4	-	6
Special or nonprofit corporations	29	14	15	18	14	4	7
University laboratories	5	2	3	4	4	-	3
Total	120	55	65	61	46	15	47

Table 2.2.2-3 Examples of Comments from Organizations That Have International Researcher Exchange Systems

Although we have no system in place, we have accepted a few foreign researchers	4 private firms, 1 nonprofit corporation, 2 research support groups
Although our system is not just for foreigners, we do have a system for inviting guest researchers (but we have not yet invited any foreigners)	1 public laboratory
Although we have no system in place, we do have a record of sending Japanese researchers (staff researchers, etc.) overseas	8 private firms, 2 research support groups

Table 2.2.2-4 Records of International Researcher Exchange Systems

	Receiving-related		Sent	Received/ sent <sup>1</sup>
	Received	Employed		
Private companies	494	249	1,165	0.42 (0.21)
Research support groups	818	818	674 <sup>2</sup>	1.21 (1.21)
Public laboratories	43	43	21 <sup>3</sup>	2.05 (2.05)
Special, nonprofit corporations	1,058	1,024	Unknown	-
University laboratories, etc.	240	240	Unknown	-
Total	2,653	2,374	-	-

- (Notes) 1) Includes some results from over more than the past few years.  
 2) The time periods are not all the same.  
 3) The time periods are not all the same.

Table 2.2.2-5 Plans for Future International Researcher Exchange Systems

	Receiving-related			Sending
		Receiving	Employment	
Private companies	Over 212	Over 70	Over 142	Over 114
Research support groups	38	38	-	Over 30
Public laboratories	Over 6	Over 6	-	Over 9
Special, nonprofit corporations	Over 268	Over 258	Over 10	Over 442
University laboratories, etc.	Uncertain	Uncertain	-	Uncertain
Total	Over 524	Over 372	Over 152	Over 595

Reference Materials 7  
Publicized Researcher Invitation Systems of Private Firms (Hitachi HIVIPS, NEC, NTT)

Company name	Sys-tem	Year estab-lished	Receiving organiza-tions	Subjects	Dura-tion of stay	No. of people invit-ed	Recruit-ment methods	Selection methods	Content of assis-tance (benefits)	Posi-tion	Remarks
Hitachi, Ltd.	HIVIPS	1984	Company's 10 labora-tories, primarily central labora-tory	Profes-sors, assis-tant profes-sors, doctor-ate level, master's level	1-2 yrs	About 25 peo-ple/year	No exten-sive recruitment program, but they distribute pamphlets whenever there is opportunity	Generally, by screen-ing resumes & interview-ing, but omitted interviews for those with recom-mendations	Living expenses for re-searcher and his fam-ily; housing expenses (for families who stay in Japan for at least 3/4's as long as re-searcher); expenses for transporting research-er's belongings; com-muting expenses; fur-nished company house leased; health and accident insurance	Visit-ing re-search-er	
NEC	No spe-cial name	--	Central labora-tory, etc.		1 yr, with a con-tract (re-lates to visa)	30-40 peo-ple/year			Salary higher than Japanese researchers, raises based on per-formance prior to con-tract renewal; housing in special dormitory for single foreign re-searcher; company housing for families; insurance and welfare, same as for Japanese workers	Short-term con-tract employ-ee	
NTT	No spe-cial name	1988		Post-doctor-ate level	1 or 2 yrs	Over 30 people (about 20 of which work at Basic Re-search Laboratory)	1) Cases where front line re-searcher directly solicited by foreign researcher or his professor 2) Cases where re-searchers recruited by adver-tisements	In second case, judgment cannot be made from research-er's resume alone and interview is set up	Housing provided in form of company apart-ments or rented apart-ments--for researcher and family, 2-bedroom apartment; for single researcher, 1-bedroom apartment; business trips to attend inter-national conferences, etc., approved for researchers who bring forth excellent results	Part-time employ-ee	Details about special treat-ment, place of work, contract period, etc. are covered in contract with re-searcher

## Hitachi HIVIPS

1. Researcher acceptance system
  - 1) Established in 1984
  - 2) Receiving organizations: The company's 10 laboratories, primarily the central laboratory
  - 3) Subjects: Professors, assistant professors, doctorate-level, master's-level
  - 4) Duration of stay: 1-2 years
  - 5) Number of people invited: About 25 people/year Thus far, over 150 graduates in all (of which about half are from North America and the rest from Europe)
  - 6) Recruitment methods: No extensive recruitment program, but pamphlets are distributed whenever there is an opportunity.
  - 7) Selection methods: Generally, by screening resumes and then interviewing, but interviews omitted for those with recommendations.
  - 8) Content of assistance (benefits):
    - Living expenses for researcher and his family;
    - Housing expenses (for families who stay in Japan for at least three-fourths as long as the researcher);
    - Expenses for transporting researcher's belongings;
    - Commuting expenses;
    - Furnished company house leased;
    - Health and accident insurance.

## 2. Results of accepting foreign researchers

- 1) An invasion of new ideas occurs when researchers with different, specialized experience and different cultural backgrounds enlighten each other.
- 2) There can be deeper international understanding and trust through exchange among experts and people of different cultures.
- 3) The foundation for further advancements based on mutual trust is solidified.
- 4) It has great significance in improving the infrastructure within the company and the laboratories.

3. When we extend invitations to foreign researchers, we sign a contract with the researcher or with the organization to which he belongs. We clarify the contents of the contract (e.g., salary, duration of stay, work content, housing, insurance, holidays, reversion and treatment of intellectual ownership rights after researcher returns to his home country).

4. The most troublesome consideration in inviting foreign researchers is the problem of housing.

Housing conditions are a very difficult problem. Even the smallest difference in attention to that problem will have a great effect on the researcher's existence.

5. Researchers are treated fairly, without making them feel any differences because of their nationality.

We decide upon the researcher's benefits according to this personal history, recommendations from professors, and evaluations from Japanese researchers and managers.

6. The acquisition of Japanese-language skills is very advantageous to the researcher's later career development.

7. Extreme measures in any matter are to be avoided.

#### NEC's System for Accepting Foreign Researchers

##### 1. Acceptance system

- 1) 30-40 people accepted every year
- 2) Duration of stay is one year, by contract (relates to visa)

##### 2. Objectives for coming to Japan

- 1) For research
- 2) For career development
- 3) Because the researcher is interested in Japan and wants to understand Japan better

##### 3. The need for equipping the research environment

- 1) Excellent research facilities and equipment are a big incentive for foreign researchers to come to Japan to conduct research.
- 2) There are very few technicians to assist the researchers in their work (a problem pointed out by foreign researchers).  
→ Japanese society is slow to recognize technicians as professionals.
- 3) People with overseas R&D management experience are needed.

4. Maintaining an environment for making it easier for foreign researchers to come to Japan

The need to solidify measures for dealing with the issue of education for the researchers' children (at the government level).

5. Treatment

1) Higher pay than the basic salary of a Japanese researcher. Raises based on past year's performance when contract is up for renewal.

2) Housing: For single foreign researchers, housing in a special dormitory for foreigners or in a dormitory for single Japanese workers. For researchers with families, company housing.

3) Insurance and welfare, same as for Japanese workers.

NTT's Acceptance of Post-Doctorate Researchers

1. Acceptance system

1) Established in 1988

2) Subjects are post-doctorate-level researchers

3) The researchers are employed as part-time employees.

4) Duration of stay is one or two years.

5) About 20 researchers work in basic research; more than 30 researchers altogether.

2. Recruitment methods 1) Cases where a front-line researcher is directly solicited by the foreign researcher or by his professor.

2) Cases where researchers are recruited through advertisements.

3. Details about special benefits, place of work, contract period, and so forth are covered in the contract with the researcher.

4. Points that should be considered in accepting foreign researchers

1) In connection with technology export control of the researcher while at work and after work, a system relating to COCOM regulations must be set up.

2) Housing is provided in the form of company apartments or rented apartments. For a researcher accompanied by his family, a two-bedroom apartment; for a single researcher, a one-bedroom apartment.

3) The problem common to both the foreign researchers and Japanese researchers is the language barrier.

4) Business trips to attend international conferences, etc., are approved for researchers who bring forth excellent results.

5) The key to operations on the receiving side is to avoid giving too much help and special treatment.

**Examples of American, British, and French Programs for Sending Researchers to Japan**

**1. NSF's Japan Program**

- 1) Long-term (6-24 months) research program
- 2) Short-term visits for research cooperation with Japan
- 3) Japan-U.S. seminars
- 4) State-of-the-art review
- 5) Japanese-language study
- 6) Japanese-language curriculum development
- 7) Summer institute in Japan

(Long-term visits (6-24 months))

- 1) Researchers from academic societies, the government, and industry
- 2) Length of stay: 6-24 months
- 3) Places of research in Japan: universities, government and private laboratories
- 4) Deadline for submitting applications:

Any time. However, departure for Japan is one year after application is submitted.

- a) Screening/matching  
Criteria—advantages of research and methods, etc.; capabilities, complementarity of Japanese and U.S. researchers;  
advantages of Japan-U.S. cooperation;  
future advantages to both Japan and the United States
- b) Gaining the understanding of Japanese people involved.
- c) Submission of visa evidence.

- 5) Pay: half the amount of a basic salary, plus allowances

**2. British Department of Trade and Industry's British Engineer Japan Training System (The Fellowship of Engineering)**

- 1) Program started in 1982.
- 2) Subjects chosen from young engineers working in British firms or laboratories  
(British citizens or permanent residents between 25-35 years of age)
- 3) Period of training generally six months to one year.
- 4) Recruitment conditions:
  - a) Return to the United Kingdom after training period finishes.
  - b) Periodic advertisements presented.
  - c) Publicity about training experiences.

5) Contents of assistance:

- a) Position maintained at sending firm.
- b) Salary guaranteed.
- c) Rights maintained over pension qualifications, etc.
- d) Salary from the British Department of Trade and Industry, up to 50% funding for other approved expenses

3. France-Japan Industrial Technology Committee (Forum Committee)

- 1) Established in 1983 (set up in Japan in 1985).
- 2) Subjects of researcher training program: French engineers or scientists who acquire a master's or doctorate degree after receiving high-level specialized education.
- 3) Period of training: 1st stage--intensive Japanese-language course (6 months in Japan) 2nd stage--research at a national laboratory or university (national, public, or private) in Japan (10-12 months) 3rd stage--research at a Japanese firm (6-12 months)
- 4) Recruitment method: 3-4 advertisements per year in Le Monde
- 5) Determination (3-5 people per year) made at Forum Committee headquarters (Paris)

**Proposals from Dr. Hinder of the British Embassy**

According to a letter from Dr. Hinder of the British Embassy, these proposals were discussed between the British Department of Trade and Industry and S&T-related agencies.

The major points of the translation of the proposals are included here as reference materials.

(Content of the proposals)

- Creating a list of foreign researcher acceptance programs that are implemented in Japanese firms.
  - Introducing foreign researchers to the laboratories of private firms. After a foreign researcher is accepted at a national laboratory for three months, a decision is made as to the suitability of the researcher and the suitability of a firm, then acting as an agent so that both the researcher and the firm are satisfied.
  - Creating PR videos to introduce the research activities of private firms to foreign researchers (scientists and engineers). To foreign researchers, printed materials are effective, but an appropriately edited video would have more impact.
  - Placing eminent foreign researchers under a single research leader working on an important project. This would indicate the attitude toward globalization in Japan's R&D.
10. Actual Numbers of People Sent and Received (Summary Tables)

10. Actual Numbers of People Sent and Received (Summary tables)

Table 1. Actual Numbers of People Sent and Received (Totals for Advanced Countries)

			To/from advanced countries			
			Industry	National laboratories, etc.	Universities	Total
To/ from Japan	Industry	A. Sent	109	19	304	432
		B. Received	38	8	124	170
		A/B	2.87	2.38	2.45	2.54
	National laboratories, etc.	A. Sent	11	56	77	144
		B. Received	4	35	50	89
		A/B	2.75	1.60	1.54	1.62
	Universities	A. Sent	13	138	843	994
		B. Received	9	25	185	219
		A/B	1.44	5.52	4.56	4.54
	Total	A. Sent	133	213	1,224	1,570
		B. Received	51	68	359	478
		A/B	2.61	3.13	3.41	3.28

(Notes) National laboratories, etc.:

In Japan: national research organizations, special corporations, nonprofit corporations, etc. (excluding public research organizations of other public groups)

In advanced countries: national laboratories, state laboratories (in the case of federated states)

Universities In Japan: national universities, private universities, and the research laboratories affiliated with those;

General research graduate schools and universities (National Laboratory for High Energy Physics, Okazaki National Research Institutes, etc.);

The National Defense Medical College, the Meteorological College, Shimonoseki University of Fishery, etc. However, test research organizations under the MOE, such as the Institute of Space and Astronautical Science and the National Observatory, are included under "national laboratories."

Table 2. Actual Numbers of People Sent and Received (United States)

		To/from the United States				
		Industry	National laboratories, etc.	Universities	Total	
To/ from Japan	Industry	A. Sent	91	10	244	345
		B. Received	12	2	67	81
		A/B	7.58	5.00	3.64	4.30
	National laboratories, etc.	A. Sent	8	27	46	81
		B. Received	1	11	19	31
		A/B	8.00	2.45	2.42	2.61
	Universities	A. Sent	11	72	578	661
		B. Received	2	6	64	72
		A/B	5.50	12.00	9.03	9.18
	Total	A. Sent	110	109	868	1,087
		B. Received	15	19	150	184
		A/B	7.33	5.74	5.79	5.90

(Notes) National laboratories, etc.:

In Japan: national research organizations, special corporations, nonprofit corporations, etc. (excluding public research organizations of other public groups)

In advanced countries: national laboratories, state laboratories (in the case of federated states)

Universities In Japan: national universities, private universities, and the research laboratories affiliated with those;

General research graduate schools and universities (National Laboratory for High Energy Physics, Okazaki National Research Institutes, etc.);

The National Defense Medical College, the Meteorological College, Shimonoseki University of Fishery, etc. However, test research organizations under the MOE, such as the Institute of Space and Astronautical Science and the National Observatory, are included under "national laboratories."

Table 3. Actual Numbers of People Sent and Received (United Kingdom)

		To/from the United Kingdom				
		Industry	National laboratories, etc.	Universities	Total	
To/ from Japan	Industry	A. Sent	3	3	28	34
		B. Received	8		10	18
		A/B	0.38		2.80	1.89
	National laboratories, etc.	A. Sent	2	5	5	12
		B. Received		1	5	6
		A/B		5.00	1.00	2.00
	Universities	A. Sent	1	9	86	96
		B. Received		3	25	28
		A/B		3.00	3.44	3.43
	Total	A. Sent	6	17	119	142
		B. Received	8	4	40	52
		A/B	0.75	4.25	2.98	2.73

(Notes) National laboratories, etc.:

In Japan: national research organizations, special corporations, nonprofit corporations, etc. (excluding public research organizations of other public groups)

In advanced countries: national laboratories, state laboratories (in the case of federated states)

Universities In Japan: national universities, private universities, and the research laboratories affiliated with those;

General research graduate schools and universities (National Laboratory for High Energy Physics, Okazaki National Research Institutes, etc.);

The National Defense Medical College, the Meteorological College, Shimonoseki University of Fishery, etc. However, test research organizations under the MOE, such as the Institute of Space and Astronautical Science and the National Observatory, are included under "national laboratories."

Table 4. Actual Numbers of People Sent and Received (France)

		To/from France				
		Industry	National laboratories, etc.	Universities	Total	
To/ from Japan	Industry	A. Sent		2	1	3
		B. Received	1		14	15
		A/B			0.07	0.20
	National laboratories, etc.	A. Sent	1	3	6	10
		B. Received	1	5	6	12
		A/B	1.00	0.60	1.00	0.83
	Universities	A. Sent		13	19	32
		B. Received	2	3	15	20
		A/B		4.33	1.27	1.60
	Total	A. Sent	1	18	26	45
		B. Received	4	8	35	47
		A/B	0.25	2.25	0.74	0.96

(Notes) National laboratories, etc.:

In Japan: national research organizations, special corporations, nonprofit corporations, etc. (excluding public research organizations of other public groups)

In advanced countries: national laboratories, state laboratories (in the case of federated states)

Universities In Japan: national universities, private universities, and the research laboratories affiliated with those;

General research graduate schools and universities (National Laboratory for High Energy Physics, Okazaki National Research Institutes, etc.);

The National Defense Medical College, the Meteorological College, Shimonoseki University of Fishery, etc. However, test research organizations under the MOE, such as the Institute of Space and Astronautical Science and the National Observatory, are included under "national laboratories."

Table 5. Actual Numbers of People Sent and Received (Germany)

			To/from Germany			
			Industry	National laboratories, etc.	Universities	Total
To/ from Japan	Industry	A. Sent	6	4	12	22
		B. Received	2		8	10
		A/B	3.00		1.50	2.20
	National laboratories, etc.	A. Sent		6	5	11
		B. Received	1		3	4
		A/B			1.67	2.75
	Universities	A. Sent	1	16	49	66
		B. Received	3	1	27	31
		A/B	0.33	16.00	1.81	2.13
	Total	A. Sent	7	26	66	99
		B. Received	6	1	38	45
		A/B	1.17	26	1.74	2.20

(Notes) National laboratories, etc.:

In Japan: national research organizations, special corporations, nonprofit corporations, etc. (excluding public research organizations of other public groups)

In advanced countries: national laboratories, state laboratories (in the case of federated states)

Universities In Japan: national universities, private universities, and the research laboratories affiliated with those;

General research graduate schools and universities (National Laboratory for High Energy Physics, Okazaki National Research Institutes, etc.);

The National Defense Medical College, the Meteorological College, Shimonoseki University of Fishery, etc. However, test research organizations under the MOE, such as the Institute of Space and Astronautical Science and the National Observatory, are included under "national laboratories."

Table 6. Actual Numbers of People Sent and Received (Totals for Other Countries)

		To/from other countries				
		Industry	National laboratories, etc.	Universities	Total	
To/ from Japan	Industry	A. Sent	9		19	28
		B. Received	15	6	25	46
		A/B	0.60		0.76	0.61
	National laboratories, etc.	A. Sent		15	15	30
		B. Received	1	18	17	36
		A/B		0.83	0.88	0.83
	Universities	A. Sent		28	111	139
		B. Received	2	12	54	68
		A/B		2.33	2.06	2.04
	Total	A. Sent	9	43	145	197
		B. Received	18	36	96	150
		A/B	0.50	1.19	1.51	1.31

(Notes) National laboratories, etc.:

In Japan: national research organizations, special corporations, nonprofit corporations, etc. (excluding public research organizations of other public groups)

In advanced countries: national laboratories, state laboratories (in the case of federated states)

Universities In Japan: national universities, private universities, and the research laboratories affiliated with those;

General research graduate schools and universities (National Laboratory for High Energy Physics, Okazaki National Research Institutes, etc.);

The National Defense Medical College, the Meteorological College, Shimonoseki University of Fishery, etc. However, test research organizations under the MOE, such as the Institute of Space and Astronautical Science and the National Observatory, are included under "national laboratories."

## Questionnaire Forms

## Survey Questions

Please fill in the sheet provided with your answers to the following three questions and information about where we can contact you. Please return the form by 24 October 1991.

- Q1. Please indicate the number of foreign researchers accepted by your company (university, laboratory) during FY1990, according to where they came from (university, national or public laboratory,\* private firm).

However, if you do not yet know the total number for FY1990, you can use the value for FY1989. In that case, please indicate that it is a FY1989 value, as shown in the examples below. And, if you do not know the exact value, fill in the estimated value and enclose it in parentheses.

In answering this question, please indicate the number of foreign researchers who satisfy the following conditions:

- 1) Foreign researchers who entered Japan during that fiscal year, not those who were already present during that fiscal year.
- 2) Foreign researchers accepted for the purpose of research, and not for training or because they were transferred within the company.

Transfer within the company means "transfer from an overseas subsidiary to the company's main branch in Japan, or transfer from the company's main branch in a foreign country to a subsidiary in Japan."

- 3) Foreign researchers accepted for a period of six months or more.
- 4) Only researchers in natural science fields.
- 5) Foreign researchers from advanced countries\*\* (basically, those who have citizenship in an advanced country, but also to include those who have rights of citizenship in the country). Please give separate answers for foreign researchers from the United States, the United Kingdom, France, or Germany. The numbers for researchers from other countries may be lumped together.

\* Here, "national or public laboratory" indicates, for example, in the case of the United States, the NIH, NIST, and other such research organizations under the direct control of the federal government, and research organizations under the direct control of state governments.

\*\* Here, "advanced countries" means the 16 nations that are members of the OECD Development Assistance Committee: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Holland, New Zealand, Norway, Sweden, Switzerland, the United Kingdom, and the United States

Q2. Please indicate the number of researchers (in the case of universities, also includes graduate students) sent overseas by your company (university, laboratory) during FY1990, according to where they were sent (university, national or public laboratory,\* private firm).

However, if you do not yet know the total number for FY1990, you can use the value for FY1989. In that case, please indicate that it is a FY1989 value, as shown in the example below. And, if you do not know the exact value, fill in the estimated value and enclose it in parentheses.

In answering this question, please indicate the number of researchers who satisfy the following conditions:

- 1) Researchers who departed from Japan during that fiscal year.
- 2) Researchers who were sent overseas for the purpose of research, and not for training or because they were transferred within the company.
- 3) Researchers who were sent overseas for a period of six months or more.
- 4) Only researchers in natural science fields.
- 5) Researchers sent to the same 16 countries given in the question above about foreign researchers accepted in Japan. Please give separate answers for researchers sent to the United States, the United Kingdom, France, or Germany.

Q3. Please answer the following items about your company.

- 1) Type of industry
- 2) Scale (of capital) (Not needed for universities and national laboratories)
- 3) Number of researchers

These data will be used for analyzing researcher exchange by type of industry and by scale of capital. If it is inconvenient for you to answer any of these items, you can leave them blank.

For the type of industry, please fill in the number from the boxed item below that corresponds to your organization's type of industry. For the scale of capital, please answer in units of million yen.

\*\*\* Here, the number of researchers means the number of regular researchers as defined in the Management and Coordination Agency's Survey of S&T Research (Designated Statistics No. 61).

(Definition of researchers and regular researchers from the Survey of S&T Research)

Researchers: People who completed university (not including two-year college) course work (or people who have the equivalent specialized knowledge), have two or more years of research experience, and are conducting research with a specific research theme.

Regular researchers: Those researchers described above who mainly conduct research within the organization.

Additional-post researchers: Those researchers described above whose regular research work is outside of the organization.

### Examples

#### Example 1. FY90 record

Please fill in the numbers of foreign researchers accepted in your company and the numbers of your company's researchers sent overseas during FY90 (the numbers of researchers who entered Japan and departed from Japan that year). Please indicate estimated values within parentheses.

	Received from that country			Sent to that country		
	Univer- sities	National labora- tories	Compa- nies	Univer- sities	National labora- tories	Compa- nies
FY	1990	1990	1990	1990	1990	1990
U.S.	2 <sup>4</sup>	2	0	6	4 <sup>5</sup>	2
U.K.	1	(2) <sup>6</sup>	1	3	3	1

\*4 This means the number of foreign researchers from U.S. universities that were received during FY90 (April 1990-March 1991). (This also includes non-American researchers who have U.S. citizenship.)

\*5 This means number of researchers sent from your company to national laboratories in the United States during FY90 (April 1990-March 1991).

\*6 The parentheses indicate an estimated value.

#### Example 2. FY89 record

	Received from that country			Sent to that country		
	Univer- sities	National labora- tories	Compa- nies	Univer- sities	National labora- tories	Compa- nies
FY	1989	1989	1989	1989	1989	1989
U.S.	2	1	0	5	4	2
U.K.	1	1	0	3	3	1

Note: When FY89 figures are used instead of FY90 values, cross out the "90" with a pen and write in "89."

## Types of Industries

### (Private firms)

- (1) Agriculture, forestry, and fisheries
- (2) Mining
- (3) Construction
- (4) Food processing
- (5) Textiles
- (6) Pulp and paper
- (7) Printing and publishing
- (8) Chemicals (not including pharmaceuticals)
- (9) Pharmaceutical manufacturing
- (10) Petroleum and coal products manufacturing
- (11) Plastic products manufacturing
- (12) Rubber products manufacturing
- (13) Ceramics
- (14) Iron and steel
- (15) Nonferrous metals manufacturing
- (16) Metal products manufacturing
- (17) Machinery
- (18) Electrical machinery manufacturing
- (19) Transport machinery manufacturing
- (20) Precision machinery manufacturing
- (21) Other manufacturing
- (22) Transportation and communications
- (23) Electricity and gas
- (24) Other

- (Other)
- (25) National and public laboratories
  - (26) Special corporations
  - (27) Nonprofit corporations
  - (28) Universities and affiliated laboratories (national and private)

- END -