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日本における政府研究機関

The Japanese Governmemt Laboratory System

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まえがき

本調査資料「The Japanese Government Laboratory System（日本における政府研究機関）」は、科学技術庁科学技術政策研究所と米国シラキュース大学マックスウェルスクール技術情報政策センターとが共同して行った調査研究の成果をとりまとめたものである。

本調査研究の目的は、日米の政府研究機関を比較することを目標として、政府研究機関の使命や活動等に関する現状を的確に把握することにある。

本英文報告書は、科学技術政策研究所が我が国の政府研究機関を対象として実施したアンケート調査の結果と、シラキュース大学が米国の政府研究機関を対象として実施したアンケート調査の結果との比較分析を、共著の報告書としてとりまとめたものである。

なお、我が国関係者の便宜のため、

1．英文報告書本文の第1章（概要部分）の和訳、

2．英文報告書本文中の図表の和訳一覧、及び、

3．我が国政府研究機関に対するアンケートへの回答の全項目にわたる結果集計を、

科学技術政策研究所においてとりまとめ、付録として本調査資料に添付している。

科学技術政策研究所

第1調査研究グループ

Preface

This report summarizes the preliminary findings of a research survey undertaken as part of the *Japan National Laboratory Study*. This project is a two-phase research project conducted jointly by the National Institute of Science and Technology Policy (NISTEP, Science and Technology Agency, Japan) and the Center for Technology and Information Policy (CTIP) located at Syracuse University. The objective of the study is to obtain detailed information on the missions, character, and activities of the Japanese national public laboratories of a sort that is comparable to that already available for the U.S. labs.

The first phase of the Japanese study was a survey administered to the Japanese public sector R&D laboratories conducting natural science and engineering-related research. The survey was mailed out and returned in the late fall of 1991; data were compiled throughout the spring and summer of 1992. These data and findings are provided herein. Phase two of the project, semi-structured interviews with laboratory personnel, was completed in January 1993. More detail on the nature of the *Japan National Laboratory Study* is provided in Chapter 1 of this report.

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CHAPTER 1

Introduction

Since the early 1980s, there has been a substantial reevaluation of the function, role, and perceived effectiveness of government research and development laboratories. Spurred almost entirely by economic considerations, policymakers in most of the advanced industrialized countries have initiated new mandates and missions for their public research establishments. In Japan, the importance of basic research in the national laboratories has been emphasized (Council for Science and Technology, 1987). In almost all instances, new performance requirements attempt to correct perceived weaknesses in the government research system and to increase operational effectiveness in an environment of severely constrained R&D resources.

There is, however, a long-acknowledged lack of key data and information on government laboratory systems (Cordell and Gilmour, 1976; OECD, 1988). National priority-setting and policymaking with regard to government research has proceeded without any independent empirical verification of conventional assumptions about laboratory activity or even benchmark data against which changes and consequences may be assessed. Useful aggregate data is to be found regarding such concerns as budget and personnel trends and technological outputs (NSF, 1990; NISTEP, 1989), but impressions and characterizations of the labs as both *organizations* and *a system* are generally lacking. The notable exception for the United States is the research conducted as part of the National Comparative Research and Development Project, an ongoing data collection and analysis effort of the Center for Technology and Information Policy (CTIP) at Syracuse University (see Bozeman and Crow, 1990; Crow and Bozeman; 1991).

In order to expand the knowledge base with regard to government research laboratories, CTIP and the National Institute of Science and Technology Policy (NISTEP) in Japan have jointly undertaken a study of Japan's national research institutes. This project, the *Japan National Laboratory Study (JNLS)*, has been in progress since 1991. Its objectives are to provide systematic, scholarly inquiry into the nature, characteristics, and functions of Japan's national research institutes. By doing so, this research can provide new insights into the Japanese research system as well as provide baseline information against which to measure change. Additionally, with a few exceptions detailed below, the data obtained in the Japanese study are comparable to those already collected for the United States. As a consequence, international comparisons can yield more generalized knowledge about the nature of government research and better guide policymaking in both nations.

This report provides a basic description of the survey data which resulted from phase I of the *JNLS*. It is useful to highlight some key comparisons between the U.S. and Japanese government research laboratories as well as those that pertain to specific Japanese policy interests. This chapter therefore contains a brief summary of the project, a discussion of the role of the government R&D sector in both Japan and the United States, and a summary of major findings as they are described in the following chapters.

Before proceeding, it is important to note that there is no agreed upon or standard way to think about and analyze government research institutions. They are often discussed in terms of their major functions (for example, to compensate for market failures), according to broad classes of mission (defense, health, space), or their roles as they pertain to public and market influences. Inevitably, such classification schemes cannot perfectly capture each R&D laboratory, since labs can conceivably be classified in different categories.[1] A final analysis of the laboratories will nevertheless have to consider their broader socio-economic purpose, since this functionality acts as a key determinant of the character and content of research within laboratories. However, in this draft report mission as it pertains to broader governmental objectives is not addressed; rather, it is discussed in terms of type of R&D activity (basic research, technical assistance, and so forth).

Overview of the *Japan National Laboratory Study*

The *JNLS* has been in progress since 1991. As mentioned, it is a cooperative research project between the National Institute of Science and Technology Policy in Japan and the Center for Technology and Information Policy in the United States. It is a two-part study, the first of which was a detailed mail survey on the nature of lab structure and activity administered to Japanese government research institutes. The second phase was composed of a number of semi-structured qualitative interviews with laboratory personnel regarding lab management and operations. Interviews were completed in January 1993.

The data reported herein are from the laboratory questionnaire. This survey was sent out in late fall, 1991 to essentially the entire population of Japanese government laboratories. There are three categories of public R&D laboratories in Japan: national research institutes (NRIs, those attached to government ministries and agencies), semi-government research organizations (*tokushu-hojin*; legally a distinct class of organizations established under separate public laws, but

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[1]For example, those relating to energy and power generation can also be viewed as contributing to "industrial technology."

nominally affiliated with individual ministries and agencies via budget allocations and appointment of directors), and non-profit R&D organizations.[2] All of the national research institutes and *tokushu-hojin* were surveyed except for those doing social science or management research or those determined not to conduct R&D at all. Of the more than dozen not-for-profit laboratories, three were selected to receive surveys because of their strong present or past connection with the Japanese government.[3]

There were 102 NRIs and *tokushu-hojin* and 3 non-profit organizations at the time of the survey; 8 establishments were excluded for the above reasons. A total of 97 surveys were sent. Responses were received from 88 laboratories during December 1991 and January 1992, yielding an excellent response rate of 91%. A complete list of the Japanese government laboratory respondents is provided in Appendix B.

The survey itself was designed jointly by NISTEP and CTIP. Most of the survey items duplicate those in the government questionnaire sent as part of the National Cooperative Research and Development Project (NCRDP) in 1990. The NCRDP is an ongoing research project conducted under the aegis of CTIP; details of this program and its survey activities are provided in Appendix A. Additional questions were added to cover laboratory issues of particular policy relevance in Japan, especially with regard to personnel and mobility. NISTEP translated the survey into Japanese[4] and handled all administration of the questionnaire. The questionnaire, and its English translation, are provided in Appendix C.

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[2]The national research institutes run by the Japanese Ministry of Education were excluded from this study because these are affiliated with institutions of higher education and not the government sector *per se*.

[3]These are the Remote Sensing Technology Center of Japan (established under the guidance of STA and NASDA), the Nippon Institute for Biological Sciences (under the joint jurisdiction of MAFF and Monbusho), and the Railway Technical Research Institute (formerly laboratories attached to the Japanese National Railways and reorganized into current status in 1986 when JNR was privatized).

[4]The Japanese version was reverse-translated into English by an independent translation firm to ensure maximum semantic comparability to the U.S. government laboratory questionnaire.

The Japanese and U.S. Government Laboratory Systems

Popularized notions held in the United States and Western countries about Japanese science and technology suggest that the government's involvement has largely been to promote industrial technology. While this may certainly be the case with various dimensions of Japanese industrial and economic policies, it is not entirely reflected in Japan's government laboratory system. The Japanese system of national research institutes and *tokushu-hojin* is a diverse collection of laboratories serving traditional government R&D missions in agriculture, defense, public health and safety, standards, basic science, space, and so on. Research facilities encompass such "structures" as particle accelerators, wind tunnels, tea plantations, and oceanographic vessels as well as the more traditionally conceived research laboratories. The fundamental *diversity* of the Japanese laboratory population cannot be overstressed and in this respect is quite consistent with what is commonly understood about the role of governments in conducting intramural R&D.

There is, nonetheless, a strong industrial technology mission within the system itself. The national research institutes affiliated with MITI have had long-acknowledged roles in the promotion of industrial technologies, and there are other such labs attached to several other government agencies as well. Kawasaki (1989) estimates that roughly 30 labs can be specifically associated with industrial technology missions. Even so, several important qualifiers are in order. First, a number of these research institutes do not provide technologies to industry. This would include such laboratories as MITI's National Research Laboratory for Metrology (standards). Still others serve regulatory functions, such as the Ministry of Welfare's National Institute of Hygienic Science. Several other industrial labs have strong *basic research* missions, as well as direct analogs in the United States (for example, STA's Institute of Metals and the Department of Energy's Ames Research Laboratory).

The point is that we must be cautious about oversubscribing to generalizations about the industrial orientation of the Japanese laboratory system. As will be seen below and in the following chapters, Japanese labs are not uniformly devoted to the creation of industrial technologies or the commercial advancement of industry. Many of the so-called government industrial labs are not unique to Japan and reflect basic government responsibilities to the economy; for example, the Geological Survey of Japan is a MITI lab, but does not in any way develop manufacturing technologies. What *is* unique to the Japanese system is the handful of first-class laboratories under the aegis of MITI (for example, the Electrotechnical and Mechanical Engineering Laboratories) whose historical missions have been to promote and develop industrial technologies. The existence of these labs cannot, however, be separated from the fact that they are associated with a parent ministry that has a well-defined role with regard to the industrial sector.

While the U.S. may have functionally comparable laboratories in terms of the substance of the research, it is lacking both the overarching bureaucratic structure and public policy mandate for associated industrial policies.

Preliminary Findings

The four chapters which follow detail the basic descriptive findings of the laboratory survey. The major conclusions are reviewed here, given their overall policy significance in Japan at the moment. The first deals with the conduct of basic research in the laboratories, the second with laboratory operations and funding, the third with personnel and management issues, and the fourth with cooperative R&D and technology transfer.

The Role of Basic Research.--Japanese science and technology policymaking has consistently stressed the need to stimulate creative basic research in Japan. What is very clear from the laboratory survey is that basic research is the highest research priority among Japanese government labs, and to the same degree as the United States. One quarter of the Japanese government labs reported basic research as their singlemost important mission, and another one-third gave it the next highest possible rating in terms of importance. In all, nearly 60% of the laboratories believe this is a highly significant mission. The emphasis on basic research is reflected throughout many of the components of the survey. For example, most labs devoted the largest proportion of their budgets to the conduct of basic research, most perceived that their most important effectiveness criteria was their contribution to scientific knowledge, and most labs devoted most of their time towards the production of scientific articles and reports. The impression one gets is that the Japanese government research system is in fact "doing" basic research and explicitly acknowledging its significance.

Two issues cannot be determined from this survey, however. The first is whether this is a new emphasis for the labs (as a result of new national objectives) or simply a reflection of longstanding practice. Data presented elsewhere (Papadakis and Jankowski, 1991) suggest that basic research has in fact been an important focus in the government laboratory system for some time and at levels proportionally comparable to the United States. Second, the data do not indicate how *good* this research is--whether it is creative and pioneering, or more pedestrian. In this respect, Muto and Hirano (1991) have reported a number of difficulties that the government laboratories have in stimulating creative fundamental science. The task confronting the laboratory system may not be to increase the amount of time or resources devoted to basic research, but to improve the overall quality levels through changes in internal laboratory management.

Laboratory Operations and Funding.--The survey data show little which can shed light on some of the laboratory management difficulties detailed in the Muto and Hirano (1991) study, but they strongly reinforce the funding issues discussed by Kawasaki (1989).

By and large, the structure of Japanese government laboratories is similar to that in the United States. They are comparably decentralized organizations, and researchers have a high degree of autonomy in their work, although Japanese lab autonomy ratings tend to be slightly lower than those in the United States. However, Japanese laboratory directors do not appear to believe that bureaucracy acts as a hindrance to effective laboratory operations, and unlike the United States, Japanese labs reflect higher levels of management diversity. Most labs apparently use several different approaches to research organization. As a consequence, it isn't clear what may be said regarding the need to be more flexible in laboratory management. Management activity at very micro levels (such as research planning, project selection) are largely invisible in the context of this survey, although both the U.S. and Japanese laboratories indicated in comparable proportions that project selection was influenced more by government policies than industrial needs.

What is eminently apparent is the tight resource environment in Japanese labs, a point that Kawasaki (1989) has discussed with some concern. Laboratory budgets and personnel levels have been in a "no growth" status for the past several years, and this shows in the data in several ways. First, Japanese labs funding levels are, on average, smaller than their U.S. counterparts even when laboratory size and lower salary costs are allowed for in the comparisons. Second, directors cite personnel and funding constraints as the major barriers to R&D productivity in their labs, constraints which also show up in administrative procedures. For example, it takes a Japanese lab about 3-6 months to receive permission to hire a full-time employee, contrasted to 3-6 weeks in the United States.

Personnel and Management Issues.--Several kinds of personnel and management issues are relevant to the Japanese policy concern regarding the stimulation of creative basic science. The first relates to the general obstacles to R&D productivity in the laboratory; the second to bringing in and keeping new researchers; and the third to factors which affect the selection of R&D projects in the lab.

The survey responses give a rather mixed set of impressions regarding these issues. On the one hand, we see very clearly the traditional laboratory system. Most labs hired very few researchers on average, the median was just about 3 people per year. And, most of new recruitment is done through the civil service examination system (two-thirds of the labs use this method more than half of the time). Mobility to and from the laboratory is limited: the majority of researchers who left appear to do so through normal retirement, and few in the younger cadres (typically less than 20%) leave at all. In this respect, it seems that very few "fresh" minds are coming into the laboratories, and certainly not from outside the normal channels of entry.

However, there are hints that there are in fact a set of dynamic laboratories, and this issue will be explored further. Some labs have hired, on average, as many as 18 new researchers per 100 employees. About one-third of the laboratories reported that more than 30% of the researchers who left their organization were less than 39 years old, and it is not uncommon for labs to recruit without the general exam and even without public advertisement. Whether or not such practices are confined to labs with certain kinds of missions (such as health or agriculture) will be investigated.

On the whole, the laboratory directors believed that their research environments were good enough to attract high quality researchers. This is somewhat at odds with perceptions that such is not the case: it is often asserted that inadequate technical support and poor equipment discourage the best researchers and divert them to industry. Overall, the shortage of personnel, rather than the ability to attract them, seems the most serious issue. Not only did successfully acquiring resources register as the second most important effectiveness criterion for the labs, but personnel shortages are considered to be the singlemost important barrier to lab productivity. Preliminary interviews with laboratory directors indicate that such shortages are one of the primary motivators of cooperative R&D, since this usually involves visiting researchers to the labs. Although there is still no major presence of foreign researchers in the national research institutes, there does appear to be a fair degree of visiting research activity. About 25-33% of the labs reported some kind of frequent visitation, while the vast majority (about two-thirds) reported at least occasional visits, especially by researchers from other government laboratories and universities.

Cooperative R&D and Technology Transfer.--Some of the more distinctive differences between Japanese and U.S. government laboratories are evident with respect to technology transfer activities. While the motives and benefits of cooperative R&D seem to be relatively equivalent in the two countries, their experiences with regard to technology transfer are appreciably different. One feature of the survey data is problematic in this respect, which is the age of the information. The U.S. survey reflects laboratory activities in 1989, and in the past few years, both cooperative R&D and technology transfer efforts in the U.S. labs have changed considerably. It is not clear to what extent U.S. labs may currently be more similar--or still more different--than the Japanese.

The major distinction between Japan and the United States is the degree to which technology transfer activities have been institutionalized in Japanese labs. Japanese labs' motives for technology transfer are those related to the routine course of R&D, while U.S. motives reflect the pressures of legislation, budgets, and the interests of individual scientists and engineers. Japanese labs also view themselves as more successful in their technology transfer efforts, and appear to have had much more successful experiences with a wider range of technology transfer strategies.

CHAPTER 2

Mission Orientation

The most traditional way of thinking about government laboratory missions is with respect to the broader government functions which they serve. We therefore typically think of labs "for" defense, agriculture, space, health, energy, occupational safety, and so forth. Virtually all of the advanced industrialized countries support public R&D for a standard set of socioeconomic purposes. Two elements of these broad government objectives especially distinguish the U.S. and Japanese science and technology systems from one another--the high proportion of U.S. funds which go to defense, and the presence in the Japanese system of labs dedicated to industrial health. These distinctions are interpreted as telling national differences in governmental R&D priorities.

Over the past ten years these traditional categories of R&D funding have been of declining policy focus in Japan and the United States. Of growing concern is the character of the R&D itself. In Japan, there has been substantial policy attention paid to the production of basic scientific research, largely as a result of international and domestic perceptions that Japan's scientific research establishment is underdeveloped relative to other advanced countries and to Japan's own private sector R&D enterprise. It has been widely accepted that Japan has pursued commercial R&D at the expense of science in all of its R&D performing sectors.

The United States has followed an opposite path in its government lab policies. Commercial relevance has become the stated policy goal by both Congress and the White House, largely because of the trade deficit and competitiveness crisis. Through rhetoric, legislation, and budget allocations, the federal government is trying to induce its laboratory establishment to be more sensitive to industrial needs and improve its record of effective technology transfer: the common perception is that the labs have failed to deliver on their promise to enhance national economic health.

Some insight into what labs do and who they do it for can help put the role of government R&D in perspective. Several elements from the government laboratory surveys are helpful in this regard: ratings of the importance of different specified mission objectives; the proportion of laboratory budgets allocated to each of these missions; ratings of the importance of different laboratory effectiveness criteria; and the proportion of lab time spent on producing different kinds of R&D "products."

Mission Activity

Two items from the government lab surveys inquire directly about mission activity. The first asks laboratory directors to rate (from single most important to not a mission) the importance of nine typical R&D activities. The other asks how laboratory budgets are allocated among these missions. By comparing the ratings with the patterns of lab funding, we can assess how closely perceptions of mission significance align with the "reality" of spending. Presumably, labs will spend money on those programs and activities that are truly most important to them.

Generally speaking, the financial information does reinforce the lab ratings of mission importance. There are some limitations in conducting these comparisons, however. First, it appears that budgets are allocated almost exclusively by the nature of R&D--basic research, applied research, development, and so forth. Other elements of mission orientation--technical assistance and technology transfer functions--seem to reflect the *direction* of R&D outputs rather than any measurable expense. As a consequence, these missions can rate highly in importance, but receive little in the way of actual funds.

What is most striking about the mission data is the high degree of similarity in the research orientations of Japanese and U.S. labs. Two comparisons were made here: the proportion of labs that viewed missions as highly important, and those that viewed missions as of little or no importance. These two comparisons capture the degree of significance of any given mission (how important it is), and how pervasive a mission is throughout the laboratory system (by measuring how many labs consider it to be of little importance).

The data reflect the overwhelming significance and scope of basic research in the government laboratory system. In both Japan and the United States, roughly 60 percent of all labs viewed basic research as a highly important mission (figure 2-1), while only about one-fifth viewed basic research as a mission of little or no importance (figure 2-2). By and large, no other lab mission rated so highly in degree of importance, and each of the other research missions had far greater proportions of labs that considered the mission to be inconsequential. All in all, the data suggest that in both Japan and the United States, the primary function of government labs is to conduct basic scientific research.

Two characteristics of the research mission data are worth commenting on. The first is the much greater emphasis that U.S. labs place on precommercial applied research. As reflected in figure 2-1, 51 percent of U.S. government labs consider precommercial applied research to be their singlemost important mission or an important mission. Only 43 percent of the Japanese labs indicated such. Second, in both Japan and the United States, commercial applied research shows up as the least significant research mission. Only about one-third of the labs considered this mission to be highly important, and a full one-half view it as of little or no significance. This is not so surprising with regard to the United States, where the government has generally been hesitant to directly involve itself in commercial activity; it is more unexpected with respect to Japan, where the government is thought to have a more active commercial role in R&D. Related to this last point, Japanese labs are also slightly less oriented to development than those in the U.S.: 37 percent of the Japanese labs indicated that development was not a mission of any importance, compared to 30 percent in the United States.

More pronounced differences between the Japanese and U.S. labs are evident with respect to their technical assistance and technology transfer missions. Japanese labs are overwhelmingly concerned with technical assistance to their parent agency: 82 percent indicated that this was a highly important mission; the most labs (one-third) considered this to be their singlemost important mission; less than 10 percent of labs considered this to be a mission of little importance (figure 2-3; table 2-1). Technical assistance was not nearly as significant a mission in the U.S., or as widespread.

Generally speaking, other than technical assistance to the parent agency, none of the other technical assistance or technology transfer roles of the Japanese labs rated very highly--few labs considered these other missions to be highly important, and over 40 percent of the Japanese labs thought technology transfer was a mission of little or no significance. U.S. labs, on the other hand, are quite sensitive to technology transfer missions, as well as technical assistance to *other* government organizations: for each of these missions, roughly half of the labs reported that it was highly important.

Given current U.S. emphases on the need for federal labs to be more sensitive to the needs of the private sector, one difference between Japan and the U.S. labs is notable. Slightly more Japanese labs view technical assistance to the private sector as a highly important mission (33 percent vs. 27 percent), and this mission is more pervasive in the Japanese system. Only 24 percent of Japanese government labs considered this to be a mission of little or no importance, contrasted to 41 percent in the United States.

In spite of some of these variances in mission significance and scope, Japanese and U.S. labs confront the same degree of mission complexity. If we count the number of missions that individual laboratories consider to be at least somewhat important, it is apparent that most labs are responsible for a relatively large number of R&D and technical responsibilities. More than half of all labs in both countries are responsible for seven or more missions (out of a possible nine), and less than 10 percent are responsible for three or fewer missions. This undoubtedly creates organizational challenges, as the nature of R&D, technical assistance, and technology transfer tasks are considerably different.

As mentioned previously, the budget data tend to reinforce the lab ratings of mission importance as they relate to the R&D missions (as opposed to technical assistance or technology transfer). Basic research tends to receive the largest amount of funding in most of the labs, but in Japan much more so than in the United States. For example, 23 percent of Japanese labs spend less than 10 percent of their budget on basic research, compared to 40 percent of the U.S. labs. About one-fourth of the labs in both countries spend more than half of their budget on basic research (tables 2-3, 2-4). For all other missions, more than half of the labs in both countries spend less than 10 percent of their budget on any given mission activity.

Effectiveness Criteria

Another way of examining what government labs do is to evaluate the criteria by which they consider themselves effective. Performance criteria can reflect the goals of R&D or laboratory activities, as opposed to the character and nature of the R&D itself.

Consistent with the basic research mission of the labs, most labs in Japan and the United States considered advancing scientific knowledge to be the single most important effectiveness criterion for the lab. Forty-one percent of the Japanese labs viewed this as the most important criterion, as did 32 percent of the U.S. labs (figure 2-6). In Japan, producing commercially useful knowledge was also a major effectiveness measure, considered to be the single most important criterion by one-third of the labs (and only 15 percent in the United States). Exactly the inverse may be found for the criterion "meeting constituent needs," where roughly one-third of the U.S. labs perceived this as the most important effectiveness concern, compared to only 15 percent in Japan.

Of notable difference is the degree to which Japanese and U.S. labs regard increasing lab resources as evidence of effectiveness. About 10 percent of Japanese labs considered this to be their primary effectiveness criterion, and another 41 percent viewed it as important. Far fewer U.S. labs did so. There may be two reasons for this disparity. First, the resource environment in Japan is highly constrained, and under current political circumstances, garnering more personnel and budgets is an indicator that the parent agency views the laboratory in a positive light.

A second factor is the way in which government R&D is funded in Japan. All labs get most of their funds from their parent agency, and budgets are calculated on the basis of personnel costs, overhead expenses, and so forth. Another increment of lab budgets, however, comes from other government agencies through a somewhat competitive grant process. Program funds in special

R&D areas are available from the Science and Technology Agency (in priority areas mostly set by the Council for Science and Technology) and the Environment Agency (in environmental research areas). While these "grant" funds are rather small elements of a lab's total budget (less than 10 percent or so), they often count for a more substantial portion of a lab's *operational* research budget--sometimes as much as a full third. As a consequence, the ability of a Japanese laboratory to obtain outside resources is, again, a signal that the lab is conducting relevant research of reasonable quality.

R&D Outputs

Laboratories estimated the personnel time devoted to the production of different types of R&D outputs, such as written documentation, prototypes, devices, and demonstration projects. In both Japan and the United States, the preponderant amount of lab time devoted to output production is spent on written documentation. As seen in table 2.5, over two-thirds of lab output time is devoted to writing scholarly publications, internal reports, and papers for professional conferences. On average, very little time is spent on such tangible outputs as patents (3-4 percent), algorithms and software (6-7 percent), and prototypes (7-8 percent). Patterns of Japanese and U.S. laboratory time devoted to output production are virtually indistinguishable.

Conclusions

On most measures of mission activity and significance, Japanese and U.S. goverment R&D labs appear highly similar. Even though the *substantive* orientations of the labs are different in some respects (for example, the defense focus in the United States, the industrial focus in Japan), the character of the R&D itself is rather convergent. In both systems, we see the major emphasis on basic research, and then lesser degrees of attention to precommercial applied research and development. In both systems, commercial applied research receives the least amount of emphasis of the R&D missions. It is not clear to what extent the Japanese focus on basic research has been longstanding, since the survey data capture lab activities in 1990--earlier in the decade there may have been relatively less basic research activity. In any event, Japanese labs currently view basic research with a degree of significance that their U.S. counterparts do; moreover, the budget data suggest that the policy emphasis on research is being realized in the lab programs. New U.S. policy developments are reflected in the data as well. The most notable mission differences between Japan and the United States relate to the technical assistance and technology transfer missions; U.S. labs place far more importance on their technology transfer missions and the servicing of constituent needs as an effectiveness criteria.

Table 2. 1 Laboratory Ratings of Mission Importance

R&D Mission/Country	Percentage of labs indicating R&D mission is --- Single Most Important	Important	Somewhat Important	Of Little Importance	Not a Mission
Basic research					8
Japan	24	35	17	15	
U.S.	23	35	22	10	10
Precommercial Applied					
Japan	16	27	25	14	19
U.S.	21	30	19	14	16
Commercial applied					
Japan	4	28	17	19	33
U.S.	7	28	14	13	38
Development					
Japan	6	35	22	11	26
U.S.	8	33	29	13	17
Technical assistance to parent organization					
Japan	34	48	9	7	1
U.S.	12	32	31	4	21
Technical assistance to other government					
Japan	1	37	30	15	17
U.S.	6	48	27	10	9
Technical assistance to private sector					
Japan	4	29	43	8	16
U.S.	1	26	33	22	19
Technology transfer to government					
Japan	---	23	35	24	18
U.S.	4	46	28	11	11
Technology transfer to private sector					
Japan	---	22	36	19	23
U.S.	2	43	29	17	9

* Note: figures may not sum to 100 because of rounding

Table 2.2 Japanese Laboratory R&D Budgets by Mission

R&D Mission/Country	Percentage of labs indicating mission accounts for below share of total budget: 0 - 10%	11-25%	26%-50%	51-75%	76-100%
Basic Research	23	16	34	16	11
Total applied research	59	14	22	2	3
Commercial applied research	na	na	na	na	na
Development	47	22	20	6	5
Technical assistance to parent organization	62	17	14	6	1
Technical assistance to other government	90	10	---	---	---
Technical assistance to private sector	96	3	1	---	---
Technology transfer to government	99	---	1	---	---
Technology transfer to private sector	100	---	---	---	---

* Note: figures may not sum to 100 because of rounding

Table 2.3 U.S. Laboratory R&D Budgets by Mission

R&D Mission/Country	Percentage of labs indicating mission accounts for below share of total budget: 0 - 10%	11-25%	26%-50%	51-75%	76-100%
Basic research	40	15	20	8	17
Precommercial applied research	54	17	20	7	3
Commercial applied research	82	11	7	---	---
Development	62	17	14	3	4
Technical assistance to parent organization	84	8	5	2	2
Technical assistance to all other organizations	77	15	5	3	---
Technical assistance to private sector	na	na	na	na	na
Technology transfer to all organizations	90	7	3	---	---
Technology transfer to private sector	na	na	na	na	na

* Note: figures may not sum to 100 because of rounding

Table 2.4 Laboratory Ratings of Effectiveness Criteria

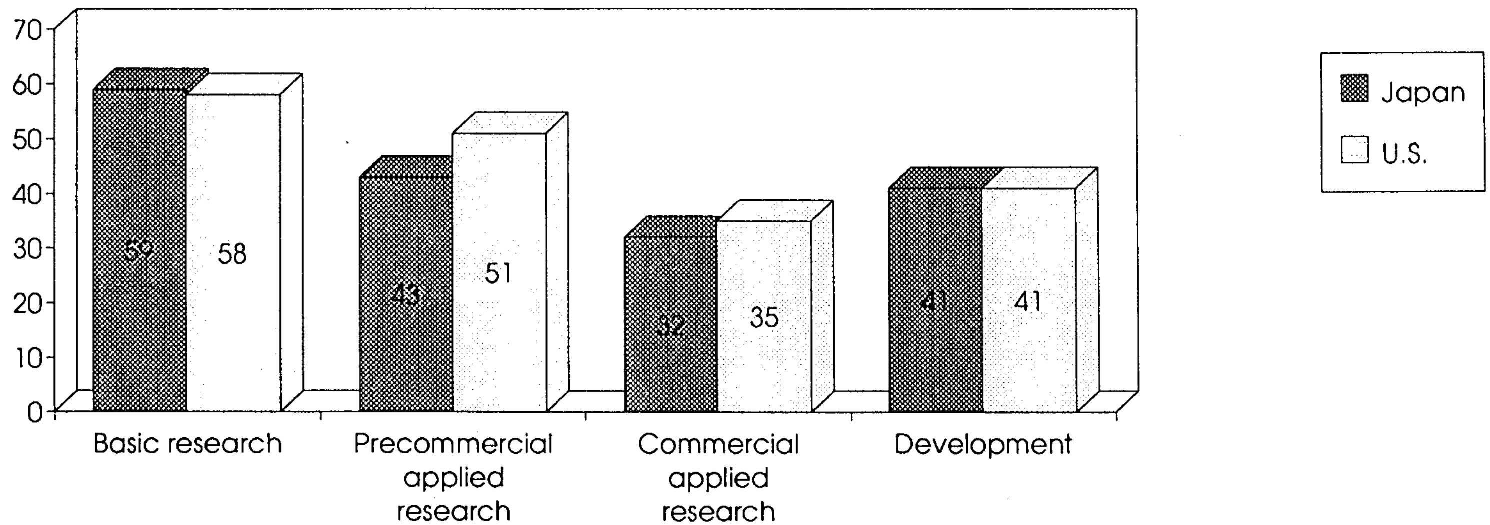
Criteria/Country	Percentage of labs indicating criteria is --- Single Most Important	Important	Somewhat Important	Not a Criterion
Advancing Scientific Knowledge				
Japan	41	41	16	2
U.S.	32	45	17	5
Producing commercially useful knowledge				
Japan	32	37	18	13
U.S.	15	40	28	18
Meeting needs of a constituent group				
Japan	15	23	27	35
U.S.	30	33	18	20
Increasing lab resources				
Japan	8	41	26	24
U.S.	2	26	45	27

*Note: figures may not sum to 100 because of rounding.

TABLE 2.5 Lab R&D Output Activities

Type of output	Average amount of time spent U.S.	Japan
Published articles and books	41	39%
Reports for internal use	14	16
Reports for external use	NA	7
Papers for external conferences	13	15
Patents and licenses	3	4
Algorithms and software	7	6
Prototypes and materials	8	7
Demonstration devices	5	3
Other products	4	3

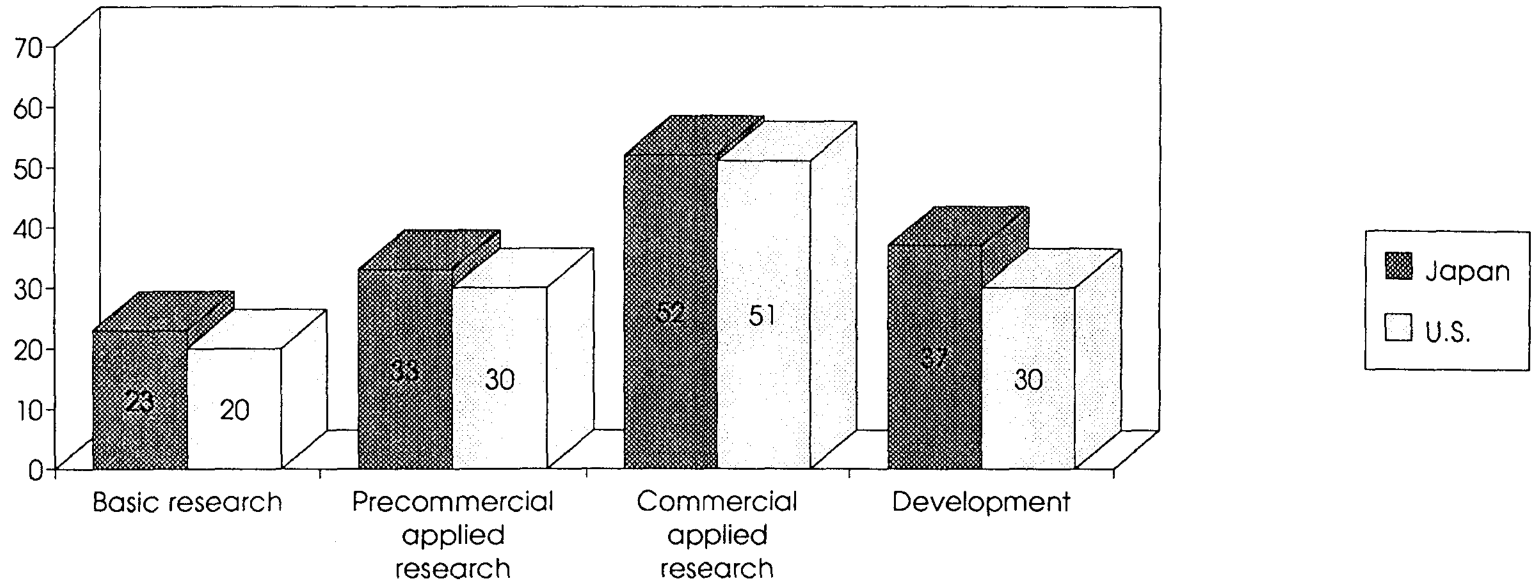
Figure 2-1: Percentage of labs indicating R&D mission as highly important*



* Labs rating the mission as singlemost important or important.

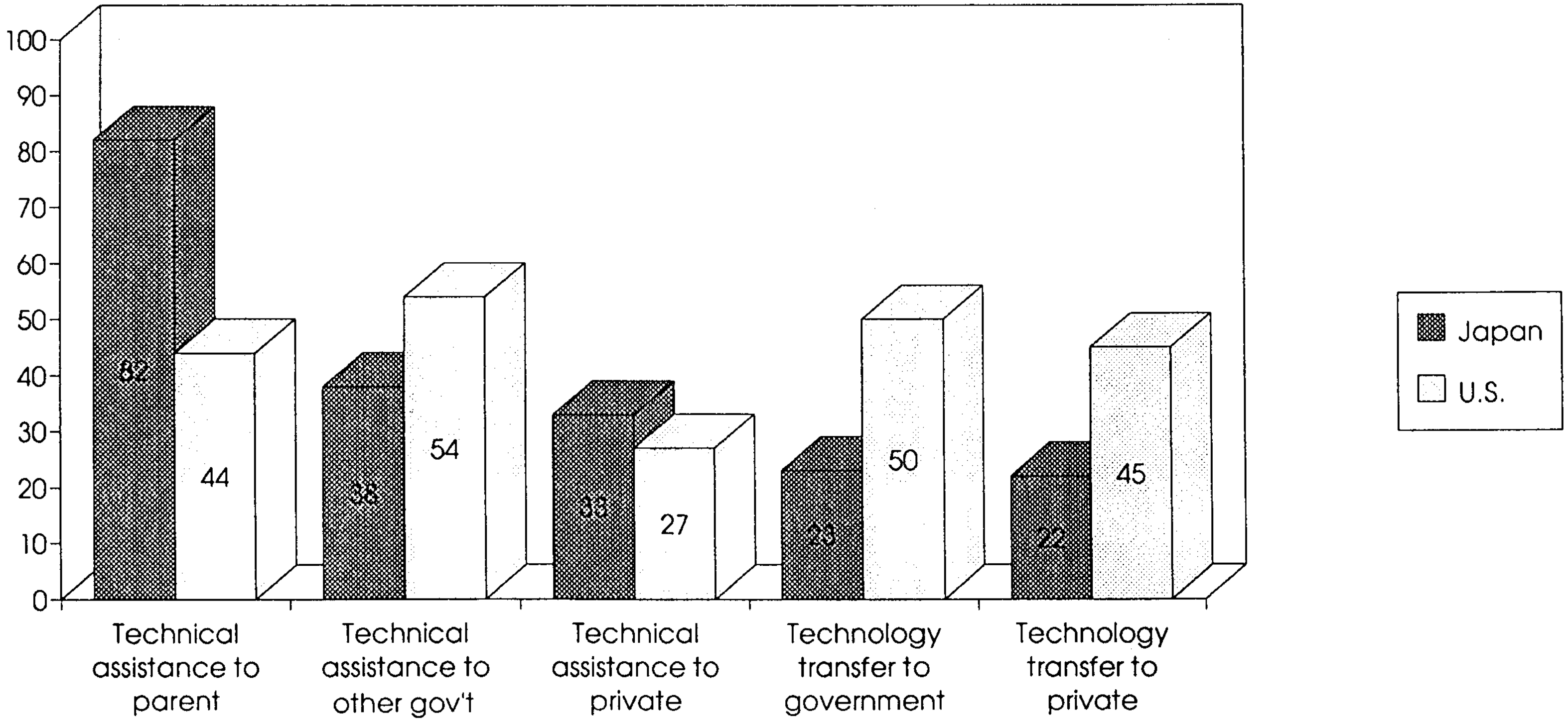
Source: Table 2.

Figure 2-2: Percentage of labs indicating R&D mission of little or no importance



Source: Table 2

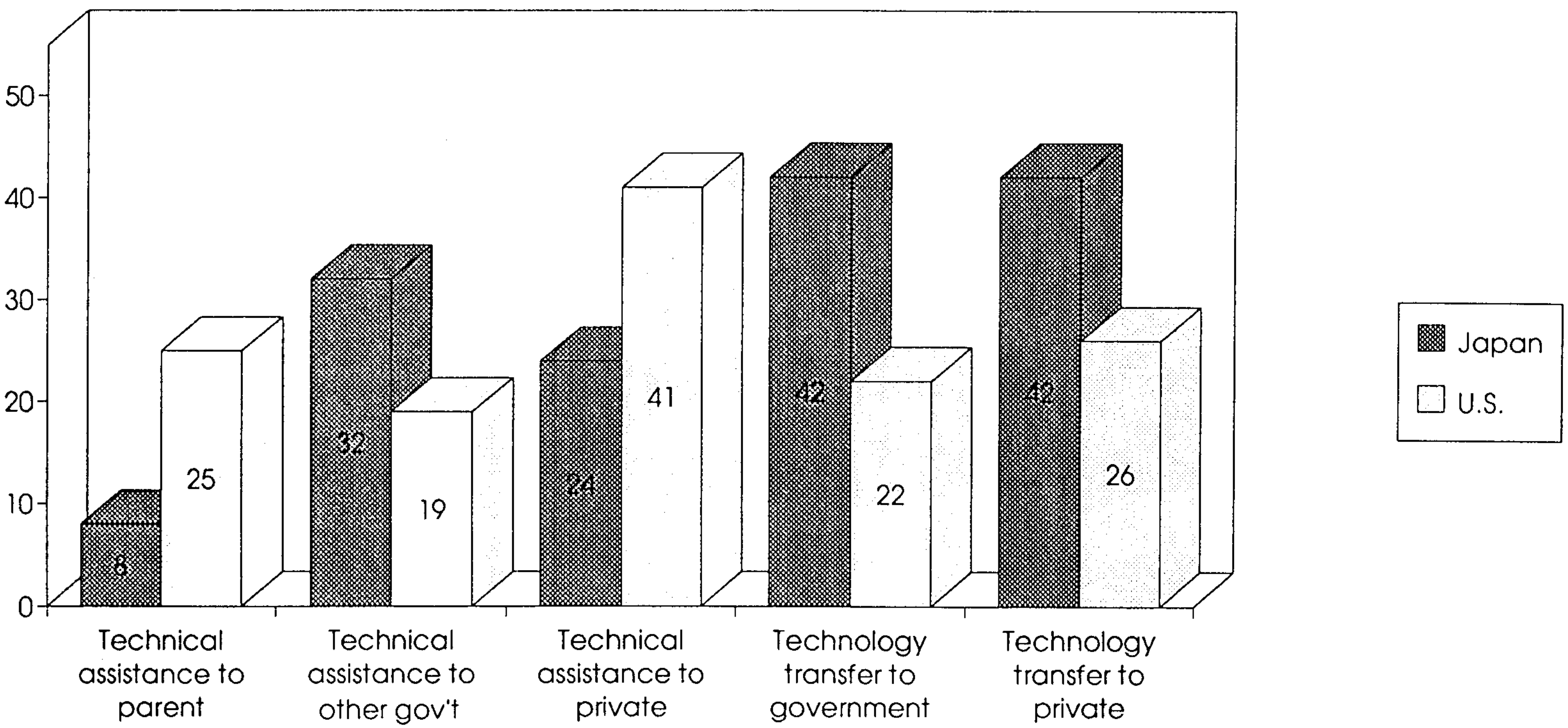
Figure 2-3: Percentage of labs indicating technical missions as highly important*



*Labs rating the mission as singlemost important or important

Source: Table 2

Figure 2-4: Percentage of labs indicating technical missions of little or no importance



Source: Table 2

Figure 2-5: Mission complexity of government labs

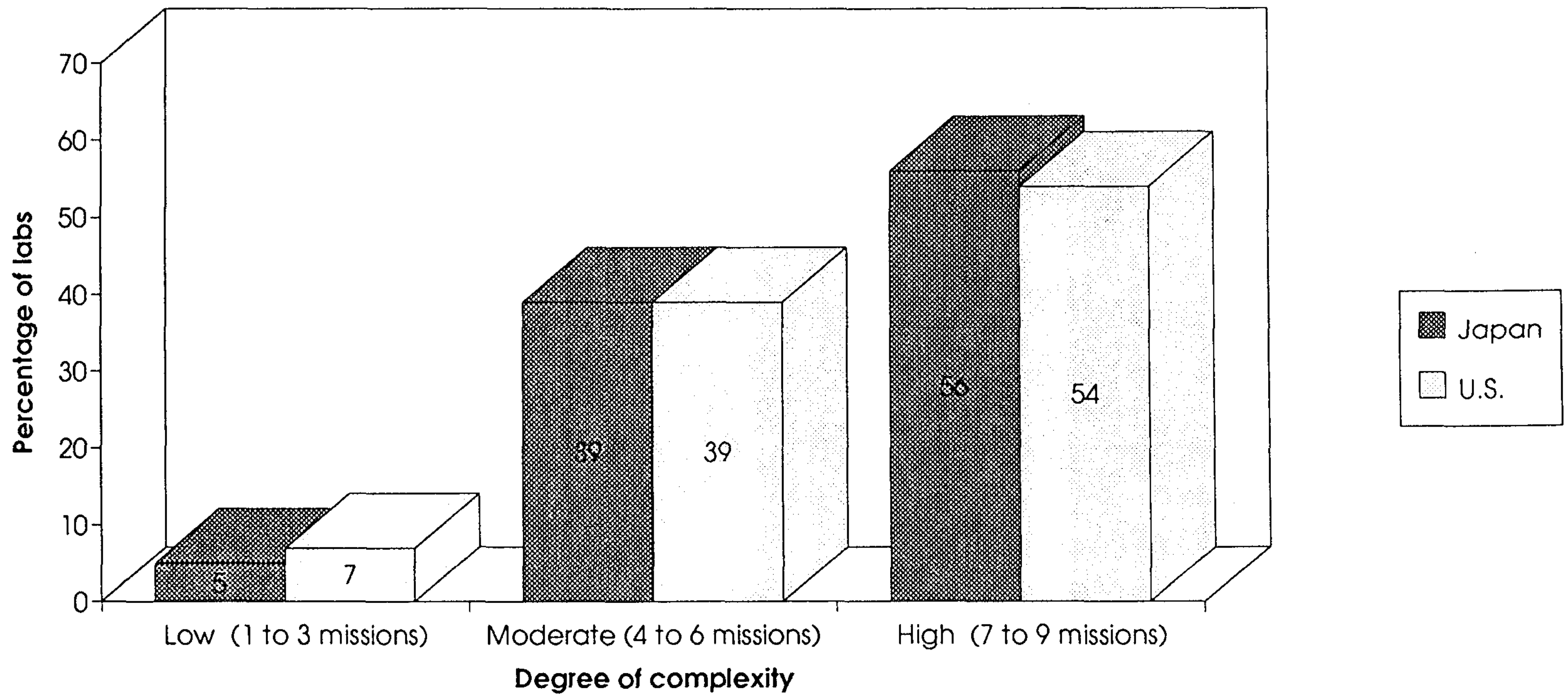
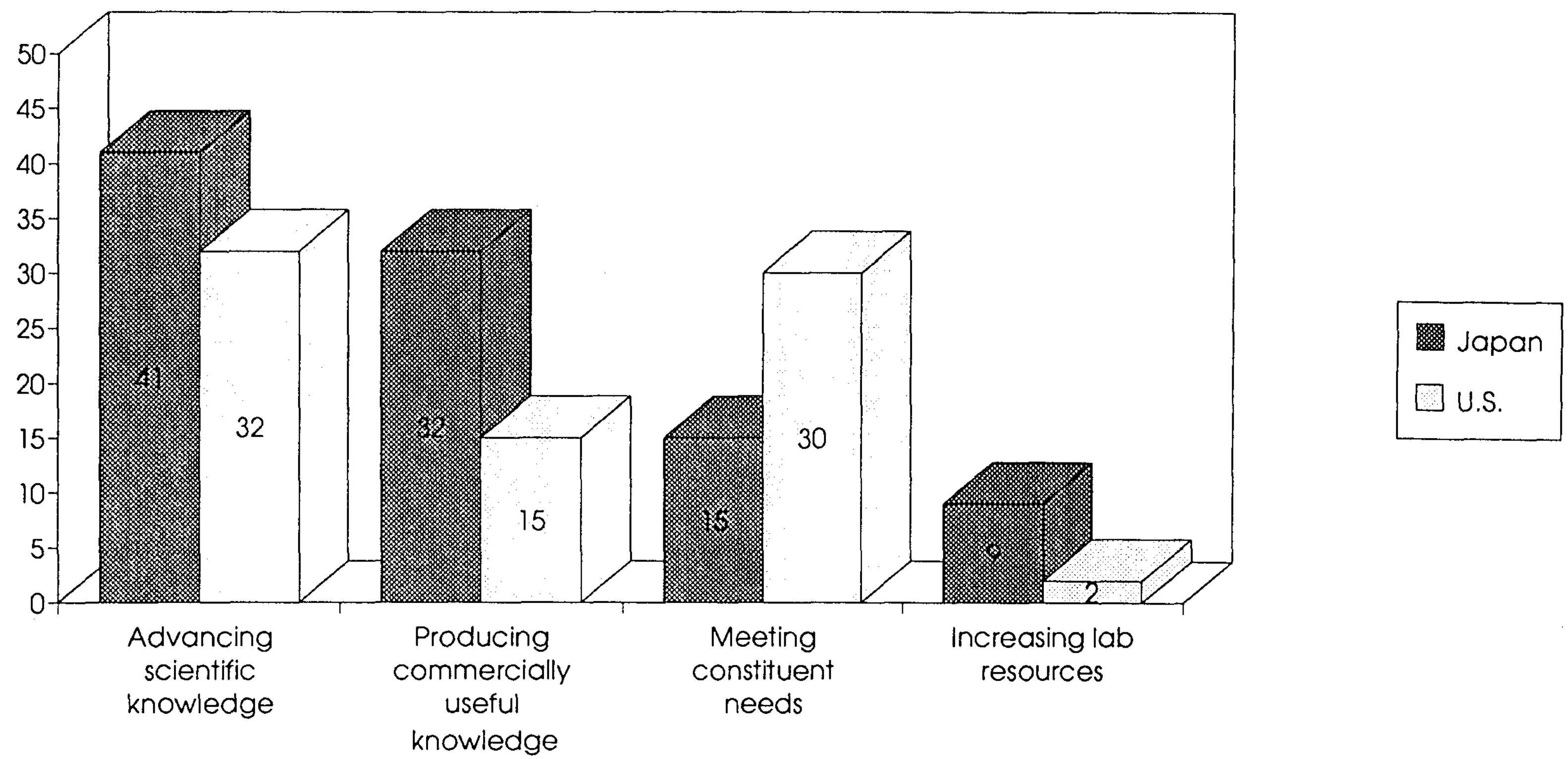


Figure 2-6: Singlemost important lab effectiveness criteria



CHAPTER 3

The Organizational and Research Settings

Internal organizational environments have a pronounced influence on the performance of institutions. Organizational cultures, structures, personnel ratios, and procedures all subtly shape the creativity, productivity, and flexibility of the organization. Major predeterminants of these factors are the institution's size and level of funding, both of which are primary forces on such elements as the availability of slack resources, autonomy of personnel, and degree of bureaucratization. The findings from the laboratory surveys indicate that in many major respects, the organizational and research settings for Japanese and U.S. government labs are essentially the same. The labs tend to be of moderate size, highly decentralized, supportive of research autonomy, and not appreciably different in their levels of bureaucratization or red tape. This suggests that government-performed R&D in Japan and the U.S. proceeds with comparable levels of independence and without undue managerial interference or bureaucratic constraint.

However, Japanese labs are financially constrained in a way that those in the U.S. are not, a limitation that shows up in other aspects of lab operations. Japanese laboratories, while only about 20 percent smaller than their U.S. counterparts in median size, receive the equivalent of just one-half the U.S. median budget. On a per capita basis, Japanese labs receive two-thirds the U.S. budget equivalent per employee. While some allowances must be made for the lower personnel costs in Japan, it seems undeniable that U.S. labs are a bit more "flush" in their financial resources.

The relatively more constrained resource environment shows up in the Japanese data in a number of ways. For example, Japanese labs have much higher researcher-to-total-employee ratios, indicating that administrative and support staff have been streamlined in the face of scarce resources. Strong perceptions of research autonomy are lower in Japan, and Japanese labs evidence more variety in the way their research is organized. Both of these features suggest that research management may be slightly more intense in Japan, probably by virtue of the resource environment--in none of the laboratory interviews did directors or research planners indicate that there was any need to supervise the science or research itself. Finally, Japanese labs reflect notable differences in the amount of time it takes to receive approval for hiring full-time employees and purchasing high-cost equipment, reinforcing impressions of a very tight financial setting.

Size and Hierarchy

Organizational size influences performance in a variety of ways. As institutions become bigger, they add levels of hierarchy and bureacratization tends to expand. The larger an organization becomes, the more administrative procedure and management are required to effectively coordinate work. For R&D labs, large size can be problematic, since bureaucracy can readily become a counterproductive influence on scientific research.

The sizes of Japanese and U.S. laboratories range widely, from 3 to over 2,800 full-time workers in Japan, and from 4 to 8,000 in the United States. In general, the government laboratory system in Japan is distinguished by a higher concentration of laboratories in the medium size range; just over half of all Japanese labs have between 100 and 500 total personnel (Figure 3-1). Only 43 percent of the U.S. labs are of comparable size, while 15 percent have more than 1,000 full-time employees. These "superlabs"--those with over 1,000 workers--are a key feature of the U.S. system, with only 1 percent of the Japanese labs falling in the same range. This substantially bigger superlab population accounts for the larger median size of the U.S. government labs, 175 full-time employees compared to 143 in Japan.

Allowing for the largeness of many labs in both systems, they are not overly hierarchical, and in fact are quite "flat." Japanese and U.S. government labs are highly decentralized, with the substantial majority of labs in each country having none to only one administrative level between their senior bench scientists and the laboratory director (Figure 3-5). U.S. labs tend to reflect more hierarchy, since 21 percent of the labs report that three or more levels exist between their senior scientists and the director, compared to only 15 percent in Japan. Given the general tendency for U.S. labs to be larger (in some cases significantly so), it is unlikely that these higher levels of centralization reflect anything other than the hierarchical differentiation that typically accompanies organizational size.

Based on impressions from size and hierarchy alone, we would not expect any great disparity in the structural influences on organizational performance in Japan or the United States. While there are extremely small and large labs in both systems, the majority of laboratories fall into the moderate size range. And it would seem that the research nature of the labs is taken into account in their organizational designs, since there are few, if any, administrative levels between the scientists and the director. Japanese and U.S. labs exhibit the high degree of decentralization that one would expect in a professionalized research enterprise. As a consequence, it is likely that the negative bureaucratic impacts on research that accompany size have been diminished by minimizing the number of management layers.

Financial and Human Resources

Larger size tends to create more administration and management, often perceived as a negative organizational feature. It also tends to bring the benefit of more resources, especially slack resources. All other things being equal, laboratories of similar size should have similar capacities to identify and use unspent funds or move underutilized personnel to more productive tasks. It does not appear, however, that all other things are equal: Japanese labs have fewer financial resources and probably less personnel flexibility that their U.S. counterparts.

Japanese government laboratories seem relatively "poorer" than those in the United States. In FY 1991, Japanese lab budgets ranged from ¥16 to ¥132,000 million, with a median value of ¥1,000 million per laboratory (U.S. $5.2 million) and ¥7.4 million per employee (U.S. $38,163).[1] U.S. lab budgets for FY 1989 ranged from $100,000 to $1 billion, with a median of $10 million per lab and $57,557 per employee. These rather large differentials in median laboratory and employee expenditure can be somewhat accounted for by the lower professional salaries in Japan (the bulk of R&D costs in both countries are personnel expenses) and the larger median size of U.S. labs. Even so, these budget disparities are greater than what we would expect to see based on size and employment levels.

U.S labs may be marginally more affluent because they are less dependent on a single source of revenues. The mission data in Chapter 2 indicated that Japanese labs were far more likely to provide research support predominantly to their parent agency, while U.S. labs tended to service government agencies other than their parent. This difference in external organizational focus is quite apparent in the funding patterns: much lower proportions of U.S. labs get large shares of their budgets through direct parental appropriations. For example, 58 percent of all Japanese labs receive 90 percent or more of their budgets through direct appropriations, contrasted to 46 percent in the U.S. (Table 3-1). While 82 percent of Japanese labs received more than three-quarters of their budgets directly from their parent, only 59 percent of the U.S. labs did so. Not surprisingly, U.S. labs have higher shares of their budgets from government contracts and grants: a quarter of U.S. labs receive more than 33 percent of their budgets through grants and contracts, compared to only 5 percent of the labs in Japan.

Nor do Japanese labs significantly leverage their budgets through industrial funds. In neither country can the private sector directly fund a laboratory, but when joint industry-government research is conducted, industry may pay fees or contribute its share of total research costs. In spite of the seemingly higher

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[1]Yen were converted to U.S. dollars using OECD purchasing power parities.

sensitivity of the Japanese lab missions to commercial objectives and needs, U.S. labs are the ones which reflect higher shares of industry R&D funds. Essentially all Japanese labs receive less than 10 percent of their budgets from industrial sources, and the vast majority (69 percent) get no such funds at all (Table 3-1). In the United States, 15 percent of the labs receive anywhere from 10 to 33 percent of their monies from industry, and 2 percent get more than a third of their R&D budgets from private sources. This does not necessarily represent more joint research in the U.S. or more successful leveraging; it could simply reflect relatively more expensive joint projects or the different funding arrangements of the government-owned, contractor-operated (GOCO) labs unique to the United States. To keep this dimension of industrial funding in perspective for the U.S., note that over 80 percent of the U.S. labs receive the equivalent of 10 percent or less of their budgets from industry.

For reasons that are not entirely clear, Japan has far higher concentrations of researchers in its labs relative to the United States. The average number of research professionals (including technicians) per 100 employees is substantially larger in Japan, 81 professionals per 100 total full-time employees compared to 63 in the United States. For 85 percent of the Japanese labs, this ratio is 66 or more per 100 contrasted to only 46 percent of U.S. labs (Figure 3-2). In most of Japan's government labs, there appears to be very little, if any, in the way of slack personnel resources. Professional staff outnumber all others on a 4-to-1 basis, suggesting that levels of related support staff--administrative, clerical, custodial, and so forth--have been streamlined to a minimum in the face of both tight budgets and personnel ceilings.[2]

Research Organization and Autonomy

The organization of research in Japanese labs and perceptions of research autonomy modestly reflect this scarce resource environment. Japan's labs use a wider array of research practices, especially departmental research organization and ad hoc approaches to the conduct of research. Japanese lab directors are also somewhat less enthusiastic in their perceptions that their scientists have a great deal of work autonomy. Although Japanese labs are in fact quite "individualistic" and supportive of research autonomy, hints of constraint exist.

In both Japan and the United States, "principal investigator" research is a

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[2]Japanese government labs have had fixed personnel limits for several years. Any increases in the total number of full-time employees must be negotiated with the lab's parent agency or ministry. For many labs, their personnel allocations have been systematically cut over the past decade.

dominant organizational characteristic. Over 60 percent of the U.S. labs reported that their research was organized by principal investigator-led groups; 70 percent of the Japanese labs indicated that research performed by single individuals was a primary laboratory practice (Figure 3-3).[3] Yet much larger numbers of Japanese laboratories also reported that research organized by departments, divisions, or branches was a primary organizational practice, 80 percent compared to half of the U.S. labs. Ad hoc approaches were also prominently featured, with 40 percent of Japan's labs indicating that they based decisions about research organization on the needs of specific projects. As seen in Figure 3-3, far fewer U.S. labs indicated either departmental or ad hoc determinations about research organization as typical lab practices.

In short, larger proportions of Japanese labs indicated their use of multiple research organization approaches than did U.S. labs. This may reflect more subtle differences in U.S. and Japanese organizational and management styles, since departmental orientations are thought to be stronger in Japan than in the United States. On the other hand, the diversity of practice in organizing research could reflect efforts to ensure more effective R&D: when funds are tight, department-based research projects can be more efficient. In any event, higher levels of ad hoc decisions and departmentally- (or divisionally-) based projects imply that higher levels of managerial attentiveness and supervision exist.

The extensive coexistence of both individual scientist and department-based research projects within Japanese labs may, in turn, account for their lower rates of perceived research autonomy. Laboratory directors were asked to rate the extent to which they agreed or disagreed that scientists and professionals working in their laboratories have a great deal of autonomy in their work; two-thirds of the Japanese laboratory directors did in fact agree that their scientists have such autonomy (Figure 3-4). Yet when compared to the U.S. responses, far fewer of Japan's directors *strongly agreed* with this statement--17 percent compared to 32 percent in the United States. And slightly more of the Japanese lab directors indicated that they disagreed with this statement (17 percent) compared to those in the United States (13 percent). Altogether, nearly one-fifth of the Japanese lab directors disagreed or strongly disagreed with the idea that their scientists have a great deal of work autonomy compared with 14 percent in the United States.

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[3]A difference in the U.S. and Japanese versions of the lab surveys makes it difficult to determine to what degree the U.S. relies on research conducted by single individuals as opposed to principal-investigator led groups. Research conducted by individuals working alone was not an item in the U.S. survey.

Bureaucratization and Red Tape

Closely related to issues of size, the organization of research, and research autonomy are bureaucratization and red tape. Of concern is the degree to which laboratory structures, procedures, and decision-making constrain or enhance the research enterprise. As discussed earlier, Japanese and U.S. laboratories reflect almost comparable degrees of decentralization, suggesting that some effort has been made to keep administrative procedure and decision-making limited. Measures of bureaucratization used in the lab surveys--estimates of the length of time to receive approval for various routine management requests--reflect a number of similarities and key differences in Japanese and U.S. labs. However, the degree to which lab directors perceive their administrative procedure as "red tape" is roughly the same in each country.

With a few exceptions which are readily explainable, the average amount of time it takes to get approval of routine management requests in both countries is essentially the same. Regarding such decisions as hiring personnel, purchasing equipment, and disseminating research results, there are few major differences between U.S. and Japanese labs. On average, most requests are approved in less than 6 weeks, and in less than 3 weeks for hiring part-time or purchasing low-cost equipment (Figure 3-6).

Three distinctions bear discussion. The first is the significant difference in the amount of time required for approval to hire a full-time employee in Japan (3-6 months contrasted to 3-6 weeks in the United States). Japanese government laboratories have been under employment ceilings for the past several years, and in some cases reductions-in-force have been imposed. Changing the total number of full-time personnel in any given laboratory is difficult, and typically involves negotiations with the parent ministry or agency. Moreover, routine retirements and other predictable losses of employees are anticipated and accounted for in the previous year's budget cycle, when personnel quota are negotiated. When a lab is allowed to hire only 2 or 3 professionals per year (if any), such decisions are not taken lightly and weighed against the staffing needs of the entire laboratory.

Similar constraints influence the amount of time it takes to get approval to buy high-cost equipment (more than ¥1 million, or $5,000). On average, the Japanese labs required an additional 3 weeks to obtain approval of such requests compared to the United States, a difference that is accentuated by noting that the equivalent amount for "high-cost" equipment in the U.S. lab survey was $10,000. Generally, it takes Japanese labs longer to get approval for equipment at lower organizational thresholds of "high cost." This, again, is not remarkable when the budgetary environment of the Japanese labs is taken into account. As with personnel, most laboratory budgets have been "no growth" for the better part of several years; expensive equipment purchases are by no means routine decisions.

The third interesting difference is the amount of time it takes to get approval for submitting research for publication. It takes U.S. labs longer to get such requests approved, on average 3-6 weeks compared to 1-3 weeks in Japan (Figure 3-6). Importantly, 20 percent of the Japanese labs reported that no such approval was even necessary, contrasted to only 6 percent of the labs in the United States. While extreme delay (more than 3 months) in approving research for publication was not common in either country (10 percent of the Japanese and U.S. labs reported it took this long), far more U.S. researchers are apparently subjected to longer periods of approval time in getting their research findings out the door for publication. This may, perhaps, be partially accounted for by the large number of defense and nuclear energy laboratories in the U.S. government lab system, where one would expect both caution and national security constraints to govern dissemination decisions. *However,* as seen in Figure 3-6, it does *not* take U.S. researchers any longer to receive approval for circulating results out of the laboratory than their Japanese counterparts, suggesting that there are real distinctions between the U.S. and Japan in how research for publication is treated.

Finally, one last key difference emerged in the approval data. Both Japanese and U.S. labs were asked to report how long it took to receive approval to terminate an employee. Seventy-eight percent of the Japanese labs indicated that such requests were never made. For the remainder, the average time was 6-9 weeks, although 25 percent of the labs indicated it took longer than 6 months to receive such approval. The nonresponse rate for this question on the U.S. survey was quite high (28 percent of the labs provided no answer), which may be taken as some indication that it was not an easy or even relevant question to answer. The average length of time it took to receive approval for terminating an employee in a U.S. lab was 9-12 weeks, but this average is somewhat misleading; 40 percent of the labs reported that it took over 6 months to receive such approval.

Related to the issue of administrative approval is the notion of "red tape," the perception that bureaucratic procedures are somehow slowing things down to an unreasonable rate. The degree to which red tape is perceived as a laboratory barrier to productivity is reviewed in the next chapter, but it is important to note here that neither the Japanese or U.S. labs see themselves as unusually bureaucratic. When asked whether they thought there was more bureaucracy in their labs slowing things down than other labs they knew about, three-quarters of the lab directors in Japan and the U.S. disagreed or strongly disagreed with this statement (Figure 3-7). Nevertheless, about one-quarter agreed with it in some fashion, indicating that, for at least a small portion of labs, a salient atmosphere of bureaucratic constraint, or red tape, must exist.

Conclusions

The structural profile of organizational context in the Japanese government laboratories is a positive one. If we assume that the U.S. culture represents the archetype of how to conduct autonomous and independent research, and that its organizational characteristics reflect such, then Japan is not measurably different. The survey data indicate that Japanese laboratories are very individual-oriented in the organization of their research, and that research proceeds in a highly decentralized management environment, is quite autonomous, and with apparently few (if any) administrative restrictions on research publication. Except for those elements relating to constrained resources, Japanese bureaucratic procedures are neither excessively longer nor excessively less that those in U.S. laboratories. The data do not suggest that the Japanese labs are appreciably over- or under-managed relative to the United States, or that information dissemination is any more restricted. In this respect, the dissemination of knowledge may be more open in Japan than the United States.

Indications of organizational difficulty exist, however. Money and people are tight. The Japanese labs receive notably fewer financial resources than their U.S. counterparts, even allowing for average differences in laboratory size and lower personnel costs in Japan. Budgets and personnel have been "frozen" for several years, and the much higher concentration of researchers-to-total employees in Japan suggests that all of the resource slack has been used up in the labs. Resource constraints show up in the much longer time required to hire full-time personnel, and in the slightly longer (but much lower threshold of cost) delay in approving expensive equipment purchases. It is also possible that limitations on finances and personnel have resulted in slightly higher levels of research management in Japan (reflected by the greater presence of departmental and ad hoc research organization), which in turn affects the degree of research autonomy.

Because of these factors and characteristics, the Japanese labs may be at the limits of their adaptability to new policy mandates. Virtually all of the lab directors and research managers interviewed indicated that the pressures to intensify creative basic research in the labs were real. These new directives are also accompanied by requests to expand the substantive scope of laboratory research missions; that is, to widen the scientific subject matter and/or technological focus of the R&D. The labs are under increasing ministerial guidance to move to creative research frontiers in a broader scope of R&D.

Without the resources to accomplish these new laboratory requirements, the quality of the existing R&D can be stressed and achieving the new goals can be problematic. When resources are tight, organizations typically become risk-averse and pursue the familiar. In the R&D setting, this means that research which is better understood and has higher levels of expected outcome are preferred. These characteristics are, however, completely contrary to those of high-risk, world-class, frontier basic science. Similarly, scarce resources can result in higher levels of management, which also runs counter to the belief that quality science must take place in a reasonably autonomous research environment. For the Japanese government labs, the trade-off between resources and research uncertainty and autonomy places considerable responsibility on lab managers and leadership. To offset the counterproductive resource pressures, a culture of research indivuality and a high tolerance for research risk must be promoted.

Table 3-1. Sources of laboratory funds

	Percentage of labs	
Source/Share	Japan	United States
Direct government appropriations as share of total budget:		
more than 90%	58	46
more than 75%	82	59
more than 50%	93	70
more than 25%	96	83
Contracts & grants from government as share of total budget:		
no share	17	22
1 to 10%	51	35
10 to 33%	27	19
more than 33%	5	25
Contracts & grants from private industry as share of total budget:		
no share	69	51
1 to 10%	30	32
10 to 33%	1	15
more than 33%	0	2

*Note: figures may not sum to 100 because of rounding.

Figure 3-1: Distribution of government laboratories by size

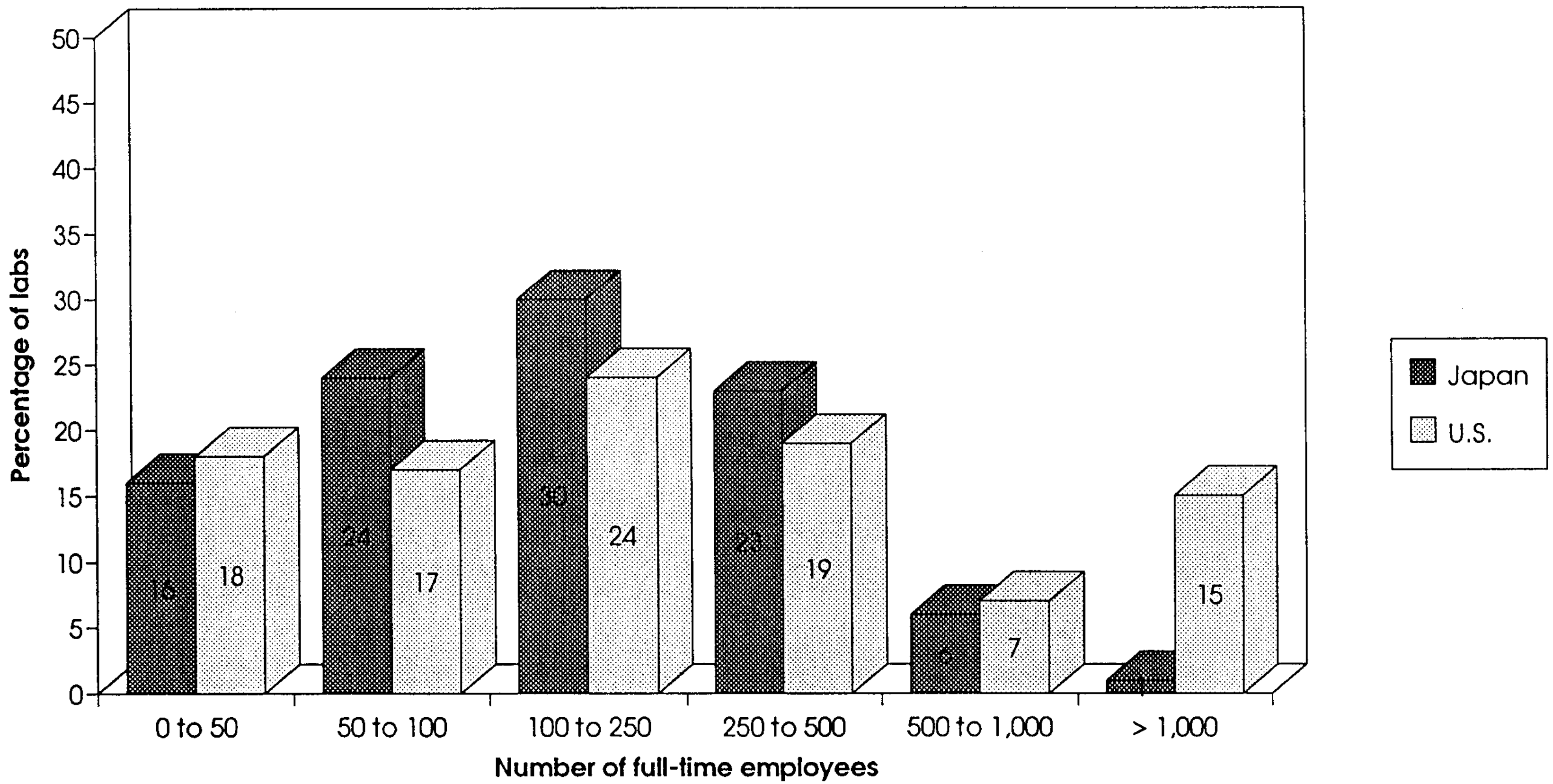


Figure 3-2: Laboratory intensities of research personnel

Figure 3-3: The organization of research

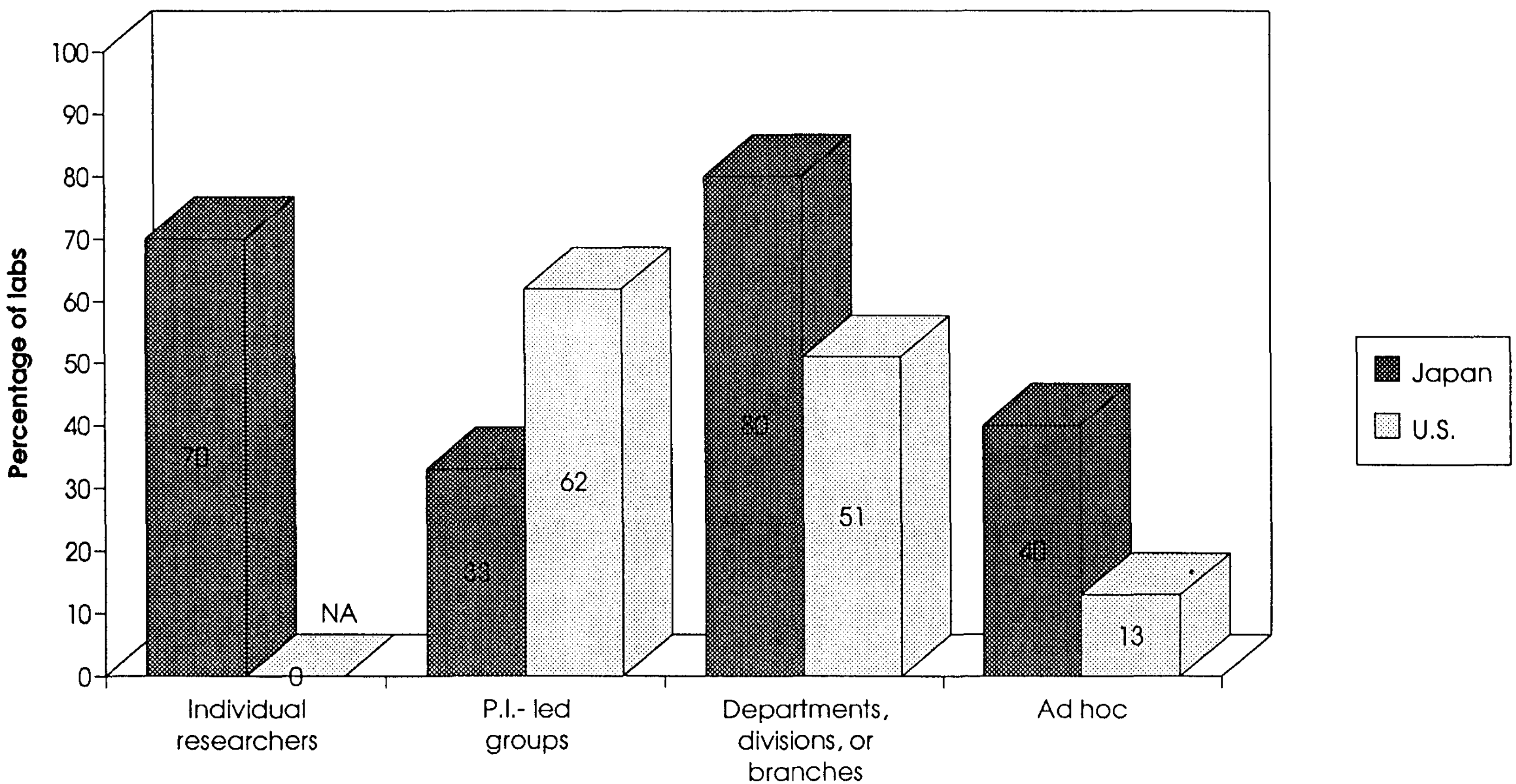


Figure 3-4: Degree of researchers' work autonomy

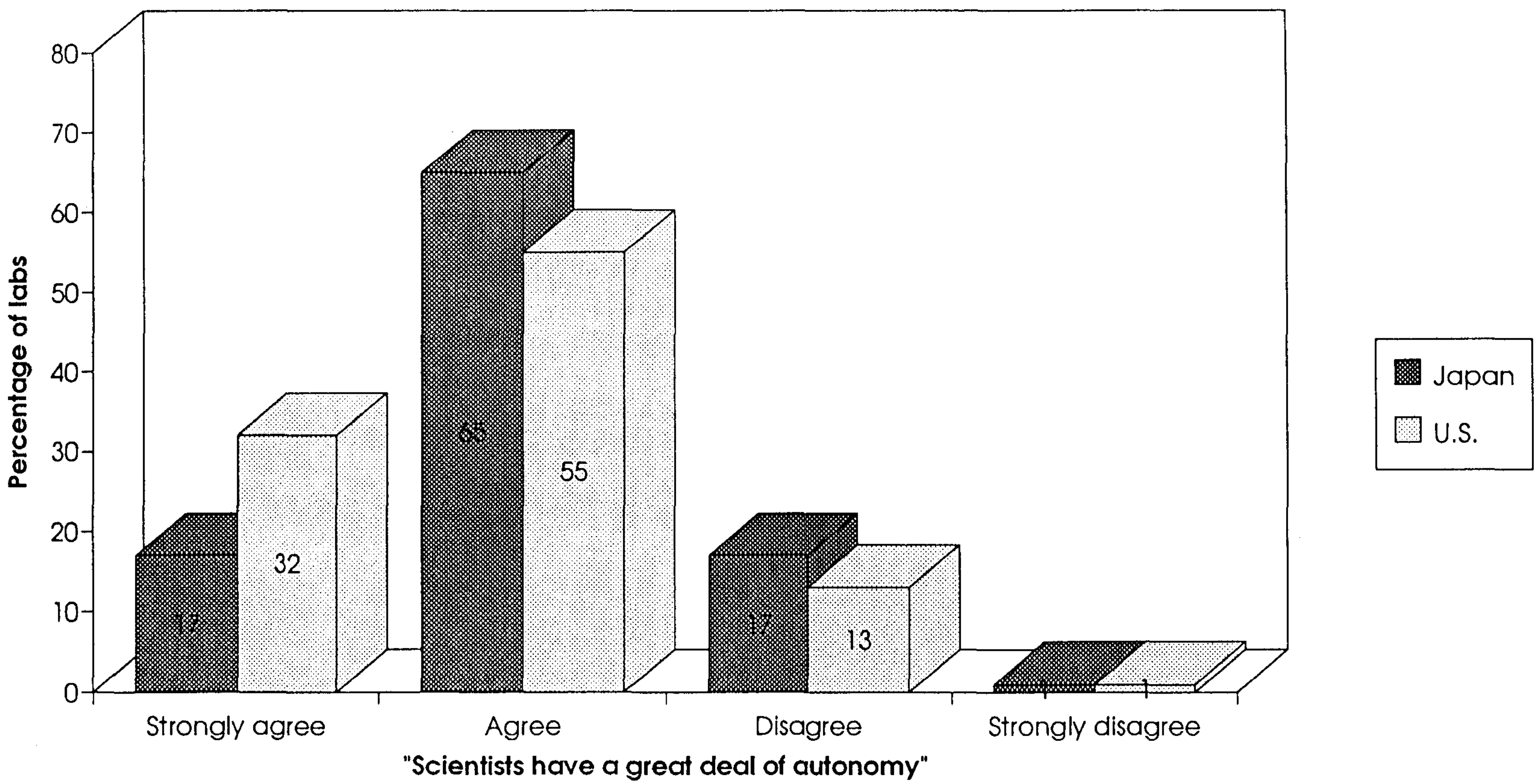


Figure 3-5: Number of administrative levels between senior bench scientists and lab director

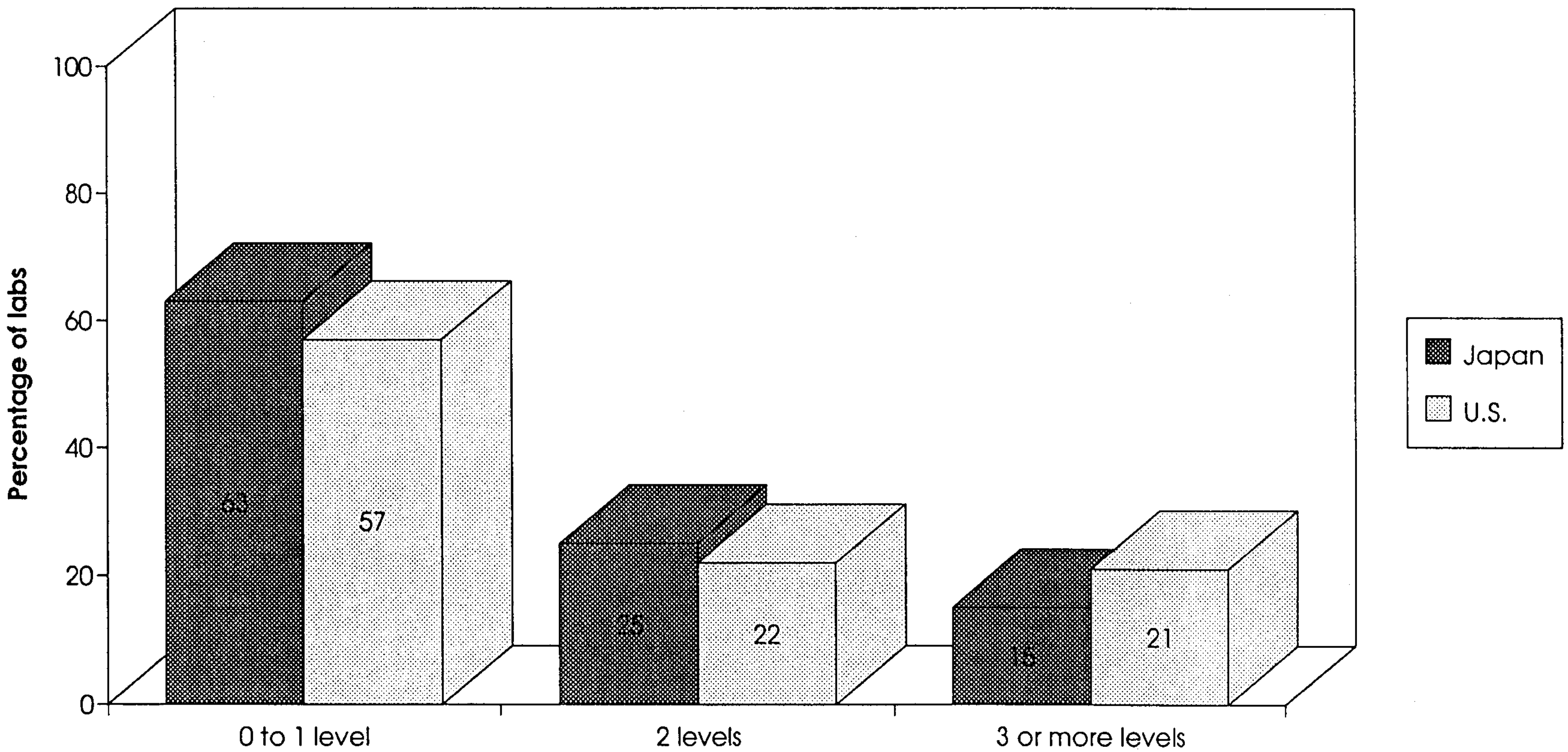


Figure 3-6: Average time required for approval of management requests

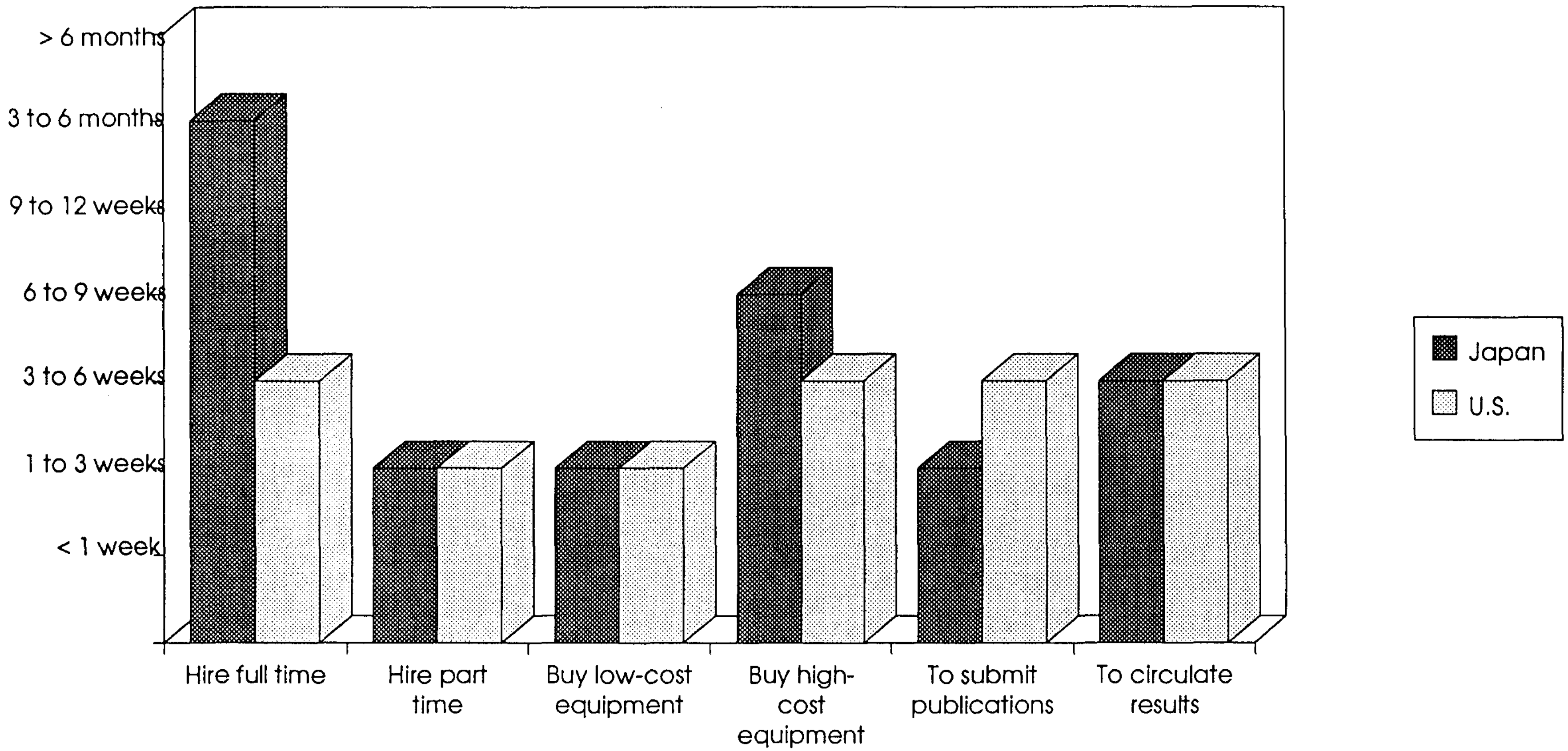
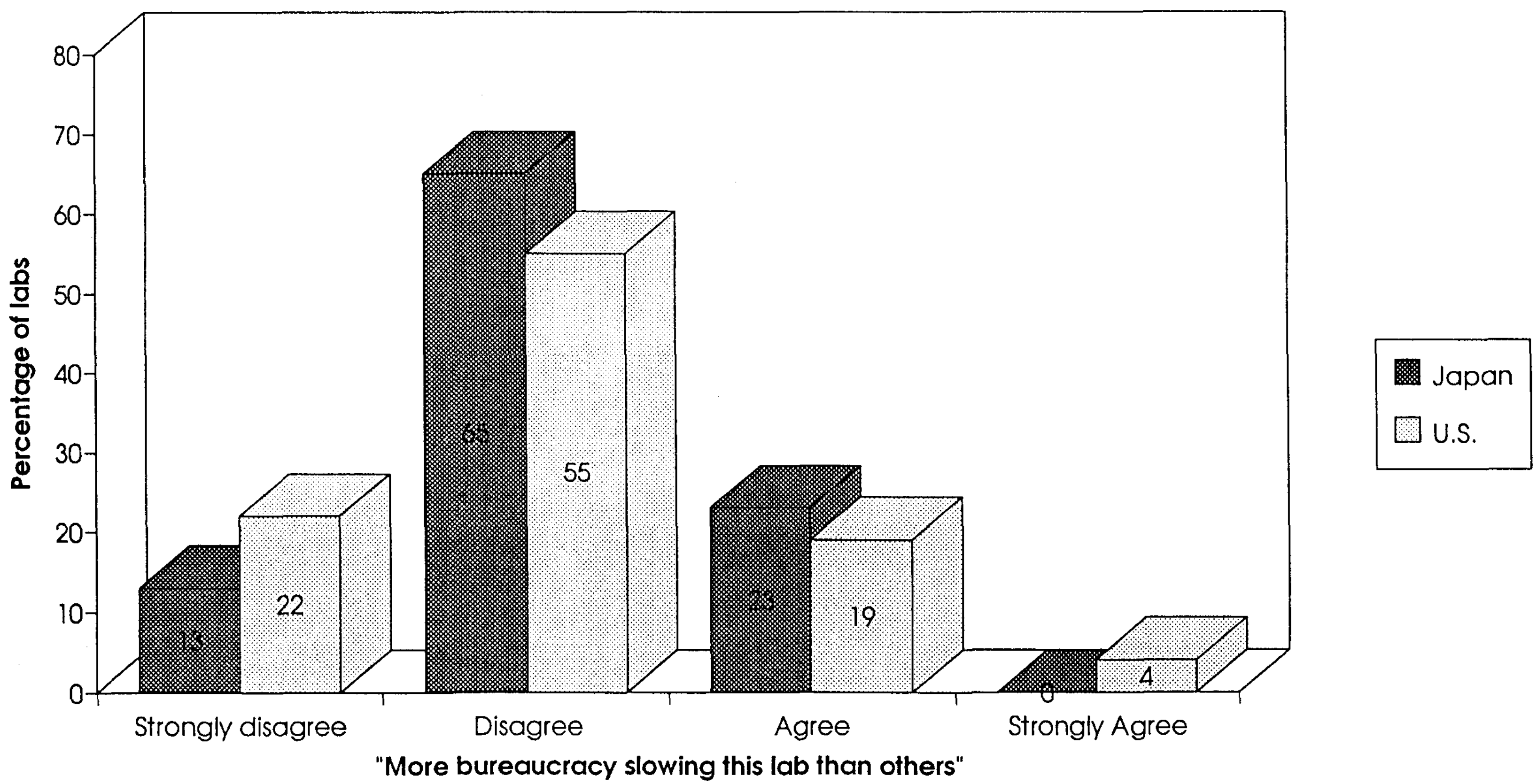


Figure 3-7: Degree of laboratory red tape



CHAPTER 4

Management and Personnel Issues

Several kinds of personnel and management issues are relevant to the Japanese policy concern regarding the stimulation of creative basic science. The first relates to the general obstacles to R&D productivity in the laboratory; the second to bringing in and keeping new researchers; and the third to factors which affect the selection of R&D projects in the lab.

The survey data strongly indicate that the single most important constraint affecting the performance of Japanese government labs is resources, particularly human resources. This is certainly evident in the previous chapters, and it is again so here. Nearly three-quarters of the laboratory directors indicated that insufficient scientific and technical personnel or support staff was the most significant barrier to productivity in their laboratory. And there is little sign that this inadequacy is being addressed: on average, most labs hire 6 or fewer new researchers per year, and these primarily as senior researchers retire. While most labs believe that their laboratory environment is of high enough quality to attract top researchers, a large proportion do not. About 30 percent of the lab directors did not think their labs could attract top researchers, and this may also be reflected in the fact that nearly 20 percent of all researchers leaving the laboratories over the past three years were in the youngest age group (30-39 years of age). Somewhat suprisingly, given common assumptions about "industrial policy" in Japan and the strong role of administrative guidance, Japanese labs were less sensitive than their U.S. counterparts with regard to the influence of government policy and commercial interests in R&D project selection.

Barriers to Productivity and Efficiency

Laboratory directors were asked to rate barriers to achieving maximum R&D productivity. The greatest barrier to Japanese laboratories as a whole was not having enough trained scientific and technical personnel. Fifty-two percent of laboratory directors reported this as the most important barrier, while an additional 28 percent rated it as a very important one (table 4.1). Two other major obstacles were insufficient government R&D funding and insufficient support staff. Insufficient government R&D funding was the most important barrier to 25 percent of the laboratories; insufficient support staff was the most significant barrier to productivity for 19 percent of the labs.

Inadequate government R&D funding was a widespread barrier to productivity among U.S. government R&D laboratories: fifty-two percent of the lab directors indicated that this was the most important barrier (table 4.1). The second major obstacle was not having enough trained scientific and technical personnel; 10 percent viewed this as the most important barrier to lab productivity.

Neither the Japanese or U.S. labs viewed such factors as the inability to keep up with changing scientific and technical knowledge, a focus on short-run commercial objectives, insufficient computing capacity, or government regulations as problematic barriers to lab productivity. Very small proportions of labs (if any) rated these as the most important obstacles, and few even saw them as very important ones. Interestingly, the U.S. labs are much more sensitive to red tape and paperwork concerns as they affect the lab: much larger proportions of U.S. labs tended to view such administrative activity as a very important barrier to productivity than Japanese laboratories.

Special Japanese Personnel Concerns

Several factors regarding personnel mobility and retention are of special concern to Japanese science policymakers. At issue is primarily the ability of the laboratories to attract and keep high quality research personnel, especially from the younger cadres. In light of these concerns, a number of questions regarding personnel were asked of the Japanese laboratories. Responses to these questions are not available for the United States since they are unique to the Japanese survey.

Notably, the majority of Japanese laboratory directors believed the laboratory research environment was attractive enough to recruit researchers of high quality--fifty-eight percent responded that they felt their laboratory environment was sufficiently attractive. However, a substantial proportion of directors (30 percent) felt that their lab environments were *not* attractive enough to bring in top researchers, and the remaining 12 percent either didn't know or made other comments (such as it depended on the field of science within the laboratory). On one hand, this is an encouraging perception of the labs, since most do seem to view their environments positively. On the other, there is clearly room for improvement in nearly a third of the government lab population. Given the limited hiring opportunities in most laboratories (see below), the ability to hire quality researchers is a critical factor: labs may bring in only a few people each year, and younger researchers show an unexpected tendency to leave the government labs.

Hiring and Mobility.--Japanese laboratories have hired, on average over the past three years, 6 researchers per year, and a third of the labs hired fewer than 3 researchers per year. These apparently low levels of hiring reinforce the impression of a very constrained research workforce in the government lab system. Moreover, it reflects a limited ability for the labs to bring in fresh perspectives through new researchers.

From all appearances, new researchers are brought to replace normal retirements within the laboratory. In terms of age, the largest proportion of researchers leaving the lab over the past three years were those over 60 years old: on average, 43 percent of researchers leaving the labs were in this age group. The second most common age cohort was the 50-59 year age range (33 percent of those leaving were in this group). The least "mobile" age group was 40-49 years, since only 7 percent of departing researchers fell in this range. And a surprisingly large number of young researchers left the labs. On average, about 17 percent of leaving researchers were aged 30-39 years, and about 10 percent of the labs reported that virtually all of their departing researchers were in this youngest group.

Foreign and visiting researchers.--The 1986 Law for Facilitating Governmental Research Exchange promoted research exchanges with individuals or entities cooperating with Japanese government organizations. Many initiatives during the 1980's by the Prime Minister's Council for Science and Technology and STA also encouraged foreign participation in research in the national research institutes. Japanese R&D laboratories had very few long-term foreign researchers, but most had at least some number of temporary foreign scientists. Eighty-five percent of the labs had no long-term foreign researchers, but a few laboratories (15 percent) did have from one to four regular foreign personnel. Temporary foreign personnel, however, were found in many Japanese R&D laboratories. Sixty-three percent of the labs had at least one foreign researcher, although all but one lab reported 20 or fewer temporary foreign personnel.

Greater cooperation between government, industry, and universities is being encouraged world-wide as a way of improving national innovation systems. In Japan, visiting researchers have been promoted, especially the exchange programs of STA and other cooperative arrangements under programs of the Council for Science and Technology. Most laboratories did not have more than 20 percent of their total personnel visiting from other R&D organizations. Twenty-six percent of the laboratories had no visiting personnel, while two exceptional cases had half or more of their research personnel accounted for by visiting researchers.

Visiting researchers from industry, university, and national regional government laboratories conducted research in respondents' laboratories quite often. Thirty percent of the labs reported that industry researchers visited quite often, 24 percent indicated so for researchers from universities, and 28 percent of the labs indicated frequent visits from regional and local government labs. Occasional visits were most common for university researchers: 61 percent of laboratories had occasional visits from university researchers, 49 percent from industry researchers, 66 percent from government laboratories with same parent agency, and 51 percent from national regional government laboratories.

Influences On Project Selection

Both Japanese and U.S. labs indicated the extent to which they agreed or disagreed that changes in policies of other government organizations and commercial concerns often have a significant effect on their laboratories' selection of research projects. The selection of research projects in Japanese R&D laboratories appears to be more sensitive to influences from government than from the market. Fifty-four percent of the directors strongly agreed or agreed that changes in other government agencies' policies influence their research project selection, while 45 percent disagreed. Only one-fifth of the lab directors felt that assessments of the commercial benefits of their R&D often had a significant effect on the selection of research projects.

Likewise, U.S. R&D laboratories' selections of projects are affected more by changes in government policies than by assessments of the commercial benefits of the R&D unit's output. Sixty-seven percent of U.S. laboratories strongly agreed or agreed that government policy changes affect their selection of projects, while only 37 percent indicated that commercial assessments of outputs affected selection of research projects. Even so, it appears that U.S. labs are generally more sensitive to external considerations when developing their research agendas, since much higher proportions of U.S. labs agreed in some fashion with the statements.

Table 4.1 Barriers to Laboratory Productivity

Type of barrier	Percent of labs indicating barrier is- Most important	Very important
Not enough trained scientific & technical personnel		
Japan	52%	28%
U.S.	10%	29%
Insufficient government funding		
Japan	25%	41%
U.S.	52%	27%
Insufficient support staff		
Japn	19%	45%
U.S.	NA	NA
Outmoded scientific & technical equipment		
Japan	1%	25%
U.S.	1%	23%
Lack of physical space for R&D		
Japan	7%	26%
U.S.	6%	22%
Government accounting & paperwork		
Japan	2%	16%
U.S.	7%	25%
Too much red tape		
Japan	-	11%
U.S.	3%	24%

NA: Not asked on U.S. questionnaire.

Table 4.2 External influences on project selection

Influence	Strongly agree	Agree	Disagree	Strongly disagree
Changes in policies of other government organizations				
Japan	3%	51%	40%	6%
U.S.	16%	51%	29%	4%
Assessments of commercial benefit of lab's R&D				
Japan	2%	18%	57%	22%
U.S.	5%	32%	36%	27%

Note: Because of rounding, figures may not sum to 100%.

CHAPTER 5

Cooperative R&D and Technology Transfer

Some of the more distinctive differences between Japanese and U.S. government laboratories are evident with respect to technology transfer activities. While the motives and benefits of cooperative R&D seem to be relatively equivalent in the two countries, their experiences with regard to technology transfer are appreciably different. One feature of the survey data is problematic in this respect, which is the age of the information. The U.S. survey reflects laboratory activities in 1989, and in the past few years, both cooperative R&D and technology transfer efforts in the U.S. labs have changed considerably. It is not clear to what extent U.S. labs may currently be more similar--or still more different--than the Japanese.

On the whole, the major distinction between Japan and the United States is the degree to which technology transfer activities have been institutionalized in Japanese labs. Japanese labs' motives for technology transfer are those related to the routine course of R&D, while U.S. motives reflect the pressures of legislation, budgets, and the interests of individual scientists and engineers. Japanese labs also view themselves as more successful in their technology transfer efforts, and appear to have had much more successful experiences with a wider range of technology transfer strategies.

Cooperative R&D

U.S. national labs are more active than their Japanese counterparts in cooperative R&D. The average number of cooperative R&D agreements for a U.S. lab was 46, contrasted to 16 in Japan. The vast majority of labs, 84 percent of the labs in Japan and 77 percent in the United States participate in 20 or fewer formal cooperative agreements per year. Two-thirds of the labs in both countries have 10 or less agreements per year, while about a quarter have no such agreements at all. About 10 percent of the U.S. labs had more than 80 cooperative agreements in 1989, as did about 5 percent of the Japanese labs.

For labs that do engage in cooperative R&D, it appears that Japanese labs are more diversified in terms of their cooperative R&D partners. Approximately 65 percent of such Japanese labs have cooperative agreements with other government organizations, 74 percent have agreements with industry, and 51 percent with universities. This clearly suggests that for those Japanese laboratories which engage in cooperative R&D, they are likely to do so with a number of other R&D performing sectors. In contrast, we may infer that U.S. labs are more likely to focus their cooperative R&D efforts on only one other sector: 32 percent of the labs reported agreements with other government labs, 38 percent with industry, and 28 percent with universities.

Laboratory motivations to participate in cooperative R&D appear to be highly similar in both countries, and a few motives seem to be quite salient.[1] In both Japan and the United States, the desire to obtain new technology or applied knowledge was the number one motive (based on the sum of ratings for all the labs), and also had the highest average rating (table 5.1). On a scale of 0-3, the average U.S. lab rating of the desire for new technology as a motivator of cooperative R&D was 2.41, the Japanese rating was 2.11. The second-ranked motivator was also the same in both countries--the desire for fundamental knowledge. Third-ranked in the United States was the desire to contribute to other parties; in Japan, it was incentives provided by other parties. For each country's top three cooperative R&D motivators, the average score was well above the scale's midpoint of 1.5, suggesting that these factors are strong determinants of the labs cooperative R&D practices. Average scores for all of the other factors were at or well below the midpoint, indicating they are relatively uninfluential motives for most labs.

There does appear to be some convergence in the primary motives for a lab's cooperative R&D and perceived research effectiveness. Lab directors were asked to rate the degree to which cooperative R&D agreements contributed to the lab's overall research effectiveness[2]; in both Japan and the United States, cooperative R&D seems to enhance basic research effectiveness more than any other kind (table 5.2), but also contributes to technology transfer efforts (in the United States) and precommercial applied research (in Japan). As indicated previously, the desire for new technology or applied knowledge was the primary motivator for cooperative R&D agreements in both countries, and the desire for fundamental knowledge was the second most important motivator for cooperative R&D. Based on the director's assessments, cooperative R&D does seem to enhance the research interests for which cooperative R&D is pursued.

Technology Transfer

Unlike laboratory motives to engage in cooperative R&D, Japanese and

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[1]Lab directors were asked to rate the degree to which several motives influenced the lab's participation in cooperative R&D. The rating system was: not at all (0); very little (1); somewhat (2); and a great deal (3).

[2]The rating system was: not at all (0); very little (1); somewhat (2); and a great deal (3).

U.S. laboratories seem to have distinctly different incentive structures for technology transfer.[3] In U.S. labs, the primary impulse for technology transfer activities is the personal satisfaction of lab scientists and engineers at seeing their ideas or technologies developed; this was the highest-ranked factor, and had an average rating of 2.29 (on a scale of 0-3; table 5.3). The second most important motive was the exchange of technical information (with average rating of 2.02), while the third was legislative requirements (average rating, 1.97). Japanese evaluations, on the other hand, reveal that the exchange of technical information is the most important factor motivating technology transfer, followed by technology transfer as an outgrowth of cooperative R&D and to help economic development. The average ratings for these three Japanese motives ranged from 1.83 to 1.95 (table 5.3).

These assessments of the motivations for technology transfer are, in some respects, telling about the changing laboratory environment in the United States. Only in recent years has there been any primary policy emphasis on technology transfer performance; under these circumstances, one would expect that transfer activity would most likely take place on the initiative of individual employees, as the ratings reveal. We likewise see the strong influence of legislative requirements,[4] and to a lesser extent, the desire to increase laboratory budgets (the fourth-ranked U.S. factor). Note that in both the congressional and presidential budget policies, lab budgets are increasingly tied to technology transfer activity.

In Japan, technology transfer seems to occur as a matter of course--to exchange technical information, as a natural outgrowth of cooperative R&D projects, to assist economic development. The degree to which attention is paid to economic development is a key difference between the Japanese and U.S. labs (this emerged as the sixth most influential motive in the United States), and reflects the different orientations of each country's post-war science policies and mission orientation of the lab systems. Japan has tended to view science and technology in more economically strategic terms than the United States, and has a number of R&D labs devoted to industrial concerns. The U.S has done neither, and is only now developing commercially explicit lab missions.

In spite of the different motives for laboratory technology transfer in each

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[3]Approximately 59 percent of the U.S. labs were engaged in technology transfer to other organizations in 1989. In Japan, 64 percent of their labs were engaged in technology transfer in 1991.

[4]For example, the Stevenson-Wydler Technology Innovation Act (1980), the Federal Technology Transfer Act (1986), and Executive Order 12591 (1987), "Facilitating Access to Science and Technology."

country, there is much greater convergence in the perception of what benefits these activities bring. In both Japan and the United States, increased public visibility was the top benefit, and a more real world approach ranked second for Japan and third for the United States (table 5.4). Japanese labs rated the approval of government officials higher than the U.S. as a benefit of technology transfer--this was the third greatest benefit for Japanese labs (sixth in the United States). In contrast, U.S. labs viewed collaboration on development as the second greatest benefit (seventh in Japan). Based on their rankings and average ratings, none of the benefits of technology transfer other than the top three for each country appears to bring more than minor benefits.

Generally speaking, Japanese labs appear modestly more successful in both getting technology "out the door" and transferring technology that has a commercial impact. Labs were asked to rate, for the previous three years, how successfully they were able to (a) get technology out the door (get other's interested in lab technology), and (b) transfer technology that had a commercial impact for the receiving organization. Evaluations were based on a scale of zero to ten, where zero represented "totally ineffective," five represented "average," and ten, "excellent." Figures 5-1 and 5-2 show the Japanese perceptions of greater technology transfer successes; in neither instance did any lab consider itself to be totally ineffective, and 5 percent or less viewed themselves as ineffective.[5] In contrast, a number of U.S. labs viewed their technology transfer as ineffective or totally ineffective: about 15 percent indicated such for their success in getting technology out the door, and about 22 percent in terms of commercial impact. The difference between the U.S. and Japanese labs in their perceptions of technology transfer success lies essentially between whether they consider themselves ineffective or average, since roughly the same proportions of labs in both countries viewed themselves as effective or excellent.

Technology Transfer Strategies and Problems

The difference in Japanese and U.S. laboratory perceptions of overall technology transfer success shows up markedly in lab assessments of effective technology transfer practices and strategies. Laboratories were asked to rate their experience in getting technology "out the door" with roughly a dozen specific transfer practices, where zero represented no success whatsoever, and three represented a very successful strategy. As can be seen in table 5.5, the average Japanese rating for *one-half* of the technology transfer practices was above 2.5, indicating that all of these were essentially very successful methods of transferring

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[5]The scale was collapsed here into five categories: totally ineffective (a rating of 0); ineffective (ratings of 1-3); average (4-5); effective (6-9); excellent (10).

lab technology to other organizations. With the exception of transfer through special technology transfer offices, none of the strategies had an average Japanese rating below 2.0. In contrast, U.S. labs on average rated *only one* strategy above 1.5, suggesting only limited success with any of the transfer practices.

The laboratory data reinforce one well-known point about technology transfer effectiveness, and that is the importance of person-to-person contact. Both Japanese and U.S. labs rated person-to-person contact as the most successful transfer strategy; this was the top-ranked factor for both countries, with an average rating of 2.89 in Japan and 1.81 in the U.S. Important means of transferring Japanese lab technologies also include presentations at government meetings, joint research in the lab, and outside access to lab facilities and equipment. The high Japanese ranking (second) for presentations at government meetings bears some explanation, since it reflects a unique feature of the Japanese system. Japanese labs do not have separate offices for technology transfer or designated technology transfer personnel. Rather, in the case of MITI and STA labs, separate corporations for licensing and marketing lab technologies exist. The laboratories commonly make presentations on their most commercially promising technologies to these brokering corporations; such meetings may be for government officials only or for the public as well.

As discussed, the average U.S. ratings reflect only marginal success with most of the different strategies. This may be partly attributed to the fact that for most labs, technology transfer is a new endeavor, and it may take some time and experience for labs to learn the most effective transfer practices. However, relative to each other, some practices appear to be more effective than others: in addition to person-to-person contact, membership in research consortia, presentations at professional meetings, and on-site seminars are the top-ranked transfer practices for the U.S. labs.

With one major exception, technology transfer activities do not seem to create problems of any significance for Japanese or U.S. labs. For example, technology transfer poses only minor, if any, problems with respect to affecting the lab's research agenda, lab conflict, or intellectual property disputes (table 5.6). The problem common to both countries, and a relatively salient one, is the time which technology transfer takes away from research. It appears that this is slightly less of a problem in the United States, since the average rating for this factor was only slightly above that for a "minor problem," whereas in Japan the average rating is closer to that of a major problem. This may be attributable to the nature of technology transfer practices in Japan, which as seen in table 5.5, tend to involve lab-based activity (person-to-person contact, joint research, and outside use of facilities and equipment). It may be that research time is diverted to assisting and interacting with the outside organizations in these circumstances.

TABLE 5.1 Laboratory Motives for Cooperative R&D.

Motive	U.S.		Japan	
	Mean	Ranking*	Mean	Ranking*
Desire for fundamental knowledge	2.15	2	1.89	2
Desire for new technology	2.41	1	2.11	1
Desire to contribute to other parties	1.97	3	1.61	5
Incentives provided by other parties	1.59	4	1.73	3
Increased profits/resource for lab	1.35	5	1.50	4
Personnel exchange opportunities	0.52	6	1.38	6

Note: 0= not at all; 1=very little; 2=somewhat; 3=a great deal.
Rankings are based on the raw sum of scores for each item.

*Rankings are based on the sum of all lab ratings for each motive.

TABLE 5.2 The Contribution of Cooperative R&D to Laboratory Research Effectiveness.

Type of Research	U.S. Mean	U.S. Ranking	Japan Mean	Japan Ranking
Basic R&D	2.15	1	2.27	1
Pre-commercial applied research	1.79	3	1.88	2
Commercial applied R&D	1.51	4	1.55	4
Technology transfer efforts	1.89	2	1.75	3

Note: (same as Table 5.1)

*Rankings: (same as Table 5.1) for each type of research activity.

TABLE 5.3 Laboratory Motives for Technology Transfer.

Motive	U.S.		Japan	
	Mean	Ranking*	Mean	Ranking*
Legislative requirements	1.97	3	1.04	6
Help economic development	1.22	6	1.95	3
Outgrowth of cooperative R&D	1.56	5	1.83	2
Exchange of technical information	2.02	2	1.86	1
Increase lab/parent budget	1.64	4	1.13	7
Employee personal satisfaction	2.29	1	1.22	4
Employee's entrepreneurship	0.98	7	0.53	5

Note: 0= not a factor; 1= oof little importance; 2= somewhat important; 3=very important.

*Rankings are based on the sum of lab ratings for each motive.

TABLE 5.4 Benefits of Laboratory Technology Transfer Activities.

Benefit	U.S.		Japan	
	Mean	Ranking*	Mean	Ranking*
Profit for the lab	0.49	8	1.39	4
Profit for individual	0.73	7	1.38	6
Increase public visibility	2.10	1	2.20	1
Approval of government officials	1.52	6	1.49	3
A more real world approach	1.62	3	1.56	2
Collaborate on development	1.75	2	1.35	7
Gained feedback and knowledge	1.39	4	1.22	8
Gained customers and users	1.30	5	0.56	5

Note: 0= no benefit; 1= minor benefit; 2= major benefit; 3= singlemost important benefit.

*Rankings are based on the sum of all lab ratings for each benefit.

TABLE 5.5 Successful Strategies in Getting Technology Out-of-the-door.

STRATEGY	U.S.		Japan	
	Mean	Ranking*	Mean	Ranking*
On-site seminar or conference	1.42	4	2.60	5
Fliers and other mailed correspondence	1.06	12	2.33	9
Person-to-person contact	1.81	1	2.89	1
Presentations at professional meetings	1.44	3	2.33	10
Presentations at government meetings	1.27	11	2.74	2
Membership in research consortia	1.60	2	2.39	7
Special office for tech. transfer	1.35	7	1.89	15
Informal, on-site visits	1.37	4	2.4	8
Personnel exchange	1.30	9	2	14
Cooperative R&D	1.36	6	2.17	11
Contractual relations in R&D	1.30	8	2.59	6
Outside access to lab equip/facilities	1.29	10	2.63	4
Sales of patents or copyrights	0.92	13	2.04	13
Presentations at industrial meetings	NA	NA	2.10	12
Joint Research in your lab	NA	NA	2.68	3

Note: 0=no success as a strategy; 1=little success as a strategy; 2=somewhat successful

NA: These questions were not asked in the U.S. survey.

*Rankings are based on the sum of all laboratory ratings for each strategy.

TABLE 5.6 Problems Experienced by Government Labs Involving in Technology Transfer.

PROBLEM	U.S. Mean	U.S. Ranking*	Japan Mean	Japan Ranking*
Taken away time from research	1.29	1	1.78	1
Moved the lab's research agenda	0.82	2	0.83	3
Led to disharmony and discord	0.75	3	0.48	5
Intellectural property disputes	0.43	5	0.65	4
Too many interruptions	0.75	4	1.12	2

Note: 0=no problem; 1=minor problem; 2=major problem; 3=singlemost important problem.

*Rankings are based on the sum of all laboratory ratings fo each strategy.

Figure 5-1: Success in "getting technology out the door"

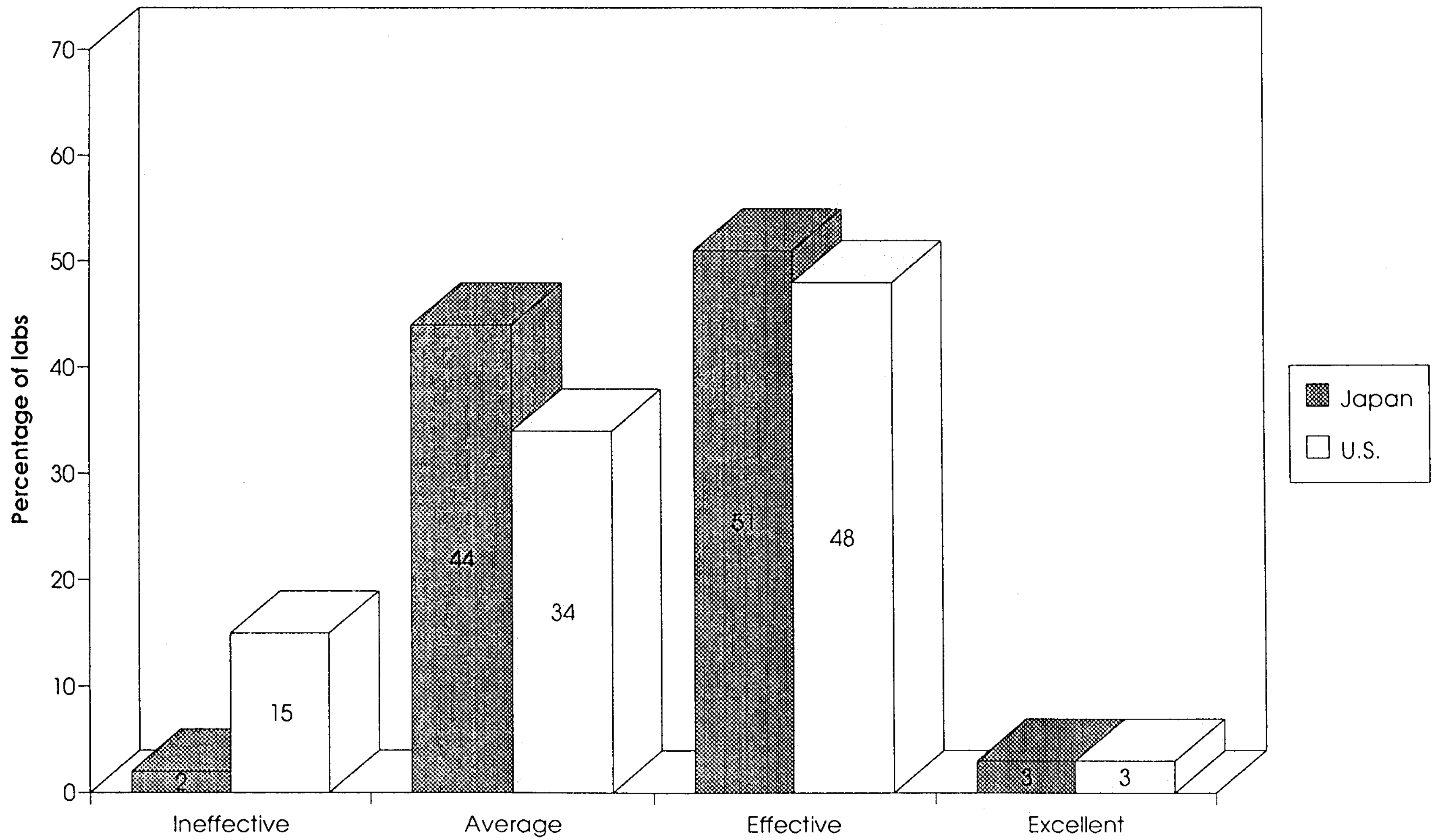
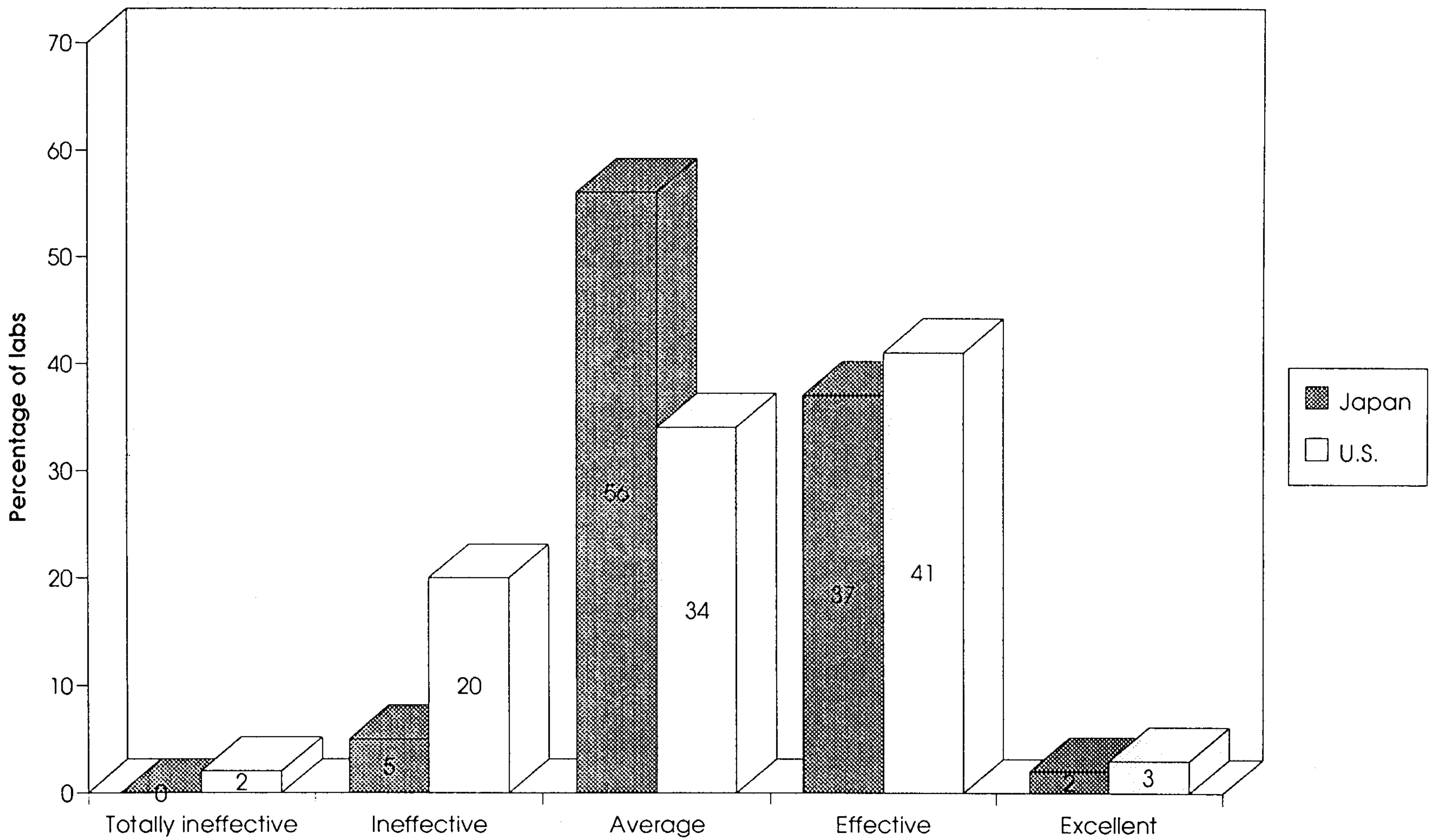


Figure 5-2: Successful commercial impact of technology transfer



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Appendix A

Summary of the U.S. Laboratory Study

The National Comparative R&D Project (NCRDP) is a broad-based interdisciplinary research project seeking to develop a better understanding of U.S. R&D laboratories, their environments, behaviors, and structures. Having begun in 1984 at Syracuse University's Technology and Information Policy Program, by 1993 the NCRDP involved more than 25 researchers in 16 institutions in three countries.

To this point, there have been four distinct phases of the NCRDP. Phase I focused on the population of 825 energy R&D laboratories, developing 30 intensive case studies; Phase II expanded the focus to the population of about 16,000 U.S. R&D laboratories in all fields of science and engineering, using survey data to examine a sample of 935 laboratories; Phase III, focusing on the dynamics of change, resurveyed Phase II respondents. Phase IV, reported in part in this document, focuses on government laboratories in Japan.

Despite the differences in data and methods among the first three phases (the focus of this appendix), each was based on a common assumption: that the more than 16,000 U.S. R&D laboratories must be understood as a **knowledge production and development system.** Typically, R&D laboratories are examined individually or by sector or by industry or product attributes. Rarely is there sufficient consideration of R&D performers as a system, as a set of interacting components encompassed by boundaries and constrained by resource needs and other identifiable interdependencies.

A fundamental assumption of the NCRDP, in all its aspects, is that effective public policy for R&D requires such systemic thinking about R&D laboratories. Indeed, several studies from the first and second phases of the NCRDP have been concerned with conceptualizing the U.S. R&D system, including system profiles, developing taxonomies for classification of laboratories, and generating and testing propositions about the relationship of laboratory types to environments. This appendix presents an overview of the NCRDP phases and methods. Each of three phases of the NCRDP is identified and described. Each relies on different data sources taken from different time periods but with similar objectives. Several types of data have been compiled in the NCRDP--documentary data, interview data, telephone survey data, case study data, and, particularly, questionnaire responses from laboratory directors.

Three Phases of the U.S.-Based NCRDP

From relatively small scale beginnings in 1984- a study base predominantly on intensive case studies of 32 laboratories devoted to energy research- the latter stages of the NCRDP have examined more than 1,000 laboratories using multiple data sources and encompassing the full spectrum of institutions contributing knowledge, technology products, and technical assistance to the technology development and innovation process.

The NCRDP was not planned as a multi-stage research project: its evolution was determined more by incremental decisions about continuing gaps in our knowledge rather than by a systematic mapping out of a research agenda. However, each of the three phases does address a distinct problem. Phase I used a limited data base to begin conceptualizing the R&D system and its components; Phase II employed a much broader and more representative data base and refined the conceptualization; Phase III filled in several gaps by re-surveying Phase II respondents, expanding the coverage of government laboratories well beyond the Phase II study, and emphasizing technology transfer and cooperative R&D.

NCRDP Phase I: Case Studies of Energy R&D Laboratories

The first phase of the NCRDP was designed for the primary purpose of developing and testing empirically a taxonomy of R&D laboratories based not on traditional sector-based (i.e. industry, government, university) distinctions but on the impact of two fundamental features of laboratories environments: influence of the resources base, government or private, and the market orientation of the laboratories' R&D products, public domain or proprietary.

The data base for Phase I was derived from the population of all U.S. and Canadian R&D laboratories engaged in energy-related research and development. Using laboratory directories and personal telephone calls, some 829 energy R&D laboratories were identified. While the chief focus of NCRDP Phase I was case study analysis, a survey was conducted for the purpose of developing and testing a classification taxonomy. During March and April, 1984, a questionnaire was mailed to the directors of each of the 829 laboratories. After sixty days had elapsed and after follow-up letters and phone call had been implemented when necessary, a respondent pool of 250 usable surveys had been developed.

NCRDP, Phase II: The U.S. R&D Laboratory System

While Phase I of the NCRDP seemed to demonstrate the need for new ways of thinking about R&D laboratory environments, there were important limits to this early work. First, and most obviously, to what extent could energy R&D

laboratories be viewed as representative of all R&D laboratories? This was particularly troubling because energy laboratories typically have greater entanglement with government (especially during the early 1980s) and among the population of energy laboratories there are more "hybrids" not easily classified by the usual sector categories. Another important limitation of the Phase I research was that it was more interested in establishing the taxonomy than in using it to predict laboratory behaviors. Thus, the survey data used in building the taxonomy had only limited utility for determining the predictive value of the taxonomy.

The second phase of the NCRDP aimed at nothing less than developing an understanding of the entire U.S. R&D laboratory "system." Thus, there was a concern about developing a more representative sample of U.S. R&D laboratories and going beyond the few attributes examined in Phase I. Thus, Phase II gathered not only sufficient information to refine the Environmental Influence Taxonomy, but also information on a wide variety of laboratory attributes including:

- laboratory missions
- budgets and sources of funds
- organization structures
- approaches to evaluation
- composition of output
- personnel characteristics
- responses to public policy initiatives
- interaction with government agencies

The more intensive data collection involved in Phase II also permitted further development and refinement of the Environmental Influence Taxonomy and the use of the Taxonomy to predict variance in each of the above laboratory attributes and behaviors.

The data reported in Phase II were derived from questionnaires, both mailed questionnaires and phone administered. Four major research center directories were used to establish a population of U.S. R&D laboratories. Laboratories with less than 25 reported employees were excluded from study population as were those chiefly conducting research in the social sciences. This yielded a study population of 16,597 R&D laboratories.

In drawing the sample for this study, both random probability and stratified sampling were used. A random probability sample of 1,300 was developed using a computer-generated random number list. In addition to a desire to assure representativeness, best achieved through random probability sampling, it was deemed useful to gather information about the largest R&D laboratories in the U.S. Since the researchers were interested in ensuring statistical significance at the <.01 level for a two-tailed test, a list of 1,300 was drawn for the sample. The largest 200 laboratories (as determined from analysis of total laboratory personnel figures) were added to this list. It was anticipated that a response rate of about 40% would be both feasible and suitable for the purposes of the study.

The researchers recognized that the data provided in the most recent standard research directories would necessarily be somewhat out of date and would entail at least a few coding and other errors. To compensate for these problems, each of the 1,500 laboratories were telephoned by the researchers and their staff in order to confirm the continued existence of the laboratory, correct addresses, develop data about areas of research focus and total personnel, and to confirm the name of the current laboratory director. As a result of this process, the study sample was reduced from 1,500 to 1,341.

The design of the questionnaires was undertaken jointly by the researchers. It was decided at the outset that most of the questionnaire items should be discrete item in nature, that mailed questionnaire length should be less than twelve pages, and that a mix of objective and opinion data would be elicited. Beginning with previous theoretical frameworks, related previous studies, and explicit hypotheses, a master list of questionnaire items was developed. The researchers agreed on priorities among the questionnaire items and developed an instrument for pre-test.

A separate sample random probability sample of 60 was drawn from the population by identical computer-generated random number techniques. In addition, to indicate the response patterns for the 200 largest R&D laboratories (the "superlaboratories"), a group of the next 20 largest (201-221) was included in the pretest. As with the more general sample, research assistant telephoned each of the firms to ensure correct addresses and to double check the name and continued tenure of the laboratory directors, the intended respondent pool. The approach of the more general study was used to the extent possible. From the 80 questionnaires mailed, 31 usable questionnaires were returned. The researchers analyzed the responses in order to determine possible ambiguities, degree of response variation, and, comparing known characteristics of the respondents to known characteristics of the population, degrees of nonresponse bias. From this information, the questionnaire was revised again.

After considering the results from the pre-test it was clear that not all of the desired information could by obtained practically from the mailed questionnaire. The length necessary for the a questionnaire including all the desired items would have been prohibitive. Because of the desire for additional information and because of concerns about the likely difficulty of obtaining a response rate of the desired 45-50% from the mailed questionnaire, a telephone questionnaire was developed. The telephone questionnaire included questions from early drafts of the questionnaire, but often revised in scale for convenience of administration. Telephone calls were completed to 1012 laboratory directors. Among these directors, 88 were deemed inappropriate as respondents for the study (not meeting one or more of the criteria pertaining to size and focus of the laboratory) and 665 participated for a response rate of 71%. Of the 1,341 eligible laboratories contacted (by phone and questionnaire) data were received (phone and/or questionnaire) from 966 for an overall response rate of 72%. Considering just the mailed questionnaire, 711 usable responses were received for a response rate of 53% (compared to a 71%

NCRDP, Phase III: Dynamics of Change

The third phase of the NCRDP was completed in 1992. Despite the amount of information generated from earlier studies there was a clear limitation- the picture was a static one. The third phase of the NCRDP was designed to permit some analysis of change. A sub-set of laboratories examined in 1986 was surveyed again in 1990-1991 for the purpose of understanding some of the dynamics of change. Phase III differs in two other respects. Because of our interest in learning more about government laboratories, survey questionnaires were sent to every government laboratory (meeting our criteria for analysis). The last several years have brought great change in the entire R&D system, but the government laboratory component has been especially affected by the policy changes of the 1980s. Another major theme of the past decade has been an increased emphasis on technology transfer and cooperative R&D and, thus, Phase III gave particular attention to those rapidly evolving issues and policies.

Phase III analysis is based on responses to questionnaires mailed to laboratory directors. Between June, 1990 and August, 1990, questionnaires were mailed to each of the laboratory directors who had participated in the Phase II study, as well as to directors of all government laboratories meeting the following criteria: (1) focus on science and engineering rather than social science; (2) more than 30 total personnel. Designed as a panel study, Phase III sought data from all government labs, all respondents from Phase II, and focused intensively on technology transfer and cooperative R&D.

Questionnaires were mailed to directors of R&D laboratories in June and July, 1990. The Phase III sample was 1137 laboratories; 533 questionnaires were returned for an overall response rate of 47%. By sector, questionnaires were sent to 594 industry labs (260 received, 44% response rate); 164 university laboratories (71 received, 43% response rate); 23 nonprofit or hybrid laboratories (12 received, 61% response rate) and 356 government laboratories (189 received, 53% response rate). Given a concern to measure change, most of the sample (939 of the 1137) and most of the respondents (420 of the 533) were drawn from the pool of respondents to a 1988 Phase II questionnaire. However, given a particular concern with government laboratories, all government laboratories in the U.S. (meeting sample criteria) were mailed questionnaires.

The data used in this report are entirely from the government laboratory sub-sample (n=189) of the Phase III data. Of particular interest, given this comparison of U.S. and Japanese laboratories, are the U.S. laboratory participants in the NCRDP, Phase III. Below is the list of participating U.S. government laboratories.

Government Respondents to NCRDP Questionnaire[1]

Agricultural Experiment Station, Pacific Basin Area
Agricultural Experiment Station, Midwest Area
Agricultural Experiment Station, North Atlantic Area
Agricultural Research Service Units, Mountain States Area
Agricultural Research Service Units, Northwest Area, Washington State University
Agricultural Research Service Units, South Atlantic Area
Agricultural Research Service Units, South Atlantic Area, University of Florida
Agricultural Research Service Units, Southern Piedmont Conservation Research Center
Agricultural Research Center, Washington State University
Air Force Armament Laboratory AD/PA
Air and Energy Engineering Research Laboratory
Air Force Engineering Services Laboratory
Air Force Geophysics Laboratory (AFGL)
Alabama Agricultural Experiment Station
Albany Research Center
Animal Metabolism, Agricultural Chemical Research Unit
Arecibo Observatory
Argonne National Laboratory
Arkansas Agricultural Experiment Station
Avionics Laboratory
BioMolecular Engineering
Bureau of Research, Wisconsin Dept. of Natural Resources
C.P Anderson Meson Physics Facility
Center for Infectious Diseases
Center for Electromechanics
Charles Stark Draper Laboratory, Inc.
Chesapeake Bay Detachment
Citrus Research Center and Agricultural Experiment Station

[1] Some laboratories preferred not to have their names listed as participants, those laboratories are omitted from the listing but not from the NCRDP data banks.

Continuous Electron Beam Accelerator Facility
Cotton Production Research Unit
Cropping Systems Research Lab
David Taylor Naval Ship R&D Center
Eastern Regional Research Center
Energy Technology Engineering Center
Engineering Science Research Unit
Engineering & Research Center
Environmental Monitoring Systems Laboratory
Experimental Engineering Labs
Federal Aviation Administration
FERMI National Lab
Fish and Wildlife Research Center
Forage-Livestock Management Systems Research Unit
Forest Animal Research Station
Forestry Sciences Lab
Frank J. Seiler Research Lab
Ft. Keogh Livestock and Range Research Lab
Galveston Laboratory
Gerentology Research Center, Dept. of HHS
Goddard Space Flight Center
Hanford Engineering Development Laboratory
Hazardous Materials Technical Center (HMTC)
Horticultural Research Laboratory
Horticultural Crops Research Laboratory
HQ Human Systems Division (AFSC)
Human Nutrition Research Center On Aging
Hurricane Research Division
Hydro-Ecosystem Research Unit
Idaho National Engineering Laboratory (INEL)
Illinois State Water Survey
Inhalation Toxicology Research Institute (ITRI)
Institute for Medical Research
Institute for Computer Science and Technology
International Fertilizer Development Center
Isotope and Nuclear Chemistry Division, LANL
Jet Propulsion Laboratory
Lab of Comparative Oncology
Lab of Chemical Physics
Lab of Molecular Biophysics
Langley Research Center
Lawrence Berkely Laboratory
Lawrence Livermore Lab
Letterman Army Institute of Research (LAIR)

Livestock Insects Lab
Los Alamos National Laboratory
Lyndon B. Johnson Space Center
Marshall Space Flight Center
Materials Research Laboratory
McDonald Observatory
Metabolism and Radiation Research Laboratory
Minnesota Agricultural Experiment Station
Mississippi Agricultural & Forestry Experiment Station
Montana Bureau of Mines and Geology
Morgantown Energy Technology Center
National Aeronautics and Space Administration
National Center for Toxicological Research
National Center for Supercomputing Applications
National Measurement Laboratory
National Maritime Research Center
Naval Civil Engineering Laboratory
Naval Surface Weapons Center
Naval Research Laboratory
Naval Health Research Center
Naval Air Propulsion Center
Naval Ship Weapon Systems Engineering Station
Naval Air Development Center
Neutron Research Facility
Nevada Agricultural Experiment Station
New Hampshire Agricultural Experiment Station
New York State Agricultural Experiment Station
North Central Forest Experiment Station (NCFES)
Northern Great Plains Research Lab.
Northern Regional Research Center
Nuclear Fuels Laboratory
Nursery Crops Research Laboratory
Oak Ridge National Laboratory
Office of Standard Reference Materials (OSRM)
Optical Sciences Division
OSHA Salt Lake City Lab
Pacific Southwest Forest and Range Experiment
Penn Bureau of Topography & Geology
Pennslyvania Agricultural Experiment Station
Pittsburgh Energy Technology Center (PETC)
Pittsburgh Research Center
Polymer-Concrete Development Laboratory
Reno Research Center
Research Coordinator, Armed Forces Institute of Pathology

Respiratory Disease Studies Division
Rome Air Development Center (RADC)
Sandia National Laboratories
SERI Daylight Laboratory
Soil & Water Management Research Center
Sondrestrom Radar Facility
South Carolina Agricultural Experiment Station
South Dakota Agricultural Experiment Station
Southeast Poultry Research Laboratory
Southeastern Forest Experiment Station (SEFES)
Southern Research Institute
Southern Regional Research Center
Southwestern Cotton Ginning Research Laboratory
Space Environment Laboratory
Space Programs Lab.-Army Engineer Topography
Subtropical Horticultural Research Station
Subtropical Agricultural Research Laboratory (SARL)
Sugarbeet Production Research, U.S.
Terminal Effects Research and Analysis Group
Texas Transportation Institute
Texas Agricultural Experiment Station
Tropical Fruit and Vegetable Research Lab
Twin Falls Idaho Field Station
U.S. Army Electronics Technology & Devices Lab
U.S. Naval Observatory
U.S. Army Institute of Environmental Medicine
U.S. Army Institute of Surgical Research
U.S. Vegetable Laboratory
U.S. Army Aeromedical Research Laboratory
U.S. Army Atmospheric Sciences Laboratory
U.S. Army Engineer Waterways Experiment Station
U.S. Bureau of Mines,Spokane Research Center
U.S.Army CERL
U.S. Army Belvoir R&D Engg
USDA Sedimentation Laboratory
Vector-Borne Viral Diseases Division
West Virginia Agricultural & Forestry Experiment Station
Western Human Nutrition Research Center
Western Research Institute
Western Cotton Research Laboratory
Wisconsin Agricultural Experiment Station
Wyoming Agricultural Experiment Station

Appendix B

Respondents to the Japanese Lab Survey

NATIONAL POLICE AGENCY

National Research Institute of Police Science

HOKKAIDO DEVELOPMENT AGENCY

Civil Engineering Research, Institute, Hokkaido Development Bureau

DEFENSE AGENCY

1st Research Center, Technical R&D Institute
2nd Research Center, Technical R&D Institute
3rd Research Center, Technical R&D Institute
4th Research Center, Technical R&D Institute

SCIENCE AND TECHNOLOGY AGENCY

Institute of Disaster and Earth Sciences
National Aerospace Laboratory
National Research Institute for Metals
National Institute of Radiological Sciences
National Institute for Research in Inorganic Materials

ENVIRONMENT AGENCY

National Institute for Environmental Studies
National Institute for Minamata Disease

MINISTRY OF FINANCE

National Research Institute of Brewing
Research Institute of the Printing Bureau

MINISTRY OF HEALTH AND WELFARE

Institute of Public Health
National Institute of Health

National Institute of Health and Nutrition
National Institute of Mental Health, NCNP
National Institute of Neuroscience, NCNP
National Institute for Leprosy Research
National Cancer Center Research Institute
National Institute of Hygienic Sciences
National Children's Medical Research Center
National Rehabilitation Center for the Disabled

MINISTRY OF AGRICULTURE, FORESTRY AND FISHERIES

National Institute of Animal Industry
National Agriculture Research Center
National Institute of Agrobiological Resources
National Institute of Agro-Environmental Sciences
National Grassland Research Institute
National Research Institute of Vegetables, Ornamental Plants and Tea
National Research Institute of Agricultural Engineering
Hokkaido National Agricultural Experiment Station
Tohoku National Agricultural Experiment Station
Chugoku National Agricultural Experiment Station
Shikoku National Agricultural Experiment Station
Kyushu National Agricultural Experiment Station
The Hokuriku Agricultural Experiment Station
National Institute of Sericultural and Entomological Science
National Institute of Animal Health
National Food Research Institute
Tropical Agriculture Research Center
Hokkaido National Fisheries Research Institute
Tohoku National Fisheries Research Institute
National Research Institute of Fisheries Science
Japan Sea National Fisheries Research Institute
National Research Institute of Far Seas Fisheries
Seikai National Fisheries Research Institute
National Research Institute of Fisheries Engineering
National Research Institute of Aquaculture
Forestry and Forest Products Research Institute

AGENCY OF INDUSTRIAL SCIENCE & TECHNOLOGY,
MINISTRY OF INTERNATIONAL TRADE AND INDUSTRY

National Research Laboratory of Metrology
Mechanical Engineering Laboratory
National Chemical Laboratory for Industry

Government Industrial Research Institute, Osaka
Fermentation Research Institute
Research Institute for Polymers and Textiles
Geological Survey of Japan
Industrial Products Research Institute
National Research Institute for Resources and Environment
Governmental Industrial Development Laboratory, Hokkaido
Government Industrial Research Institute, Kyushu
Government Industrial Research Institute, Shikoku
Government Industrial Research Institute, Tohoku
Government Industrial Research Institute, Chugoku

MINISTRY OF TRANSPORT

Ship Research Institute
Port and Harbour Research Institute
Electronic Navigation Research Institute
Traffic Safety and Nuisance Research Institute
Meteorological Research Institute
Hydrographic Department, Maritime Safety Agency
Marine Technical College
Institute for Sea Training

MINISTRY OF POSTS AND TELECOMMUNICATIONS

Communications Research Laboratory

MINISTRY OF LABOUR

Research Institute of Industrial Safety
National Institute of Industrial Health

MINISTRY OF CONSTRUCTION

Public Works Research Institute
Building Research Institute

MINISTRY OF HOME AFFAIRS

Fire Research Institute

SEMI-GOVERNMENT AND NON-PROFIT RESEARCH ORGANIZATIONS

NHK Science & Technical Research Laboratories

The Institute of Physical and Chemical Research (RIKEN)
Power Reactor and Nuclear Fuel Development Corporation
National Space Development Agency of Japan
Japan Marine Science and Technology Center
Osaka Bioscience Institute
Remote Sensing Technology Center of Japan
Nippon Institute for Biological Science
Railway Technical Research Institute

Appendix C

The Japanese Laboratory Survey

JAPAN GOVERNMENT LAB R&D SURVEY

The following questions are designed to aid us in understanding your R&D unit/laboratory, and the relationship between it, government agencies, and your parent organization.

1. Some laboratories have many research and technology missions, others have only one or two. For each of the research technology missions listed below, please indicate the significance of the mission for your laboratory. (Note: no more than one mission may be listed as "single most important.")

	Single Most Important Mission	Important Mission	Somewhat Important Mission	Mission of Little Importance	Not a Mission
a. Basic research (knowledge for its own sake without any particular application in mind)	______	______	______	______	______
b. Pre-commercial applied research (focused on bringing new products and processes into being, but not directed at a specific design)	______	______	______	______	______
c. Commercial applied research (focused on product or process with specific design in mind)	______	______	______	______	______
d. Development (developing existing prototypes, modifying existing products/ processes, or applications engineering)	______	______	______	______	______
e. Technical assistance to government agencies (other than this laboratory's parent agency) *	______	______	______	______	______
f. Technical assistance to this laboratory's parent organization or agency	______	______	______	______	
g. Technical assistance to private firms and industrial organizations	______	______	______	______	
h. Technology transfer, including physical devices, processes, or "know-how" from this laboratory to government organizations	______	______	______	______	______
i. Transfer technology to private firms or industrial organizations	______	______	______	______	______

[*: Note: "Technical assistance" does not include technology transfer.]

2. Different R&D labs have different effectiveness criteria. Please rate each of the following factors in regard to its importance to your R&D laboratory as an effectiveness criteria. (Note: No more than one criterion may be listed as single-most important.)

	Single Most Important Criterion	Important Criterion	Somewhat Important Criterion	Not a Criterion
a. Contributing to advance of fundamental scientific knowledge	_______	_______	_______	_______
b. Producing knowledge useful in developing commercial products and processes	_______	_______	_______	_______
c. Meeting the needs and serving the interests of a constituent group (e.g. a trade association, an industry, or local government)	_______	_______	_______	_______
d. Increasing the resources (operating budget, program scope) of the laboratory	_______	_______	_______	_______

3. Please indicate the extent to which you agree or disagree with the following statements.

	Strongly Agree	Agree	Disagree	Strongly Disagree
a. "I think there is more 'bureaucracy' slowing things down in this laboratory than in other labs I know about."	_______	_______	_______	_______
b. "Scientists and professionals working here have a great deal of autonomy in their work."	_______	_______	_______	_______
c. "Changes in policies of other government organizations often have a significant effect on my laboratory's selection of research projects."	_______	_______	_______	_______
d. "Assessments of the commercial benefits of my unit's R&D output often have a significant effect on selection of research projects."	_______	_______	_______	_______

4. How many administrative levels are there between (but not including) the level of the most senior bench level scientists and engineers and the laboratory director?

__________ levels

5. What is your laboratory's total R&D budget, from all sources, for the current fiscal year?

¥__________ Million Yen

6. In the last complete fiscal year, what was the percentage of R&D funding received from each of the sources listed below? (Note: should total 100%.)

% from:

______% Direct government appropriations or allocations from our parent government agency

______% Contracts and grants from other government agencies (not from our parent)

______% Industrial grants and contracts

______% Other (please specify)________________________________

7. How many full-time workers of all types are employed at your laboratory?

How many researchers?__________

How many technicians?__________

Others __________

TOTAL __________

[Note: technicians may be defined as people who are engaged in supporting the research of the laboratory through testing, inspection, maintenance (or construction) of research equipment. Technicians may be computer staff as along as that work relates to the compilation and recording of research data or the monitoring of research equipment. Other general computer support (including library work and archives) should not be considered technicians.]

8. During the last two weeks, about what percentage of your (not the lab's) business-related telephone calls was with non-government personnel, (e.g. personnel from industry, small business, nonprofit organizations, universities)?

________%

9. During the last two weeks, about what percentage of the mail correspondence initiated by you was sent to non-government agencies or personnel?

________%

10. For each of the missions listed, please indicate the approximate percentage of your laboratory's total budget devoted to each. (Note: should total 100%.)

__________% Basic research

__________% Applied research: [Pre-commercial and commercial]

__________% Development

__________% Technical assistance to parent agency

__________% Technical assistance to government agencies other than your parent agency

__________% Technical assistance to private industry organizations or individuals

__________% Technology transfer to business organizations

__________% Technology transfer to government agencies

__________% Other (Please specify) ________________________________

[Note: "Technical assistance" does not include technology transfer.]

11. Please indicate, for each activity listed below, how much time (in weeks) is typically required between a request made by a unit within a lab and the actual approval of the request. Check the closest time period. If no approval is necessary, please check "NA". If requests are never made, check "NR."

	Less than 1 week	1-3 weeks	3-6 weeks	6-9 weeks	9-12 weeks	3-6 months	More than 6 mths	NA	NR
Hiring full-time personnel	____	____	____	____	____	____	____	____	____
Hiring part-time personnel	____	____	____	____	____	____	____	____	____
Termination (because of poor performance or inadequate qualifications) of a full time employee	____	____	____	____	____	____	____	____	____
Buying low-cost (less than ¥100,000) equipment	____	____	____	____	____	____	____	____	____
Buying expensive (more than ¥1,000,000) equipment	____	____	____	____	____	____	____	____	____
Submitting research results for publication	____	____	____	____	____	____	____	____	____
Circulating research results outside the lab	____	____	____	____	____	____	____	____	____
Getting internal funding for an individual researcher's research project	____	____	____	____	____	____	____	____	____
Getting internal funding for intermediate to large-scale team research project	____	____	____	____	____	____	____	____	____

12. Approximately what percentage of the laboratory director's effort is devoted yearly to the maintenance of relationships with other organizations (not including your parent organization) of any type?

__________%

13. How is research conducted in your laboratory?

	Primary practice	Secondary practice
Based on the initiatives of individual researchers	____	____
Principal investigator-led research groups	____	____
Departments, divisions or branches	____	____
More or less ad hoc, based on the needs of the project	____	____

Other (please specify) ______________________________

14. Please indicate how often researchers from the following types of organizations conduct research (short or long term) at your laboratory.

	Very often	Occasionally	Never
University researchers	______	______	______
Researchers from industry	______	______	______
Researchers from other government laboratories belonging to your parent company	______	______	______
Researchers from other national or regional (local) government labs	______	______	______

15. On average, about what percentage of all of the R&D personnel at your laboratory are from other R&D organizations?

______%

16. Please identify the relative percentage of your lab's R&D output (in terms of person hours devoted yearly to each) for each category listed below.

______ %Published articles and books

______ %Patents and licenses

______ %Algorithms and software

______ %Technical and scientific reports for internal use(*) only

______ %Technical and scientific reports for use by others outside the parent agency

______ %Prototype devices and materials

______ %Papers for presentation at external conferences

______ %Demonstration of technological devices

______ %Other products

[*Note: "Internal use" includes use within the parent agency.]

17. Who are the primary users of your laboratory's R&D outputs? [Check as many as apply.]

	Yes, a primary user	No, not a primary user
Our laboratory itself	______	______
Our parent agency	______	______
Other government labs in your ministry or agency	______	______
Other government labs outside your ministry or agency, including local government labs	______	______
University scholars and researchers	______	______
Private industry	______	______
Farmers or agricultural organizations	______	______
Physicians, hospitals, or health-related professionals	______	______

18. Laboratories differ with respect to the barriers they encounter in seeking to achieve maximum R&D productivity. Please indicate the extent to which each factor given below is an important R&D barrier for your laboratory. (Note: only one item should be listed as "the most important barrier.")

	Most Important Barrier	Very Important Barrier	Somewhat Important Barrier	Of Minor Importance as a Barrier	Not a Barrier
Not enough trained scientific and technical personnel	____	____	____	____	____
Insufficient government R&D funding	____	____	____	____	____
Insufficient support staff	____	____	____	____	____
Outmoded scientific and technical equipment	____	____	____	____	____
Lack of physical space for R&D operations	____	____	____	____	____
Inability to stay abreast of rapidly growing scientific and technical knowledge	____	____	____	____	____
Too much "red tape" causes delays in either the management or performance of R&D	____	____	____	____	____
A focus on short-run commercial benefit to the exclusion of longer-run development of technology or scientific and technical knowledge	____	____	____	____	____
Insufficient computing and information processing capacity	____	____	____	____	____
Government health, safety and environmental regulations	____	____	____	____	____
Government accounting and paper work requirements	____	____	____	____	____

[Note: "Support staff" includes technicians and secretaries]

19. How has your laboratory hired researchers during the past three years?

__________% Choosing among candidates who passed the general examination for government official recruitment given by the National Personnel Authority.

__________% Recruiting through public advertisement of new research posts without general examination.

__________% Hiring, without public advertisement or general examination.

100 % Total

20. What is the average number of researchers who have joined your laboratory each year during the past three years?

________ persons

21. What is the age distribution of researchers who have left your laboratory during the past three years? (percentages should sum to 100%)

_____% -39 Years old
_____% 40-49 Years old
_____% 50-59 Years old
_____% 60- Years old

100 % Total

22. How many foreign researchers does your laboratory have (as of March 31, 1991)

______ Regular personnel
______ Temporary personnel (including post-doctoral fellows supported by some followships)

23. Do you feel that senior executives in headquarters offices of the parent agency have due interests in the situation and outputs of research activity in your laboratory?

(1) Yes
(2) No
(3) Don't know
(4) Others

24. Do you feel that the administrative division of your laboratory properly understands the significance of research activity of your laboratory?

(1) Yes
(2) No
(3) Don't know
(4) Others

25. Is the research environment of your laboratory attractive enough for recruiting researchers of high enough quality to do the work of the laboratory?

(1) Yes
(2) No
(3) Don't know
(4) Others

NOTE: QUESTIONS 26 - 32 SHOULD BE ANSWERED ONLY IF YOUR LABORATORY IS INVOLVED IN TECHNOLOGY TRANSFER TO OTHER ORGANIZATIONS. IF YOUR LABORATORY IS NOT, PLEASE PROCEED TO QUESTION 33.

Note: For purposes of the questions below, we are defining technology transfer as "the transfer of physical devices, processes, 'know how' or proprietary information from your laboratory, to either business or government, either Japanese or foreign."

26. Government laboratories engage in technology transfer for any of a number of reasons. To what extent is each of the following an important motivation for your laboratory's or parent organization's technology transfer activity?

	Very Important	Somewhat Important	Of Little Importance	Not a Factor
Legislative requirements	______	______	______	______
To help economic development	______	______	______	______
Outgrowth of cooperative R&D, consortium membership or joint ventures	______	______	______	______
Exchange of technical information	______	______	______	______
Hope to increase lab's or parent agency's budget	______	______	______	______
Scientists' and engineers' personal satisfaction at seeing their ideas or technologies developed	______	______	______	______
Scientists' and engineers' interests in entrepreneurship and personal wealth	______	______	______	______

27. From the standpoint of "getting technology out the door" (getting others interested in using your lab's technology), how would you evaluate the lab's success during the past three years? Please rate on a 0-10 scale where 10 is excellent, 5 is average, and 0 is totally ineffective.

0---1---2---3---4---5---6---7---8---9---10

28. From the standpoint of commercial impact on the organizations receiving the technology, how would you evaluate your lab's technology transfer success during the past three years? Please rate on a 0-10 scale where 10 is excellent, 5 is average, and 0 is totally ineffective.

0---1---2---3---4---5---6---7---8---9---10

29. Below is a list of possible technology transfer strategies. For those used by your laboratory, evaluate the success of particular strategies from the standpoint of "getting technology out the door," or interesting other organizations in your lab's technology.

	Not a Strategy We Use	Very Successful Strategy	Somewhat Successful Strategy	Little Success as a Strategy	No Success as a Strategy
On-site seminars or conferences	____	____	____	____	____
Fliers, newsletters or other mailed correspondence	____	____	____	____	____
Person-to-person contacts of our scientific and technical personnel with persons in technology recipient organizations	____	____	____	____	____
Present papers or demonstrations at industry meetings	____	____	____	____	____
Presentations at scientific meetings sponsored by professional organizations	____	____	____	____	____
Presentations at scientific meetings sponsored by government organizations	____	____	____	____	____
Memberships in research consortia or associations	____	____	____	____	____
A special office or staff with responsibility for technology transfer activities	____	____	____	____	____
Encouraging informal, on-site visits	____	____	____	____	____
Personnel exchanges	____	____	____	____	____
Cooperative R&D (as a technology transfer strategy rather than other possible purposes)	____	____	____	____	____
Contractual relations for direct R&D funding between our lab and the organization receiving the technology	____	____	____	____	____
Permitting persons from other organizations access to our laboratory's equipment and facilities	____	____	____	____	____
Sales of patents or copyrights	____	____	____	____	____
Electronic media, such as videotape or computer diskettes	____	____	____	____	____
Joint research in your lab	____	____	____	____	____

30. For most labs, technology transfer activities can have both benefits and problems. First, we would like to list some possible benefits of technology transfer activity. Please indicate whether your lab has experienced these benefits. (Note: check only one item as single most important benefit.)

BENEFITS	Single Most Important Benefit	Major Benefit	Minor Benefit	No Benefit
Profit for the laboratory	______	______	______	______
Profit for individual scientists and inventors employed by your laboratory	______	______	______	______
Increased public visibility of the laboratory and its activities	______	______	______	______
Approval of legislative or executive branch government officials, improved political standing	______	______	______	______
A more "real world" approach among the lab's scientific and technical personnel	______	______	______	______
Drawing together scientific and technical personnel to collaborate on technology development and transfer projects	______	______	______	______
Gained technical knowledge from organizations on the receiving end of the technology we've transferred	______	______	______	______
Gained clients, users	______	______	______	______

Now, here are some possible problems. Please indicate whether your lab has experienced these problems. (Note: check only one item as single greatest problem.)

PROBLEMS	Single Greatest Problem	Major Problem	Minor Problem	Not a Problem
Has taken away time from other research-related activities	______	______	______	______
Has moved the lab's research agenda away from more fundamental or pre-commercial research	______	______	______	______
Has led to disharmony and discord as some personnel continue with traditional research and others have become more oriented to entrepreneurial work.	______	______	______	______
Has led to intellectual property disputes	______	______	______	______
Too many interruptions from outsiders interested in our technology or technical information	______	______	______	______

31. During fiscal year 1990, about how many technologies did your laboratory (or laboratory employees) allow others to use through sales of patents and copyrights?

____

32. During fiscal year 1990, about how many technologies, if any, were patented by your lab or lab employees?

____

THE FOLLOWING QUESTIONS SHOULD BE ANSWERED ONLY IF YOUR LABORATORY HAS FORMAL COOPERATIVE R&D AGREEMENTS WITH OUTSIDE ORGANIZATIONS.

(IF YOUR LABORATORY HAS NO COOPERATIVE R&D AGREEMENTS, YOU HAVE COMPLETED THE SURVEY. THANK YOU!)

33. How many formal cooperative R&D agreements does your laboratory currently have? (Note: do not include ties to other labs owned by your parent agency.)

____

34. How many, if any, of these agreements are with foreign or foreign-owned organizations?

____

35. Please indicate below the percentage of cooperative R&D agreements with each of the categories of organizations.

______% Government (including government labs)

______% Industry

______% Universities

______% Private nonprofit

______% Other

36. Please list your most significant (up to three) cooperative R&D agreements (giving the name of the major cooperating organization or laboratory), where "significant" is defined in terms of the quality of the resulting R&D products.

1.________________________________

2.________________________________

3.________________________________

37. Considering only the first cooperative R&D agreement listed above, what is the approximate total R&D budget and about how much does your laboratory contribute to the total R&D budget.

Interlaboratory Agreement #1 (from above):

Total R&D budget	¥__________Million yen
My lab or agency's contribution	¥__________Million yen

38. Generally speaking, to what degree have all your laboratory's cooperative R&D agreements contributed to your laboratory's overall research effectiveness?

	A great deal	Somewhat	Very little	Not at all (or not relevant)
Basic research and development of new knowledge	_____	_____	_____	_____
Pre-commercial applied research	_____	_____	_____	_____
Commercial applied research and development	_____	_____	_____	_____
Technology transfer efforts	_____	_____	_____	_____

39. Generally speaking, to what degree has your laboratory's participation in cooperative R&D agreements been motivated by the following ?

	A great deal	Somewhat	Very little	Not at all
Desire for fundamental scientific knowledge	______	______	______	______
Desire for new technology or applied knowledge	______	______	______	______
Desire to contribute to other party(ies) involved in the agreement	______	______	______	______
Incentives provided by other parties to the agreement	______	______	______	______
Personnel exchange opportunities	______	______	______	______
Increased profits or resources available to the lab or parent organization	______	______	______	______
R&D Mission of Lab	______	______	______	______

Other (please specify) ____

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政府研究機関に関する日米比較調査

シラキュース大学マクスウェルスクール
技術、情報政策プログラム

科学技術政策研究所第1調査研究グループ

■ この調査は、日本における政府研究機関の運営、および他の諸機関との間の関係に関する一般的傾向を明らかにし、米国政府研究機関との比較分析を行うことを目的として各政府研究機関の長もしくはそれに準ずる方々にお尋ねするものです。

■ 本調査表に直接回答を書き込んで下さい。質問が貴研究所に当てはまらない場合は何も記入しないで下さい 。

■ 参考に、英語版のアンケート用紙を同封させていただきましたが、英語版に回答を記入する必要はありません。

■ 回答を終えた調査表は、同封の封筒を用い、直接科学技術政策研究所に送付して下さい。　　月　　日までにお願いします。

機関名＿＿＿＿＿＿＿＿＿＿

お問い合わせ先：科学技術政策研究所
第1調査研究グループ
総括上席研究官　平野　千博
特別研究員　遠藤　英樹
電話:03-3581-2392　FAX :03-3503-3996

政 府 研 究 機 関 に 関 す る 日 米 比 較 調 査

下記の質問は、我々が貴研究所を理解するとともに、貴研究所と他の組織との関係を理解できるよう作成されています。

1. 研究所には、研究及び技術に関し、多くの任務が課せられているところも、1つか2つの任務しか課せられていないところもあります。下に挙げた研究技術任務のそれぞれについて、貴研究所におけるその任務の重要性を示す欄に〇印を付けてください。（注：「最も重要な任務」の欄には、ひとつの項目にのみ〇印を付けてください）

	最も重要な任務	重要な任務	やや重要な任務	ほとんど重要でない任務	任務ではない
a. 基礎研究(特定の応用目標を意識しない知識のための知識)					
b. 前商業的応用研究（新商品あるいは新工程を生み出すことに焦点を当てているが、特定の設計のものをめざしたものではない）					
c. 商業的応用研究（特定の設計が念頭にある商品あるいは工程に焦点を当てた研究）					
d. 開発(既にあるプロトタイプの発展、既存の商品または工程の修正、実用のための工学)					
e. 政府機関（所属省庁を除く）に技術的な支援をする					
f. 貴研究所の所属省庁に技術的な支援をする					
g. 民間企業や産業組織に技術的な支援をする					
h. 政府機関への技術移転(物理的装置、工程、ノウハウの移転を含む)					
i. 民間企業または産業組織への技術移転					

[注] この質問項目においては、「技術的な支援」には技術移転を含みません。

2. 研究所の業務を評価するための基準は、研究所ごとに違います。下記の各基準について、貴研究所における重要性の程度を示す欄に○印をつけてください。(注:「最も重要な基準」の欄には、ひとつの項目にのみ○印を付けてください)

	最も重要な基準	重要な基準	やや重要な基準	基準ではない
a. 基礎的科学知識の発達に貢献する。				
b. 商品または工程の開発に有用な知識を生みだす。				
c. 特定グループ(例えば協会、産業界または地方自治体)の必要に応え、利益を供給する。				
d. 研究所の資源(運営予算、研究領域)を増加する。				

3. 下記の各記述について、賛成か反対かあてはまる欄に○印をつけてください。

	全く賛成	賛 成	反 対	全く反対
a. この研究所は、自分の知っている他の研究所と比べて、物事の処理を遅らせる「お役所仕事(bureaucracy)」が多い方の研究所であると思っている。				
b. ここで働く科学者や専門家たちは、自分の研究にかなり大きな自治権(autonomy)を持っている。				
c. 他の政府機関の政策変更は、しばしば私の研究所の研究プロジェクトの選択に、大きな影響を及ぼす。				
d. 私の研究所のR&D成果がもたらす商業的利益の評価は、しばしば研究プロジェクトの選択を大きく左右する。				

4. 実際に研究活動に従事している科学者及び技術者のうち最も上級の者と研究所所長の間(但し、両者は含みません)には、管理階層がいくつありますか?

________ 階 層

5. 今年度の貴研究所の総R＆D予算は、すべての資金源からのものを合計してどれ程ですか？

＿＿＿＿＿百万円

6. 前年度の各収入源からのR＆D資金の割合はどのようなものでしたか？
(注：合計が100%になるようにしてください)

収　入　源	割合（％）
• 所属省庁から供与された資金 • その他の政府機関（所属省庁ではない）から供与された資金 • 産業界からの寄付または委託 • その他（具体的に記入してください） ＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿	＿＿＿＿ ＿＿＿＿ ＿＿＿＿ ＿＿＿＿
計	100

7. 貴研究所の常勤職員の合計は何人ですか？ また、その内訳はどうなっていますか？

従　業　員	人数(人)
研　究　者 技　能　者 そ　の　他	＿＿ ＿＿ ＿＿
計	＿＿

［注］
技能者とは、試験、検査、研究装置のメンテナンス（または製作）を通して、研究の支援をする人々と定義します。また、研究データの記録、編集または研究装置のモニターに関するコンピューター業務に従事するスタッフも技能者として含めます。なお、他の一般コンピュータースタッフ（図書館、公文書保管所を含む）は技能者とはみなしません。

8. この2週間の貴殿自身の（”研究所の”ではない）業務関連の電話会話のうち、政府関係者以外の人物（例えば、産業界、中小企業、非営利組織、大学関係者）との電話会話の割合はおよそどれくらいですか？

＿＿＿＿＿％

9. この2週間の間に貴殿が発送した郵便物のうち、政府関係以外の組織または人物宛のものの割合はどれくらいですか？

＿＿＿＿＿％

10. 貴研究所の総予算が、下記の各任務におよそどれくらいの割合で配分されているか示してください。
（合計が100%になるようにしてください）

任　　　　　務	割合（%）
• 基礎研究	＿＿＿＿
• 商業的または前商業的応用研究	＿＿＿＿
• 開　　発	＿＿＿＿
• 所属省庁への技術的支援	＿＿＿＿
• 所属省庁以外の政府機関への技術的支援	＿＿＿＿
• 民間産業組織あるいは民間人への技術的支援	＿＿＿＿
• 民間組織への技術移転	＿＿＿＿
• 政府機関への技術移転	＿＿＿＿
• その他（具体的に記入してください） ＿＿＿＿＿＿＿＿＿＿＿＿	＿＿＿＿
計	100

［注］
この質問項目については、「技術的支援」は技術移転を含みません。

11. 下記に挙げた各項目について、研究所内の組織が要請を起こしてから実際にそれが承認されるまで、一般にどれくらい時間がかかるか、最も近いものに○印を付けてください。（注：承認を必要としない場合は「承認不要」、そのような要請がなされたことがない場合は「要請無し」欄にチェック願います）

	1週間未満	1～3週間	3～6週間	6～9週間	9～12週間	3～6カ月間	6ヶ月間超過	承認不要	要請無し
常勤職員の雇用									
非常勤職員の雇用									
常勤職員の解雇(業績が芳しくない、または能力が不十分などの理由で)									
低価格(10万円以下)の装置の購入									
高価格(100万円以上)の装置の購入									
研究成果の発表									
研究成果の研究所外への配布									
個々の研究者により行われる研究プロジェクトのための内部資金の確保									
中～大規模チームにより行われる研究プロジェクトのための内部資金の確保									

12. 貴研究所所長の毎年の努力のうち他の組織（あらゆるタイプの組織を含みますが、所属省庁は含みません）との関係維持に向けられている努力の割合はおよそ何%ぐらいですか？

______%

13. 貴研究所では、研究はどのような方式で行われていますか？　主流の方式として、あるいは副次的方式として実施されているものに○印を付けてください。

	主流の方式	副次的方式
• 個々の研究者の自発性(initiative)を基に実施	______	______
• 上級研究者により指導される研究グループを構成して実施	______	______
• 部課室制の組織形態により実施	______	______
• 対象となるプロジェクトに応じた組織形態を柔軟に作って実施	______	______
• その他（具体的に記してください） ______________________	______	______

14. 次の組織からの研究者が貴研究所で研究に従事する頻度はどれくらいですか？　それぞれ最も適当な頻度に○印をつけてください。

研　究　者　内　訳	頻 繁 に (very often)	時 々 (occasionally)	全くない (never)
• 大学の研究者			
• 産業界の研究者			
• 貴殿の所属省庁に属する他の研究所の研究者			
• 貴殿の所属省庁以外の省庁及び地方公共団体の研究機関の研究者			

15. 貴研究所の研究者のうち、他の研究開発機関から派遣されている者の割合は平均的にみておよそ何%ぐらいですか？

______%

16. 貴研究所の研究開発成果に関し下記に挙げた種類毎に、それぞれの構成割合を（それぞれの研究者が1年のうちに各種類の成果を生み出すために割いた時間を基に）示してください。

ア　ウ　ト　プ　ッ　ト	割合（％）
• 論文発表及び書物の出版	______
• 特許取得及びライセンスの許諾	______
• アルゴリズム及びソフトウェア	______
• 内部利用（所属省庁内の利用を含む）のみのための技術的及び科学的レポート	______
• 所属省庁外での利用のための技術的及び科学的レポート	______
• 装置(devices)及び材料のプロトタイプ	______
• 外部の会議で発表するための論文	______
• 技術装置(technological devices)のデモンストレーション	______
• その他の成果	______
計	100

17. 貴研究所の研究開発成果の主たる利用者は誰ですか？　各項目について、主たる利用者であるか否か○印を付けてください。

	主たる利用者である	主たる利用者でない
• 貴研究所自身	______	______
• 所属省庁	______	______
• 所属省庁に属する他の研究所	______	______
• 所属省庁以外の政府研究所（地方の公立研究所を含む）	______	______
• 大学の学者、研究者	______	______
• 民間産業	______	______
• 農家または農業団体	______	______
• 医者、病院、または保険医療に関する専門家	______	______

18. R＆Dの成果を最大限にまで高めようとする場合に、各研究所が遭遇する障害は様々です。貴研究所にとって、下記に挙げた各項目がR＆Dに対してどの程度の障害となるか当てはまる欄に〇印を付けてください。
（注：「最も重大な障害」の欄にはひとつの項目だけをチェックしてください）

	最も重大な障害	非常に重大な障害	やや重大な障害	障害としてあまり重大でないもの	障害ではない
• 十分に訓練された科学者及び技術者の不足					
• 不十分な政府のR＆D資金					
• 不十分な支援スタッフ					
• 旧式な科学及び技術装置					
• R＆Dの実施のためのスペースの狭さ					
• 急速に進展する科学技術知識についていけないこと					
• R＆D運営を滞らせ、能率を低下させる行き過ぎた「官僚化」					
• 短期的商業利益を重視するあまり、技術や科学技術知識の長期的発展が軽視されること					
• 不十分な計算及び情報処理能力					
• 政府による保健、安全、環境に関する規制					
• 政府の要求する会計処理及び書類作成のための事務作業					

（注：支援スタッフとは、技能者及び秘書職員をも含みます）

19. 貴研究所では、ここ3年どのようにして研究者を採用していますか？　下記のそれぞれの方式による採用者数のおよその割合（％）を合計が１００％となるように記入してください。

- 人事院による公務員試験に合格した者の中から選考　＿＿＿％
- 公務員試験無しで、研究ポストの公募による採用　＿＿＿％
- 公募も公務員試験も無しで採用　＿＿＿％

合計　１００％

20. ここ3年の貴研究所研究者の年間採用数の平均はおよそどれくらいですか？

＿＿＿人

21. ここ3年で、貴研究所を退職した者の年齢分布はどのようになっていますか？　合計が１００％となるよう記入してください

- ３９歳以下 ＿＿＿＿％
- ４０～４９歳 ＿＿＿＿％
- ５０～５９歳 ＿＿＿＿％
- ６０歳以上 ＿＿＿＿％

計　１００ ％

22. 貴研究所では、何人の外国人研究者がいますか？　(1991年3月31日現在)

- 正規職員 ＿＿＿＿人
- 臨時職員 ＿＿＿＿人　（何らかのﾌｪﾛｰｼｯﾌﾟ制度によりサポートされたポスドク研究員を含む）

23. 所属省庁の幹部は、貴研究所の研究活動の進捗状況及び成果にしかるべき関心(due interests)を払っていると感じますか？　当てはまるものに○印を付けてください。

- は　い ＿＿＿＿
- いいえ ＿＿＿＿
- わからない ＿＿＿＿
- その他 ＿＿＿＿＿＿＿＿＿＿＿＿

24. 貴研究所の研究活動の意義を貴研究所の管理部門は適切に理解していると感じますか？　当てはまるものに○印を付けてください。

- は　い ＿＿＿＿
- いいえ ＿＿＿＿
- わからない ＿＿＿＿
- その他 ＿＿＿＿＿＿＿＿＿＿＿＿

25. 貴研究所の研究環境は、研究業務を実施するために必要な高い資質を備えた研究者を採用する上で、十分に魅力的ですか？　当てはまるものに○印を付けてください。

- は　い ＿＿＿＿
- いいえ ＿＿＿＿
- わからない ＿＿＿＿
- その他 ＿＿＿＿＿＿＿＿＿＿＿＿

〔注〕• ２６～３２の質問は、貴研究所が他の組織への技術移転に携わっている場合のみ、回答してください。貴研究所が技術移転に携わっていない場合は、３３の質問へ進んでください。
• 下記の質問をするにあたって、技術移転を「貴研究所から国内外の企業または政府へ、装置、工程、ノウハウ、または知的所有権を伴う情報を移転すること」と定義します。

26. 政府研究所は様々な理由で、技術移転を行っています。貴研究所または所属省庁が行っている技術移転はどのような理由により行われているか、下記の各項目について、それぞれ当てはまる程度に○印を付けてください。

	非常に重要	やや重要	ほとんど重要でない	理由ではない
• 法律により義務づけられているため				
• 経済発展を支援するため				
• Ｒ＆Ｄ協力の実施、協会•組合への参加、共同事業の当然の結果である				
• 技術情報を交換するため				
• 貴研究所または所属省庁の予算増加をはかるため				
• 科学者及び技術者が、自分たちのアイディアや技術が発展していくのを見ることにより個人的な満足を得るため				
• 科学者及び技術者が、企業家精神及び個人的利益に関心を持っているため				

27. 技術を外部に出す（他者が貴研究所が生みだした技術を利用することに関心を持つ）という観点から、貴研究所のここ3年間の成果をどう評価しますか？ 10がすばらしい(excellent)、5が平均、0が全く失敗(ineffective)というように、10段階評価で当てはまる評価値に○印を付けてください。

０－１－２－３－４－５－６－７－８－９－１０

28. 技術を受けた組織に与えた営利的効果という観点から、貴研究所のここ3年間の技術移転の成果をどう評価しますか？ 10がすばらしい(excellent)、5が平均、0が全く失敗(ineffective)というように、10段階評価で当てはまる評価値に○印を付けてください。

０－１－２－３－４－５－６－７－８－９－１０

29. 下記は考えられる技術移転戦略のリストです。このうち貴研究所が採用したことのある戦略について、貴研究所の技術を他の組織に知らせるまたは関心を持たせるという観点から、これらの戦略の成果を評価し、当てはまる評価の欄に○印を付けてください。

	戦略としては使っていない	非常に効果的な戦略	やや効果的な戦略	戦略としてはほとんど効果的でない	戦略としては全く効果的でない
• 研究所で開催するセミナーまたは会議					
• ちらし、ﾆｭｰｽﾚﾀｰ、その他の通信文					
• 研究所の研究者と技術を受け取る組織の人物との直接的接触(person-to-person contacts)					
• 産業界の会合における論文発表またはデモンストレーション					
• 専門家の組織により開催される科学者の会合でのプレゼンテーション					
• 政府機関後援により開催される科学者会合でのプレゼンテーション					
• 研究協会、組合への加入					
• 技術移転活動に責任を持つ特別の組織あるいはスタッフの設置					
• 非公式な研究所訪問の勧誘					
• 職員の交換(personnel exchange)					
• 技術移転を主目的としたR＆D協力					
• 直接R＆D資金を負担することを目的とした当研究所と技術受取組織との間の契約の締結					
• 他組織の人々に貴研究所の装置や設備の利用を許可					
• 特許、著作権の販売					
• ビデオテープ、コンピューターディスクのようなエレクトリックメディアの活用					
• 貴研究所における共同研究の実施					

30. 大部分の研究所にとって技術移転活動は、利益をもたらす反面で問題を生じるものでもあります。まず、技術移転活動に伴うと考えられる利益をリストアップしたいと思います。貴研究所にとって下記の項目は、どの程度の利益であったか、当てはまる欄に○印を付けてください。（注：「最も重要な利益」という欄にはひとつの項目のみチェックしてください）

	最も重要な利益	大きな利益	若干の利益	利益ではない
• 貴研究所自身の利益				
• 貴研究所に雇用されている個々の科学者及び発明者の利益				
• 貴研究所及びその活動に対する世間一般からの知名度向上				
• 立法または行政当局からの是認の獲得、あるいは政治的立場の改善				
• 研究所の研究者が現実世界の問題により即したアプローチをするようになる				
• 技術開発及び移転プロジェクトを共同で行うため、研究者が集まる				
• 技術の移転先組織から専門知識を得る				
• 顧客、ユーザーの獲得				

今度は考えられる問題点です。貴研究所にとって下記の項目は、どの程度の問題点であったか、当てはまる欄に○印を付けてください。（注：最も大きな問題点の欄にはひとつの項目だけチェックしてください）

	最も大きな問題点	大きな問題点	若干の問題点	問題点ではない
• 他の研究関連活動のための時間が削られる				
• 研究所の研究が基礎的または前商業的なものから、より商業的なものになってくる				
• 伝統的な研究を続ける人間とより企業的な研究を目指すようになった人間との間に不和や不調和が生じる				
• 知的財産についての紛争に巻き込まれる				
• 我々の技術や技術情報に関心を持つ部外者により頻繁に仕事を中断させられるようになる				

31. 1990年度において、貴研究所または貴研究所の職員が他者に対して特許や著作権の利用を許諾した技術の数は、およそ何件ですか？

＿＿＿＿＿件

32. 1990年度において貴研究所または貴研究所の職員に対して、特許が与えられた技術の数はおよそ何件ですか？

＿＿＿＿＿件

次の質問は、貴研究所が外部の組織と正式にＲ＆Ｄ協力協定を結んでいる場合にのみ、回答してください。
（貴研究所がそのような協力協定を結んでいなければ、ここでこの調査は終了です。ありがとうございました！）

33. 現在貴研究所が結んでいる正式なＲ＆Ｄ協力協定は、いくつですか？（注：貴所属省庁に属している他研究所との協定は含みません）

＿＿＿＿＿

34. そのうち、外国のあるいは外国所有の組織との協定はいくつですか？

＿＿＿＿＿

35. Ｒ＆Ｄ協力協定を結んでいる組織について、その割合を次に示してください。

	割　合
• 政府（政府研究所を含む）	＿＿＿＿％
• 産業界	＿＿＿＿％
• 大学	＿＿＿＿％
• 民間非営利団体	＿＿＿＿％
• その他	＿＿＿＿％

36. 最も重要な協力協定を３つ以内挙げてください（主要な協力組織または研究所名も付記してください）。ここで「重要な」とは、生み出されるＲ＆Ｄ成果の質により定義されます。

１．＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿
２．＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿
３．＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

37. 上に挙げた第一番目のＲ＆Ｄ協力協定について、およその総Ｒ＆Ｄ予算と、貴研究所の負担額を示してください。

• 総Ｒ＆Ｄ予算　＿＿＿＿＿百万円
• 貴研究所の負担額　＿＿＿＿＿百万円

38. 一般的に、貴研究所の研究成果全体に対して、Ｒ＆Ｄ協力協定全体はどの程度貢献していますか？　当てはまる程度に○印をつけてください。

	多大に貢献	やや貢献	ほとんど貢献なし	全く貢献なし(または無関係)
• 基礎研究と新知識の開発				
• 前商業的応用研究				
• 商業的応用研究と開発				
• 技術移転活動				

39. 一般的に、貴研究所がＲ＆Ｄ協力協定を締結する動機はどのようなものですか？　下記の各項目に当てはまる程度に○印をつけてください。

	非常に大きい動機	ある程度の動機	ほとんど動機でない	全く動機でない
• 基礎的な科学知識を得たい				
• 新技術や応用知識を得たい				
• 協定に参加している相手の機関に貢献したい				
• 協定締結のために相手の機関から提供されたインセンティブ				
• 人事交流の機会				
• 研究所や所属省庁が利用可能な資金や利益の増加				
• 研究所のＲ＆Ｄ任務として				
• その他(具体的に記述してください) ＿＿＿＿＿＿				

以上で質問はすべて終了しました。ご協力誠にありがとうございました。

付　録

付録 1　本文第１章和訳

付録 2　本文図表和訳一覧

付録 3　「政府研究機関に関する日米比較調査」アンケート結果集計（我が国政府研究機関分）

本付録は関係者の便宜のため、科学技術政策研究所第１調査研究グループの責任においてとりまとめたものである。なお、付録１及び２については下田　隆二（総括上席研究官）及び関　正明（特別研究員）が、付録３については関　正明及び遠藤　英樹（前　特別研究員）がとりまとめを担当した。

本文第１章和訳

第１章　はじめに

１９８０年代のはじめから、政府研究開発機関の機能、役割、有効性に関して大がかりな再評価がなされてきた。経済的な考慮に主として刺激され、ほとんどの先進国の政策立案者は新しい使命と任務を公的研究機関に与え始めた。日本においては、国立試験研究機関における基礎研究の重要性が強調されてきた。（１９８７年　科学技術会議）　ほとんど全ての場合、新たに求められた役割は、政府研究システムにみられた弱点を補正し、研究開発資源が極めて制約された環境において有効性を向上させるための試みである。

しかし、政府研究機関に関するデータと情報が欠如していることが永く認識されていた。(Cordell Gilmour, 1976; OECD, 1988)　研究機関の活動に関するこれまでの前提を第３者が実証的に検定することや、変化や結果を測定するための指標となるデータもないままに、政府研究に関する国の優先順位付けと政策立案が、進められてきた。予算及び人材の動向、技術的成果等に関する有用なデータが見いだされるべきであるが（ＮＳＦ１９９０；政策研１９８９）、組織及びシステムとして研究機関を分析したものは一般に欠けている。米国における特記すべき例外はシラキュース大学技術情報政策センター（ＣＴＩＰ）において現在進行中のデータ収集・分析作業である国家研究開発比較プロジェクトである。(Boseman and Crow,1990; Crow and Boseman 1991)

知識を増やすためＣＩＴＰ及び日本の科学技術政策研究所（ＮＩＳＴＥＰ）は日本の政府研究機関に関する共同研究に着手した。本プロジェクト、日本の政府研究機関調査（ＪＮＬＳ）は１９９１年から進行中である。その目的は、日本の政府研究機関の性格、特徴及び機能に関し体系だった学問的分析を行うことである。これにより、変化を測る際に指標となる情報を提供するとともに、日本の研究システムに関する新たな知見を得ることが可能となる。さらに、後述する一部の例外を除いて、日本の調査で得られる情報は米国で既に収集されている情報と比較し得るものである。従って、国際比較により、政府研究の性格に関するより一般的知識を得、また、両国における政策立案を支援することが出来る。

本報告書はＪＮＬＳの第１段階において得られた調査データを基本的に記すものである。日本における特定の政策的関心事項並びに米国及び日本の政府研究機関の主要な比較に焦点を当てることが有益である。従って、本章は、本プロジェクトの概要、日本及び米国における政府研究開発セクターの役割に関する考察、並びに、次章以降に記される主な知見の要約からなる。

政府研究機関を考察し、分析するにあたって、合意された、あるいは一般的な手法がないことに留意することが重要である。政府研究機関は、しばしば、その機能（例えば、市場の失敗の補償）の観点から、その任務（防衛、保健、宇宙）の区分けに即して、あるいは、政府及び市場への影響に関する役割から論じられる。研究開発機関は異なったカテゴリーに分類され得ると考えられるので、このような区分けではそれぞれの研究開発機関を完全にはとらえることは出来ない。(注1) しかしながら、その機能が研究機関における研究の性格と内容を主として決定するので、研究機関の分析ではその社会経済的な目的を考察することがいずれにせよ必要となる。しかし、本報告では、任務は、広範な政府の目的との関連では言及されておらず、むしろ、研究開発活動のタイプ（基礎研究、技術的支援等）との関連で論じられている。

日本の政府研究機関調査（ＪＮＬＳ）の概要

日本の政府研究機関調査（ＪＮＬＳ）は１９９１年から進行中である。これは前述のように米国の技術情報政策センター及び日本の科学技術政策研究所（ＮＩＳＴＥＰ）の共同研究プロジェクトである。これは２段階からなり、第１段階は日本の政府研究機関に対する、その機構と活動の性格に関する詳細なアンケート調査である。第２段階は、研究機関の管理・運営に関し、研究機関職員に対する半ば体系だった定性的なインタビューからなる。インタビューは１９９３年１月に終了している。

注１：例えば、エネルギーや発電に関するものでも「産業技術」貢献しているとみなすこともできる。

ここで報告するものは研究機関に対するアンケート調査のデータである。調査は１９９１年秋に日本の政府研究機関のほとんど全てに宛て発送された。(注2) 日本においては３種類の公的研究開発機関がある。国立試験研究機関（政府の省庁に付属）、半官半民の研究機関（特殊法人：特別の法律により設立された組織であるが、通常は予算の配賦及び理事の任命を通じて個々の省庁と関係がある）、非営利研究開発機関である。(注3) 社会科学、またはマネージメントの研究を行っているもの、あるいは研究開発を全く行っていないと判明したものを除き、全ての国立試験研究機関と特殊法人が調査された。十を越える非営利研究機関から、三機関が現在あるいは過去における政府との関係から調査対象とされた。

調査時点で、１０２の国立試験研究機関及び特殊法人と３非営利機関が存在した。このうち８機関は上記の理由で除外された。９７件の調査表が発送された。１９９１年１２月から１９９２年１月にかけて、８８機関から回答があり、回収率は９１％と非常に高い値であった。回答のあった日本の政府研究機関のリストが添付資料Ｂに示される。

調査はＮＩＳＴＥＰ及びＣＴＩＰが共同して作成した。ほとんどの項目は１９９０年に国家協力研究開発プロジェクト（ＮＣＲＤＰ）の一部として送付された質問項目を流用した。ＮＣＲＤＰはＣＴＩＰが現在実施している調査プロジェクトであり、このプログラムの詳細と調査活動は添付資料Ａに示される。日本における政策的関心の持たれる研究機関の問題点、特に人材とその流動性を調査するため質問が追加された。ＮＩＳＴＥＰが日本語に訳し、(注4) アンケートの実施にあたった。調査票及びその英訳は添付資料Ｃに示される。

注２：文部省により運営される政府研究機関は、これらの機関が政府セクターそのものではなく高等教育機関と関係していることから、本研究の対象としていない。

注３：これらは（財）リモートセンシング技術センター、（財）日本生物科学研究所、（財）鉄道総合技術研究所である。

注４：日本の質問票は第３者により英訳し、米国における政府研究機関の質問票と最大限同等の質問であることを期した。

日本及び米国の政府研究機関システム

日本の科学技術に関して、政府の関与は主として産業技術の振興を目的としていると米国及び西欧では一般的に考えられている。日本の産業及び経済政策の多くの側面でこれは事実であるかもしれないが、これが政府研究機関システムに完全に反映されているわけではない。日本の国立試験研究機関及び特殊法人のシステムは、農業、防衛、公衆衛生及び安全、標準、基礎研究、宇宙等の政府の伝統的な研究開発任務のための多様な研究機関の集合体である。この基本的な多様性は強調してもし過ぎることはなく、これは、研究開発に関する政府の役割に関する一般的な理解に極めて合致するものである。

しかしながら、システム内に産業技術に関する任務が強く存在する。通産省に付属する国立試験研究機関が産業技術振興に果たした役割は古くから認識されてきたし、他の省庁に付属するいくつかの研究機関についても同様である。川崎（１９８９年）は約３０の国立試験研究機関が産業技術に特に関係していると推定している。仮にそうだとしてもいくつか留意すべき点がある。第１に、これら研究機関の多くは技術を産業に提供していない。通産省の計量研究所もこの例である。また、例えば、厚生省の国立衛生試験所等のように規制の機能を果たしているものがある。いくつかの産業技術に関係する研究機関では、米国におけると全く同様に基礎研究が盛んに行われている。（例えば、科学技術庁の金属材料技術研究所とエネルギー省のＡｍｅｓ研究所）

日本の研究機関システムの産業への指向を一般化し過ぎないよう注意することが重要である。以下及び次章以降に示すように、日本の研究機関は産業技術の創造や、産業の発展にために一律に活動している訳ではない。多くのいわゆる政府の工業研究所は日本に特有のものではなく、経済における政府の基本的役割の反映である。例えば、地質調査所は通産省の研究機関であるが、製造技術の開発は全く行っていない。日本のシステムで特徴的なのは、通産省傘下に、（電子技術総合研究所、機械技術研究所のように）産業技術の振興及び開発をその歴史的な任務としてきているいくつかの一流の研究機関があることである。しかしながら、このような研究機関の存在は、産業セクターに関してはっきりした役割を持つ省にこれらが付属しているという事実を離れて語ることはできない。米国においてこれら機関と研究内容において相応する研究機関があったとしても、米国は産業政策に関する政策的任務と上部の官僚機構の両方を欠いている。

明らかになった知見

以下の４章では研究機関調査の基本的知見を詳述する。現時点の日本における全般的な政策的重要性に鑑み、主要な結論をここに示す。第１は研究機関における基礎研究の実施に関するもの、第２は研究機関の運営及び資金に関するもの、第３は人材及び管理に関するもの、第４は研究開発協力及び技術移転に関するものである。

基礎研究の役割

日本の科学技術政策は創造的、基礎的研究を振興する必要性を継続的に重視してきた。研究機関調査から明かなように、基礎研究は研究機関の研究の中で最も優先度が高いものであり、これは米国と同じである。日本の政府研究機関の４分の１が基礎研究を最も重要な任務とし、次いで３分の１が２番目に重要としている。つまり、研究機関の６０％が基礎研究を極めて意義ある任務と考えていると言える。基礎研究の重視は調査を通じて多くの部分で明かとなっている。例えば、ほとんどの研究機関が基礎研究の実施にその予算の多くを割き、科学知識への貢献を最も重要な評価基準だと考え、科学論文や報告の作成に最も多くの時間を費やしている。日本の政府研究システムは実際に基礎研究を実施しており、明らかにその重要性を認識しているとの印象を受ける。

しかし、本調査では次の２点は明かではない。第１点は、これが研究機関の（新たな国家の目標の結果としての）新しい重点であるのか、あるいは、単に伝統的な慣行の単なる反映なのかという点である。他のデータ（Papadakis and Jankowski,1991）では、政府研究機関ではここしばらくの間、米国における程度と同様に、基礎研究が政府研究システムの重要な焦点であったことを示唆している。第２点は、データは研究がいかに優れているか：独創的、先駆的か、もっと平凡なものか、を示していない点である。この点で、武藤及び平野（1991）は政府研究機関が創造的基礎的研究を推進するにあたっての多くの困難を指摘している。研究システムが直面している問題は、基礎研究に充てられる時間や資源を増やすことではなく、研究機関内部の管理の変更を通じてその質の向上を図ることであるかもしれない。

研究機関の運営及び資金

調査データは、武藤及び平野（1991）が細かく指摘した研究機関の運営の問題点はほとんど明らかにしていないが、川崎（1989）が論じた資金問題を強く肯定するものである。

全体として、日本の政府研究機関の構造は、米国のものに類似している。これらは同程度に分権化された組織であり、日本の評価が米国より若干低くなっているものの、研究者はともにかなりの研究の自由度を持っている。しかしながら、日本の研究所長は官僚機構が研究機関の効率的な運営の障害となっていると考えていないようであり、米国と異なり、日本の研究機関は運営の多様性を示している。ほとんどの研究機関は、明らかにいくつかの異なった研究組織のアプローチを用いている。その結果、研究機関の運営における柔軟性の必要性は明らかではない。日米の研究機関とも同程度に、プロジェクトの選定は産業界のニーズよりも政府の政策により影響されていると答えているものの、細かな段階での運営にお係る活動（研究計画、プロジェクト選定等）はこの調査でほとんど判っていない。

明らかなのは、日本の研究機関の厳しい研究資源の環境であり、これは川崎（1989）が懸念を持って議論した点である。研究機関の予算と人員の水準は過去数年の間ゼロ成長の状況にあり、これがいくつかのデータに示されている。まず、日本の研究機関の予算レベルは、研究機関の規模と給与水準の低さを考慮しても、平均して、米国の研究機関と比較して低い。次に、研究所長らは、研究開発の生産性への主要な障害として、人員と予算の制約を挙げており、これは事務手続きの面でも明らかになっている。例えば、日本の研究機関では、常勤の職員の雇用が承認されるまでに３カ月から６カ月を必要としており、米国では３週から６週間である。

人材及び管理

いくつかの人員及び管理に関する問題が、創造的基礎研究の推進に関する政策的な関心事項となる。第１は研究機関の研究開発の生産性に対する一般的な障害に関するものであり、第２は新しい研究者の採用・確保であり、第３は研究機関におけるプロジェクトの選定に影響を与える要素に関するものである。

調査結果はこれらの点に関し、いくつかの異なった印象を与える。他方、伝統的な研究機関システムが明かとなっている。ほとんどの研究機関では非常に少数

の研究者しか平均して採用しておらず、中央値は年間３人である。ほとんどの新規採用は公務員試験制度を通じて行われる（３分の２の研究機関が半分以上についてこれを利用）。流動性は限られており、研究機関を離れる研究者の大多数は定年退職によるものであり、若手研究者はほとんど離れていないと見受けられる。この点で、新しい血はほとんど研究機関には導入されていない。

しかし、いくつかの活動的な研究機関が存在するという兆候もある。いくつかの研究機関では平均して職員百人当たりで年間１８人の研究者を新規採用している。約３分の１の研究機関で、離れていった研究者の３０％以上が３９歳未満であり、また、公務員試験なしでの採用や、一般公告なしでの採用も珍しくない。このような慣行がある種の任務（保健、農業等）に限られているのか否かは今後さらに分析する必要がある。

全般に、研究所長らは、研究環境は質の良い研究者を引き付けるに十分であると考えている。これは、不十分な技術的支援や貧弱な機器が最優秀の研究者を幻滅させ、産業界へ向かわせるとしばしば言われていることと合致していない。全般に、研究者を引き付ける環境ではなく、定数の不足が最も深刻な問題であると考えられる。資源の確保が２番目に重要な研究機関の評価基準として示されると同時に、人材の不足が研究機関の生産性に対する最も重大な障害と考えられている。研究所長らに対する予備的インタビューでは、このような不足が、通常研究者の受け入れに結びつく研究開発協力の主要な動機のひとつであることが示された。政府研究機関では、外国人研究者はまだ大きな存在とはなっていないが、かなりの程度の研究受け入れがあると見受けられる。２５％から３３％の研究機関では頻繁な受け入れを報告しており、大多数（約３分の２）の研究機関は少なくとも、時々の受け入れ、特に他の政府研究機関や大学の研究者の受け入れを報告している。

研究開発協力及び技術移転

いくつかの日米の政府研究機関の際だった相違が、技術移転活動に関して明かである。研究開発協力に係る動機と利益は比較的同等であると考えられるが、技術移転に関する経験はかなり異なっている。調査データの特性、調査の時点がこの点で問題である。米国の調査は１９８９年における研究機関の活動を反映しているが、過去数年で、米国の政府研究機関における研究開発協力及び技術移転活動が大きく変化している。現在の米国の政府研究機関が日本により類似してきたのか--あるいはまだ相当に異なっているか--は明らかになっていない。

日米の大きな相違は技術移転活動が日本の研究機関において制度化されている度合いである。日本の研究機関の技術移転の動機は、通常の研究開発の一連の動機と関連しており、米国の動機は、法令による圧力、予算並びに個々の研究者及び技術者の関心である。日本の研究機関は、また、自らの技術移転活動を成功しているとみなしており、広範な技術移転戦略において成功した経験を多く持っているように見受けられる。

本文図表和訳一覧

（第２章）　［本文　頁］

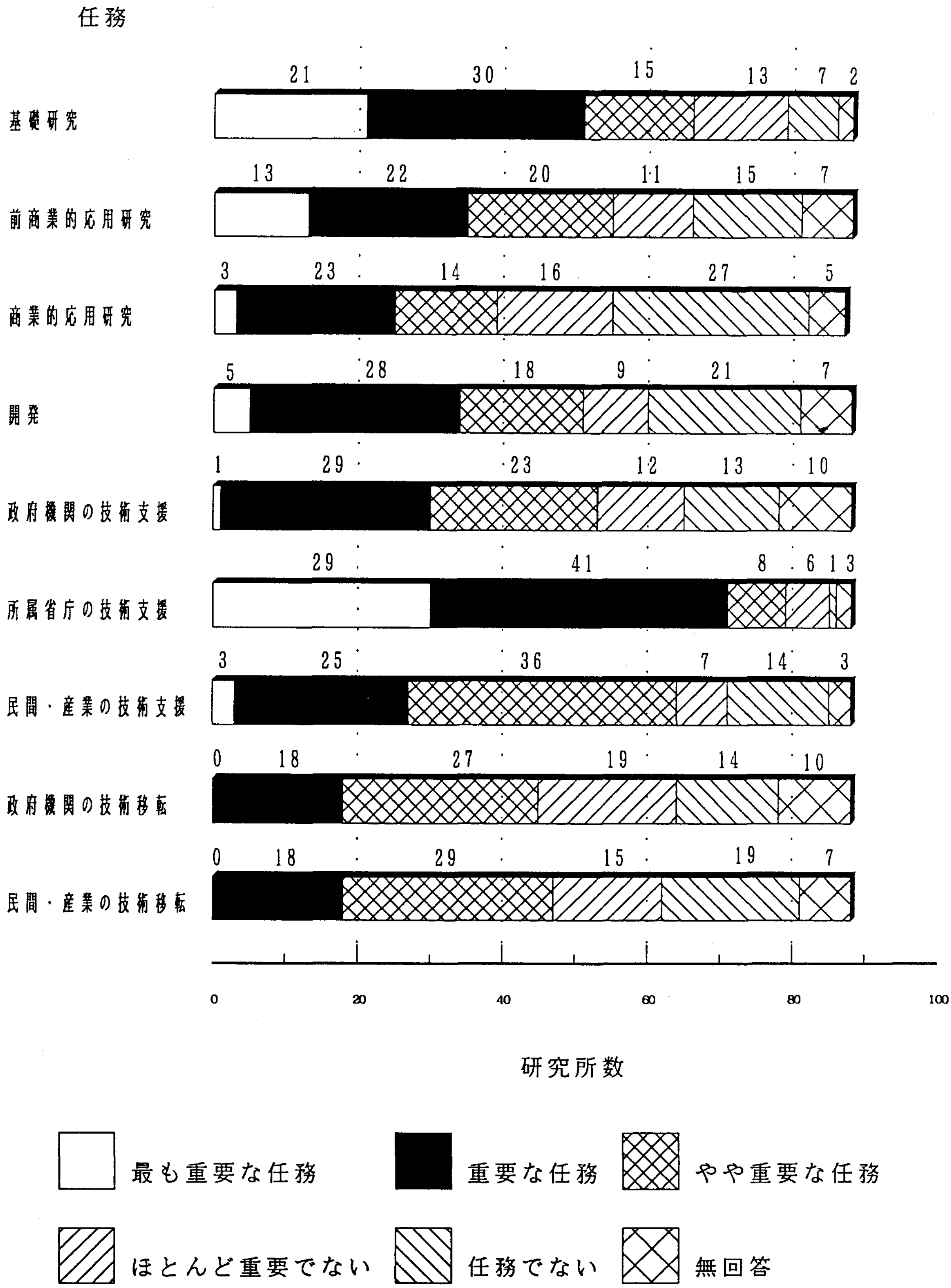
（第３章）

<付録　3>

「政府研究機関に関する日米比較調査」アンケート結果集計
（我が国政府機関分）

アンケート結果一覧

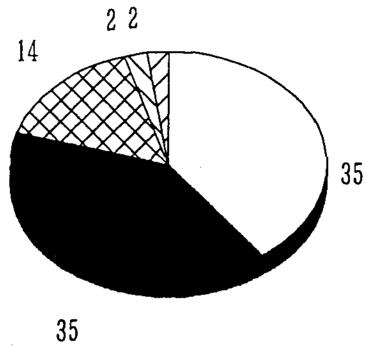
1．任務の重要性（数字は研究所数）



2．業務を評価するための

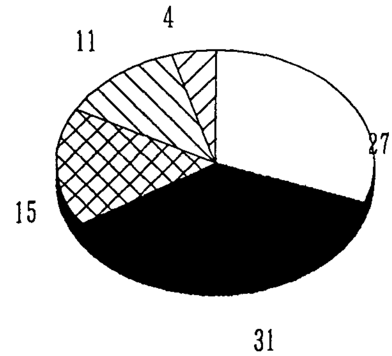
重要性の程度

（円の数字は研究所数）



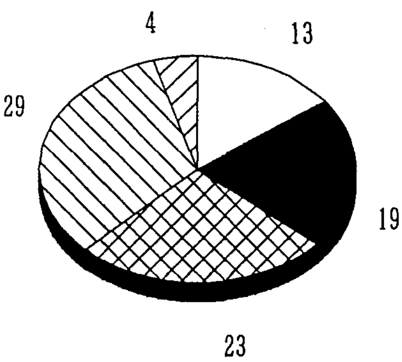
a.基礎的科学知識の

発達



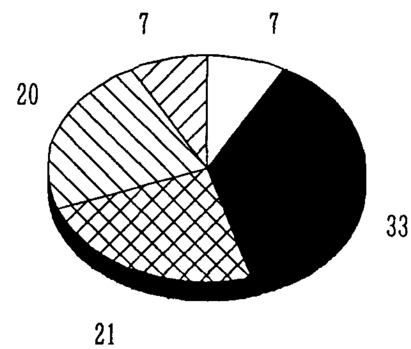
b.商品・工程の

開発に有利



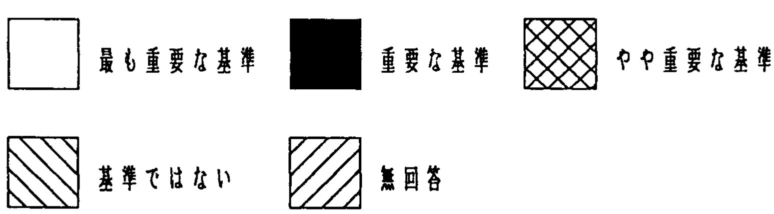
c.特定グループの

利益



d.研究所資源の

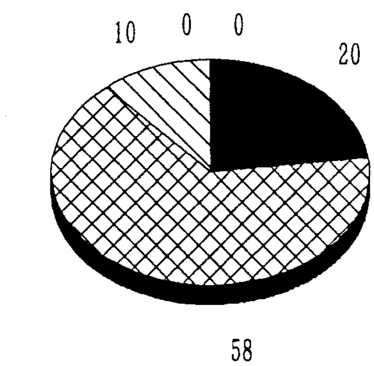
増加



3．研究の進め方および

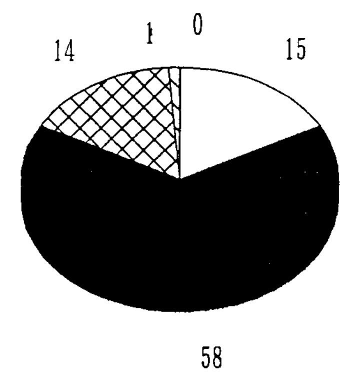
プロジェクトについて

（円の数字は研究所数）



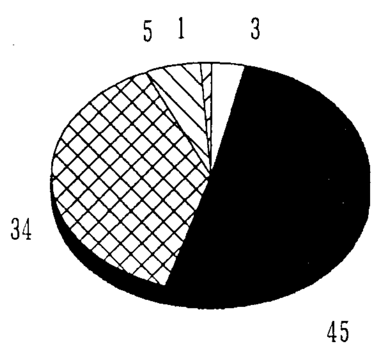
a.「お役所仕事」

が多い方



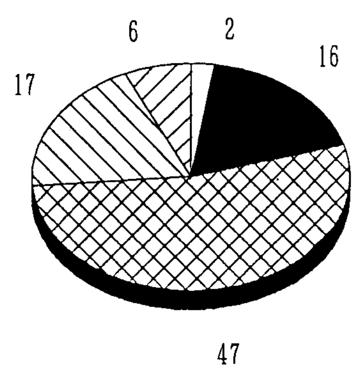
b.自治権を

持っている



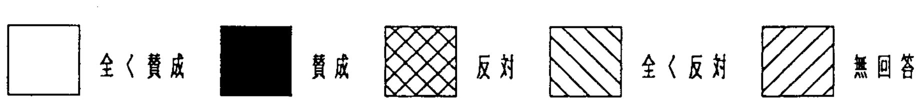
c.政策変更が

影響

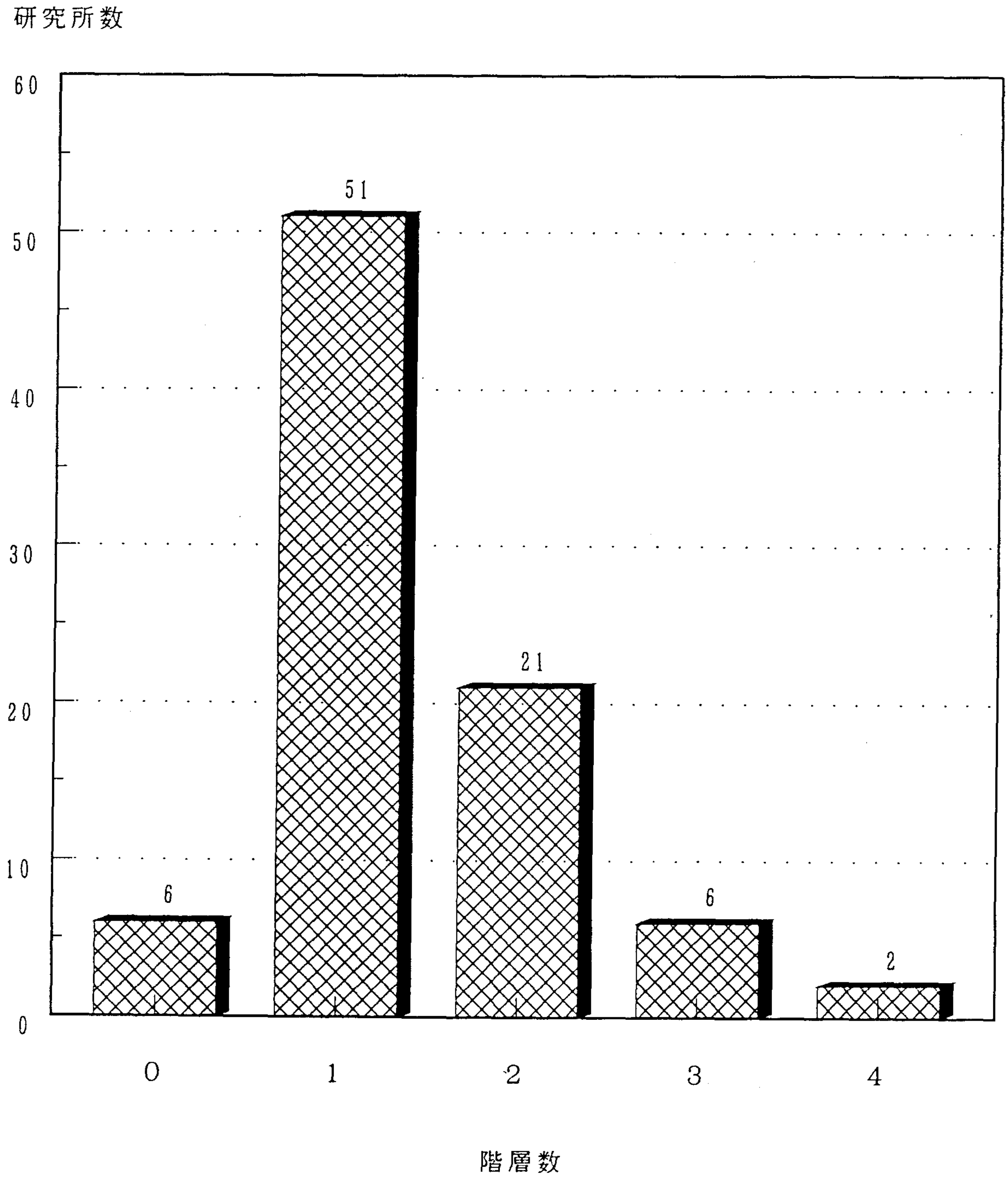


d.商業的利益の

評価

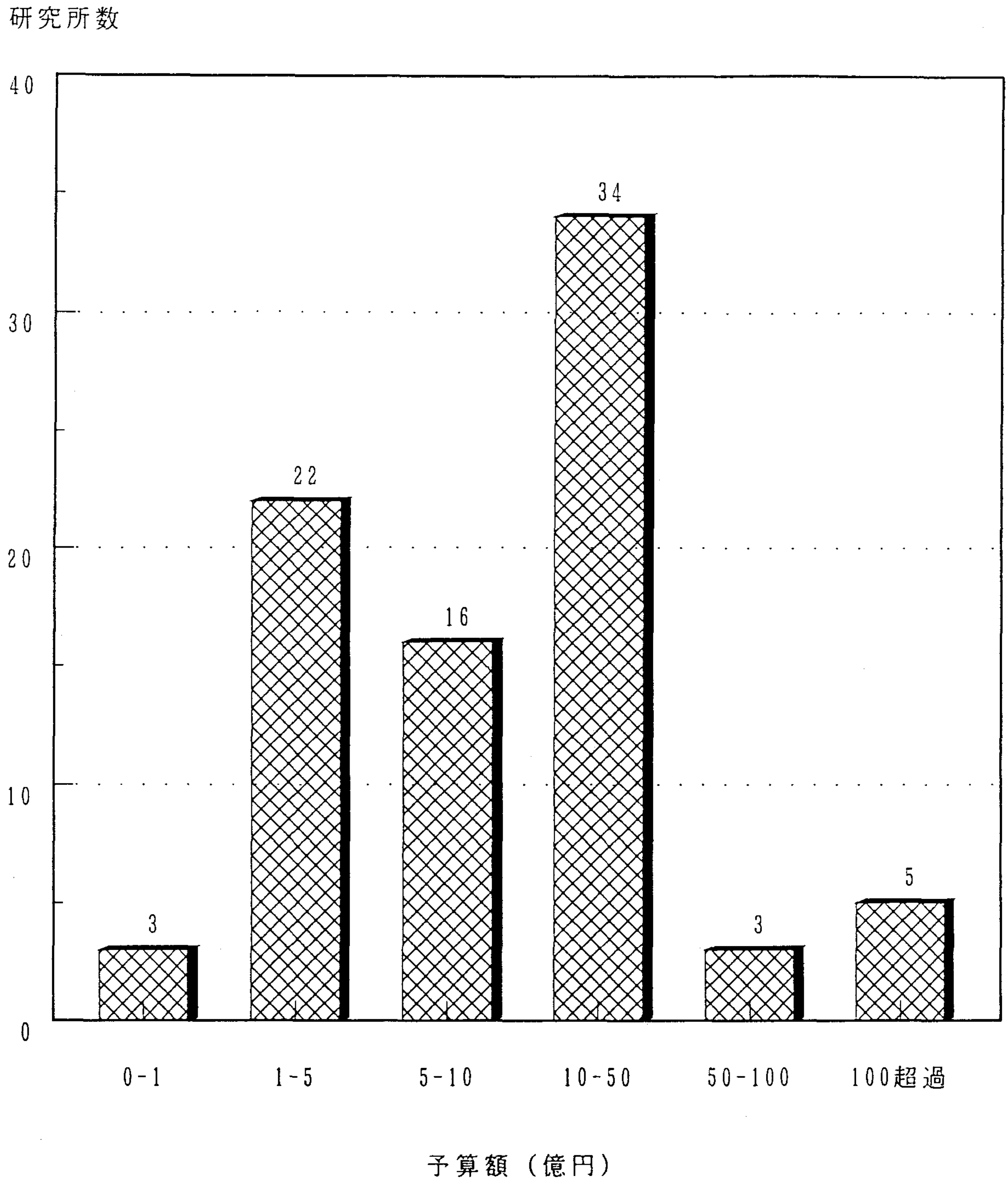


4．管理階層数



回答	86
回答無	2

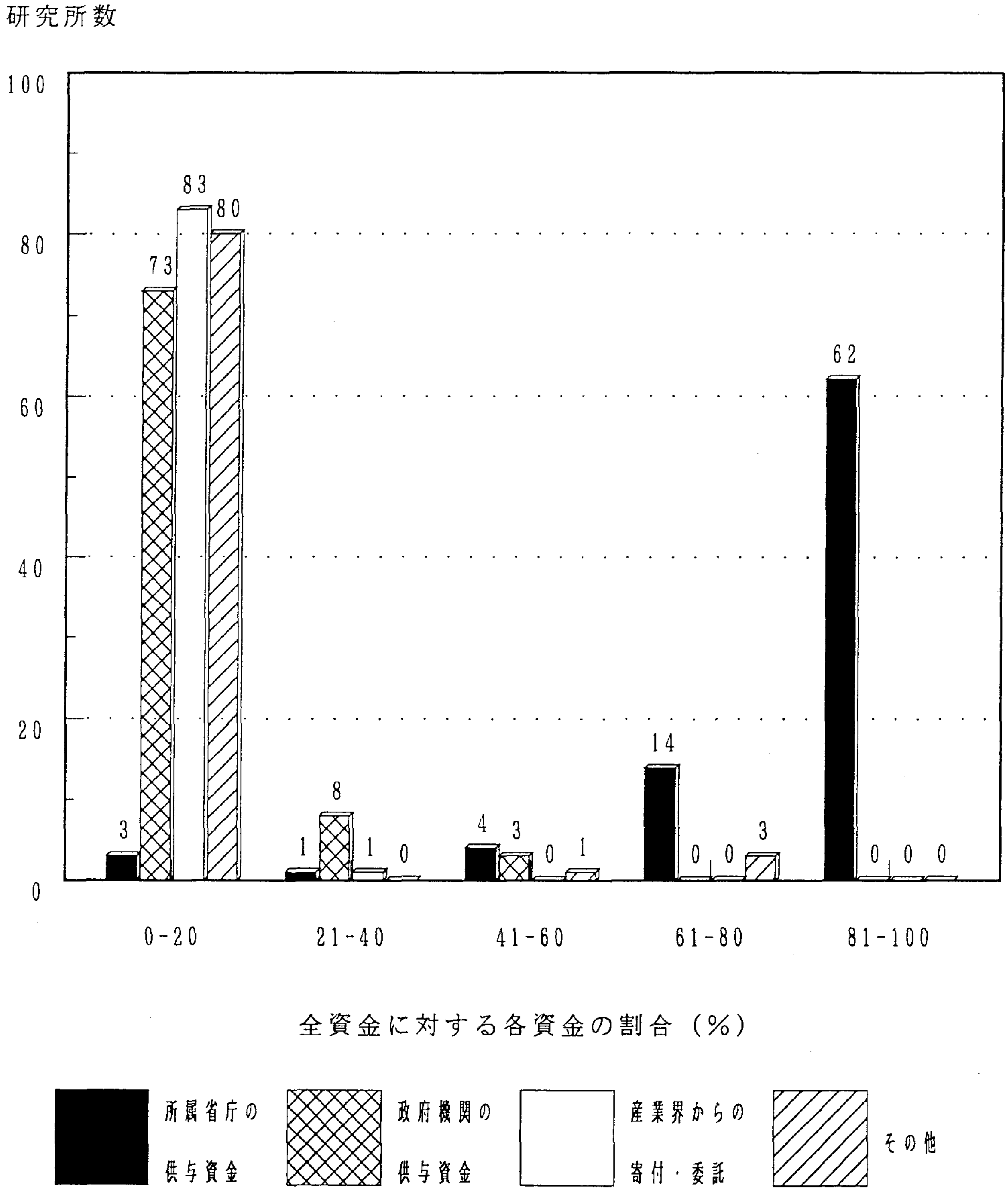
5. R＆D予算額



回答　８３

回答無　５

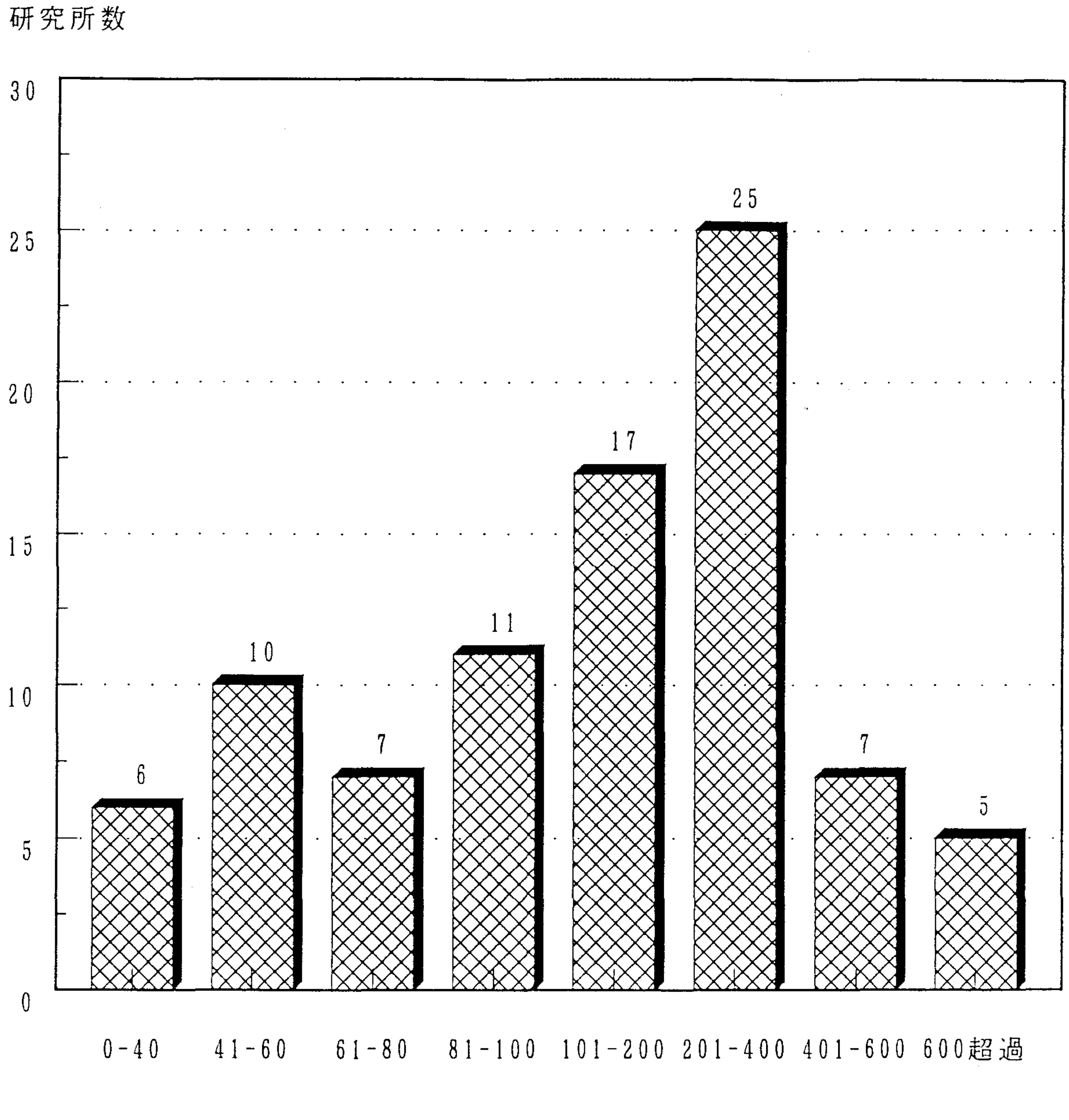
6. R&D資金割合



回答	８４
回答無	４

7．常勤職員数

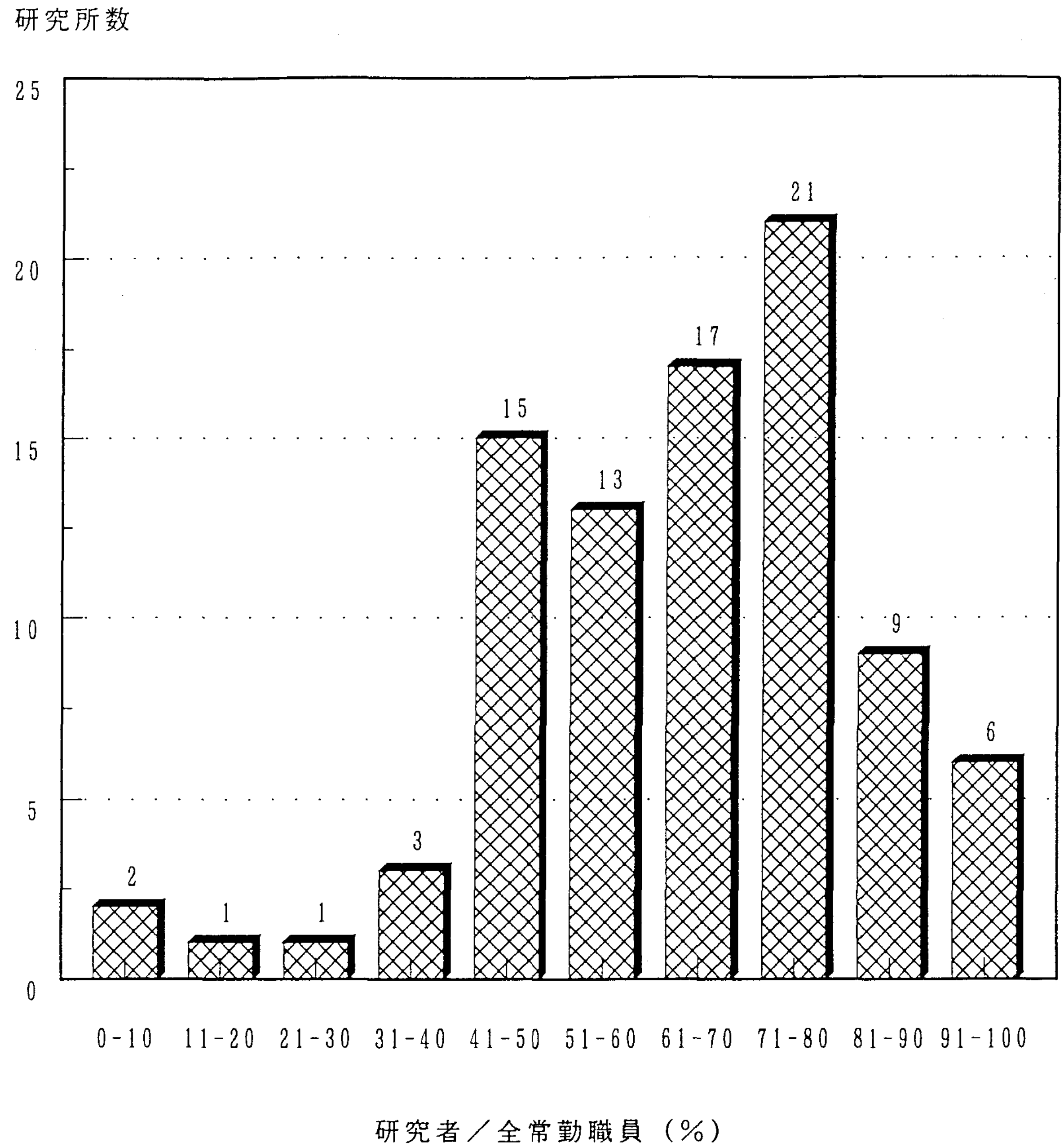
（1）常勤職員数合計



回答	88
回答無	0

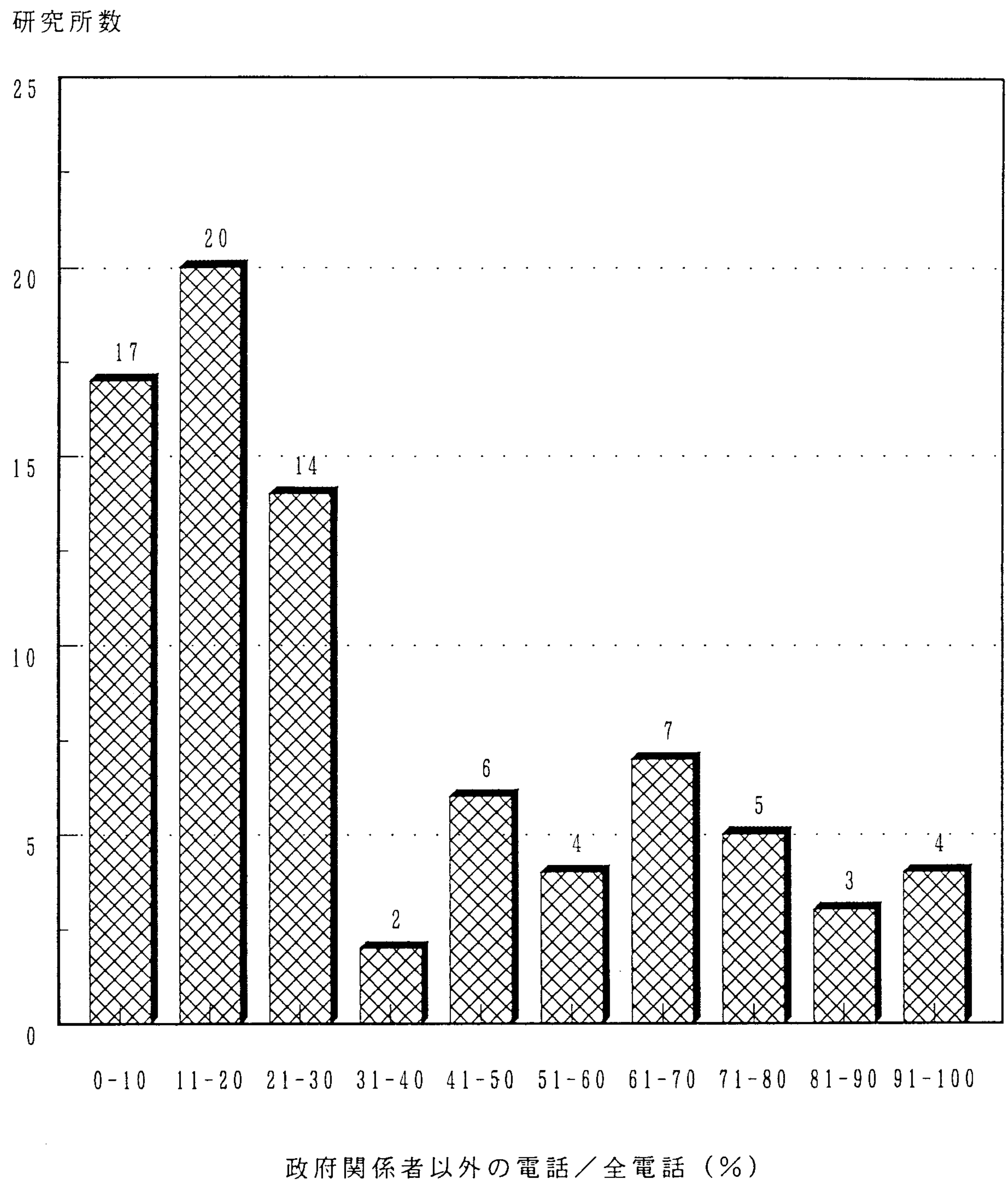
7．常勤職員数

（2）研究者割合



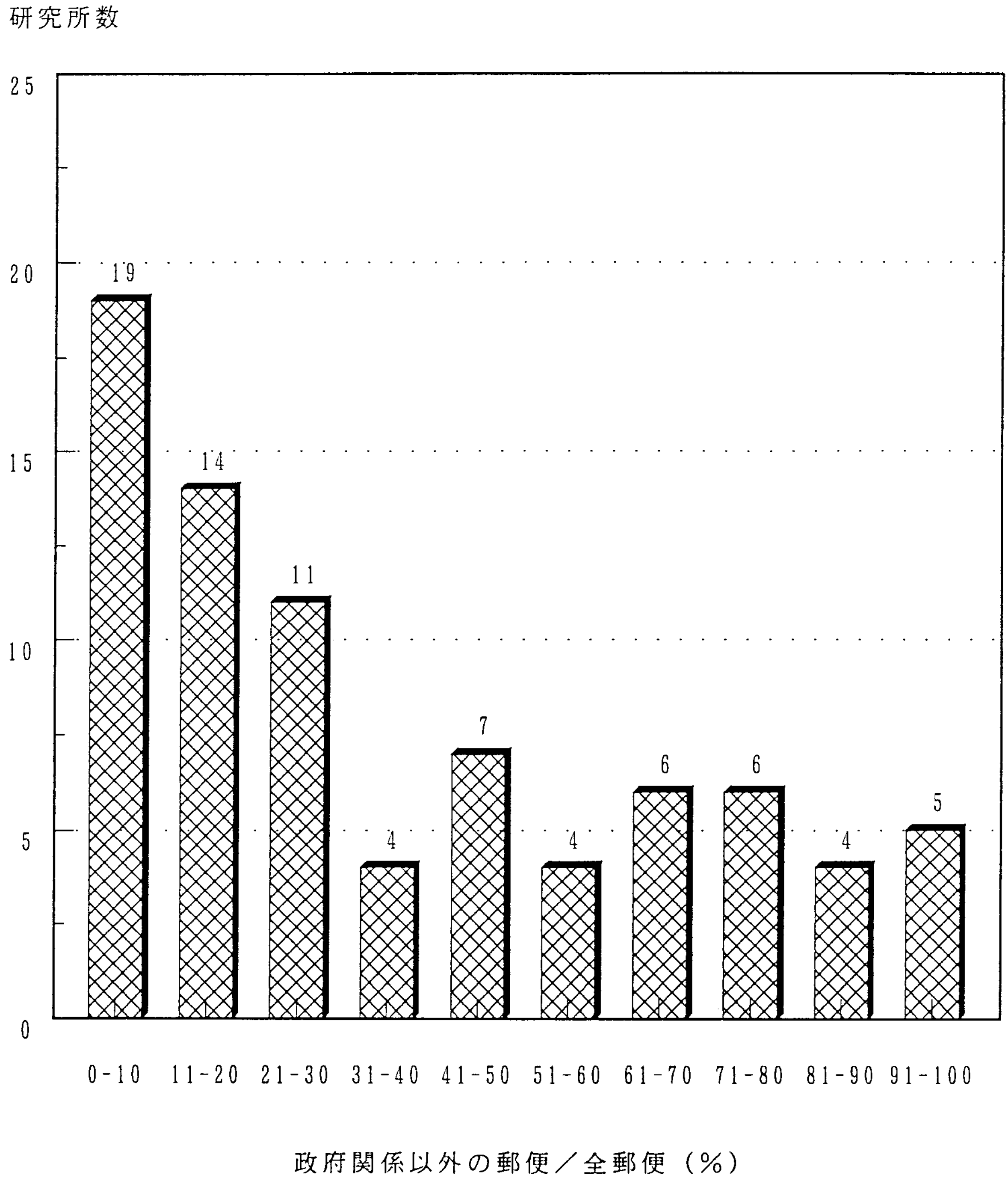
回答	88
回答無	0

8. 政府関係者以外との電話



回答	８２
回答無	６

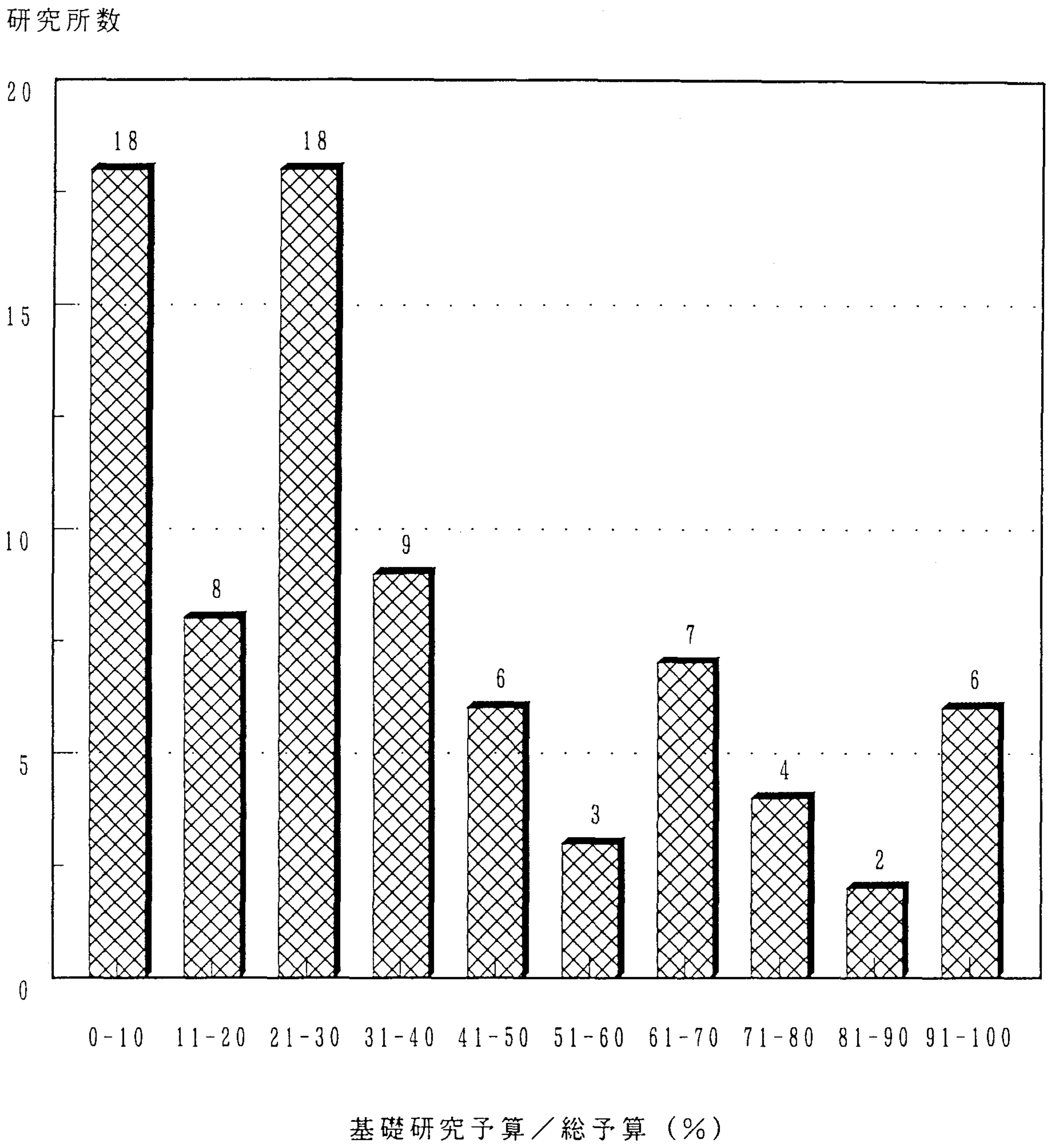
9．政府関係以外への郵便物



回答	８０
回答無	８

１０．予算配分

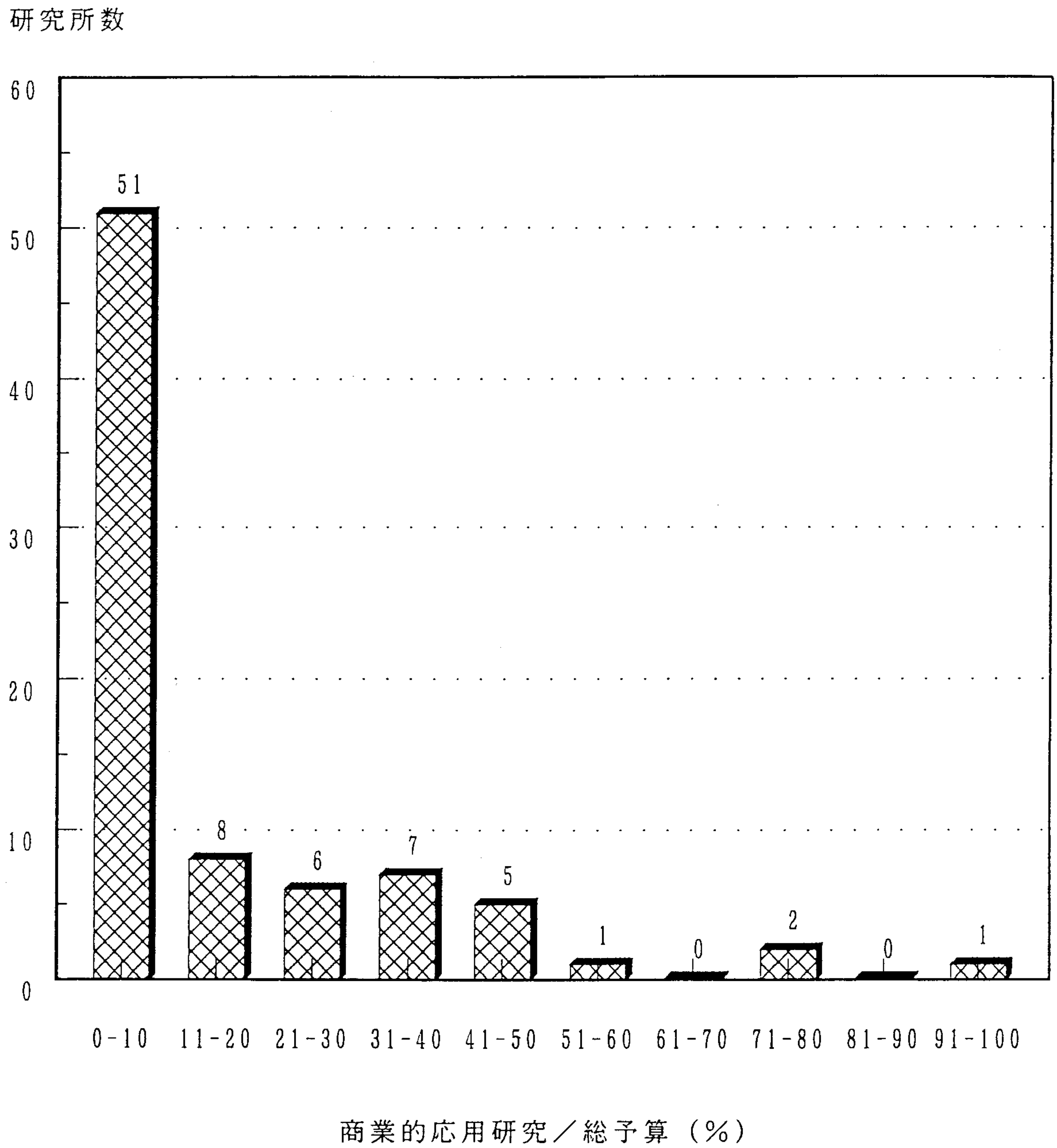
(1) 基礎研究



回答	８１
回答無	７

１０．予算配分

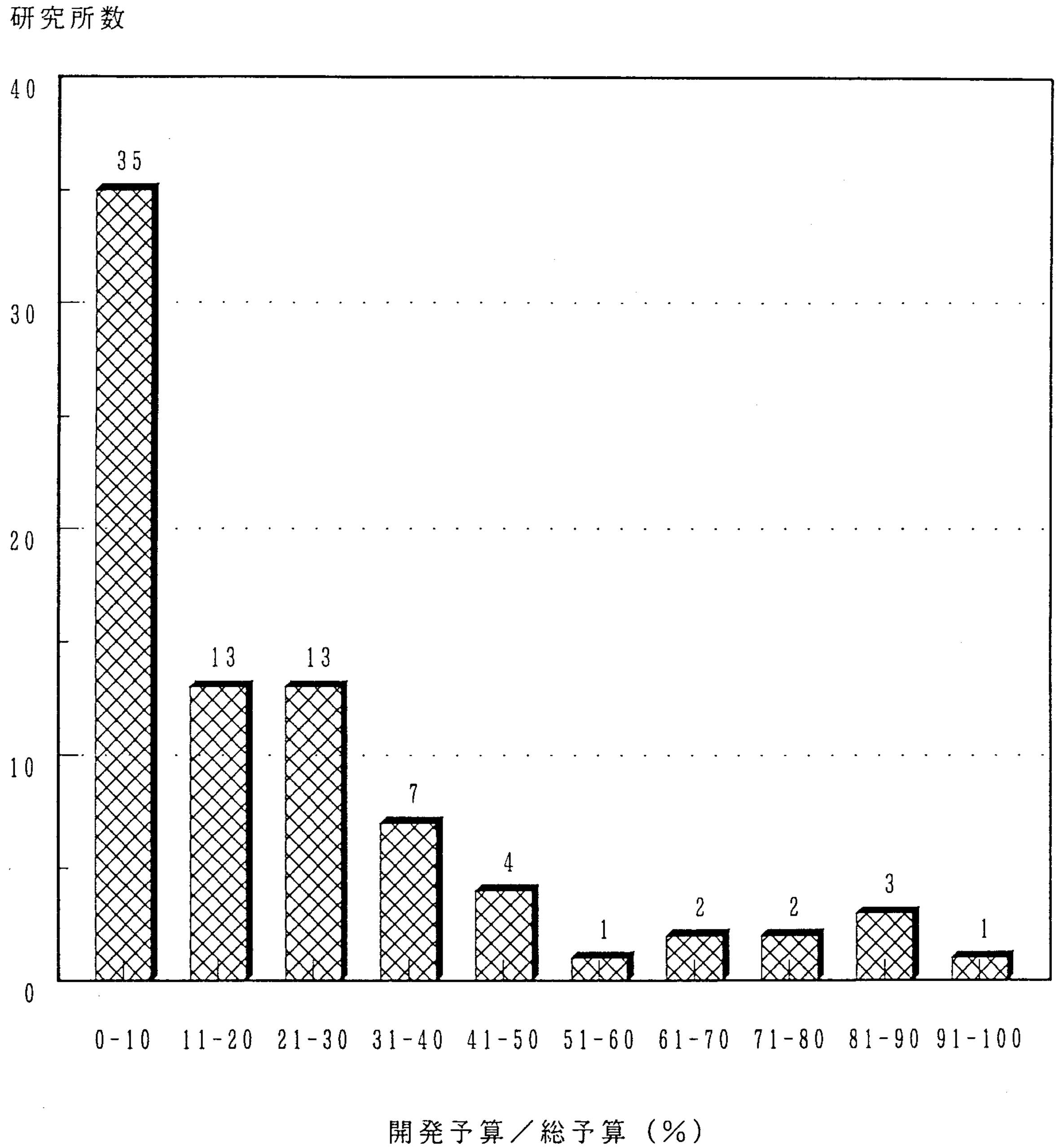
(2) 商業的応用研究



回答	８１
回答無	７

１０．予算配分

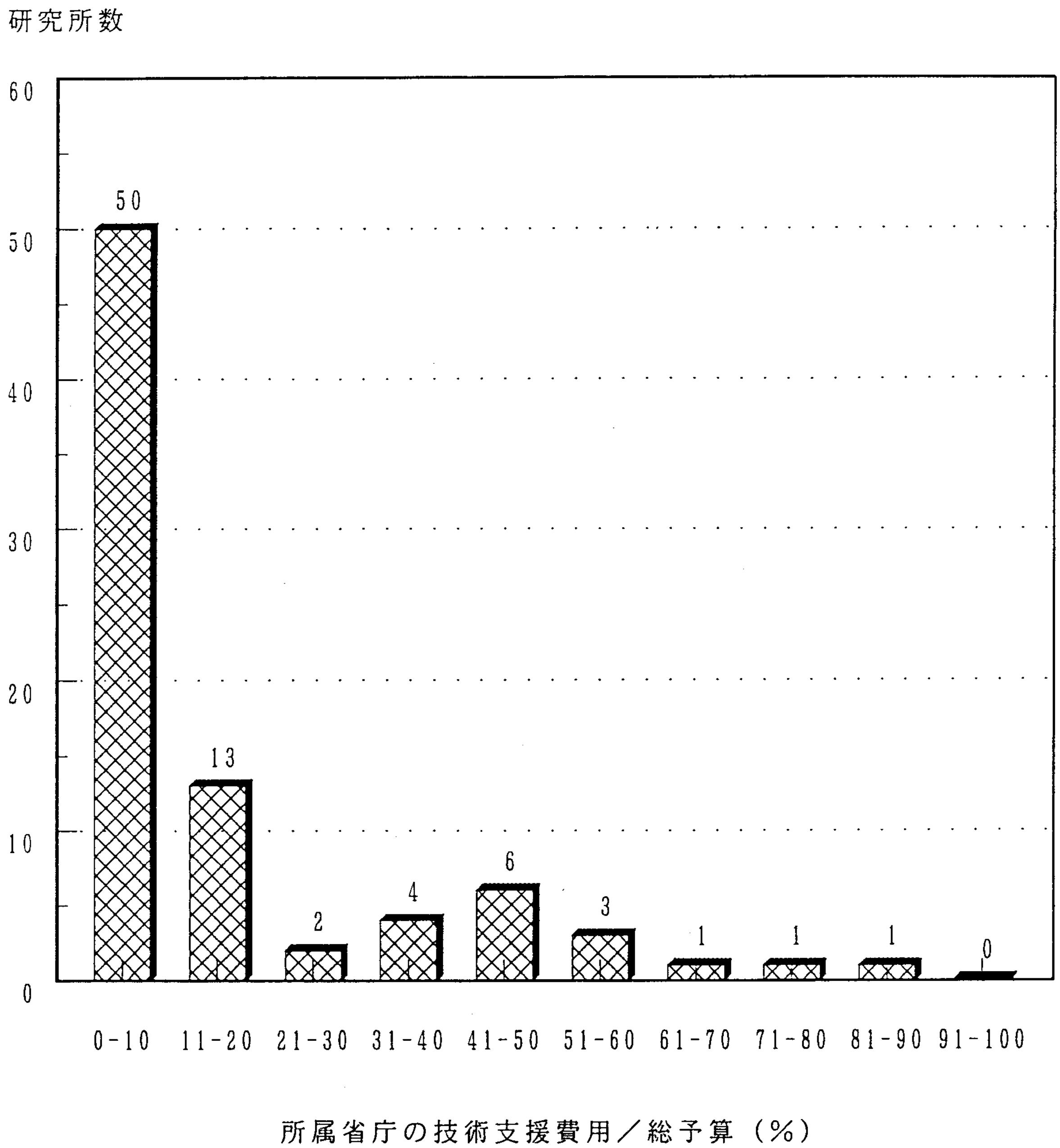
(3) 開発



回答	８１
回答無	７

１０．予算配分

(4) 所属省庁への技術的支援



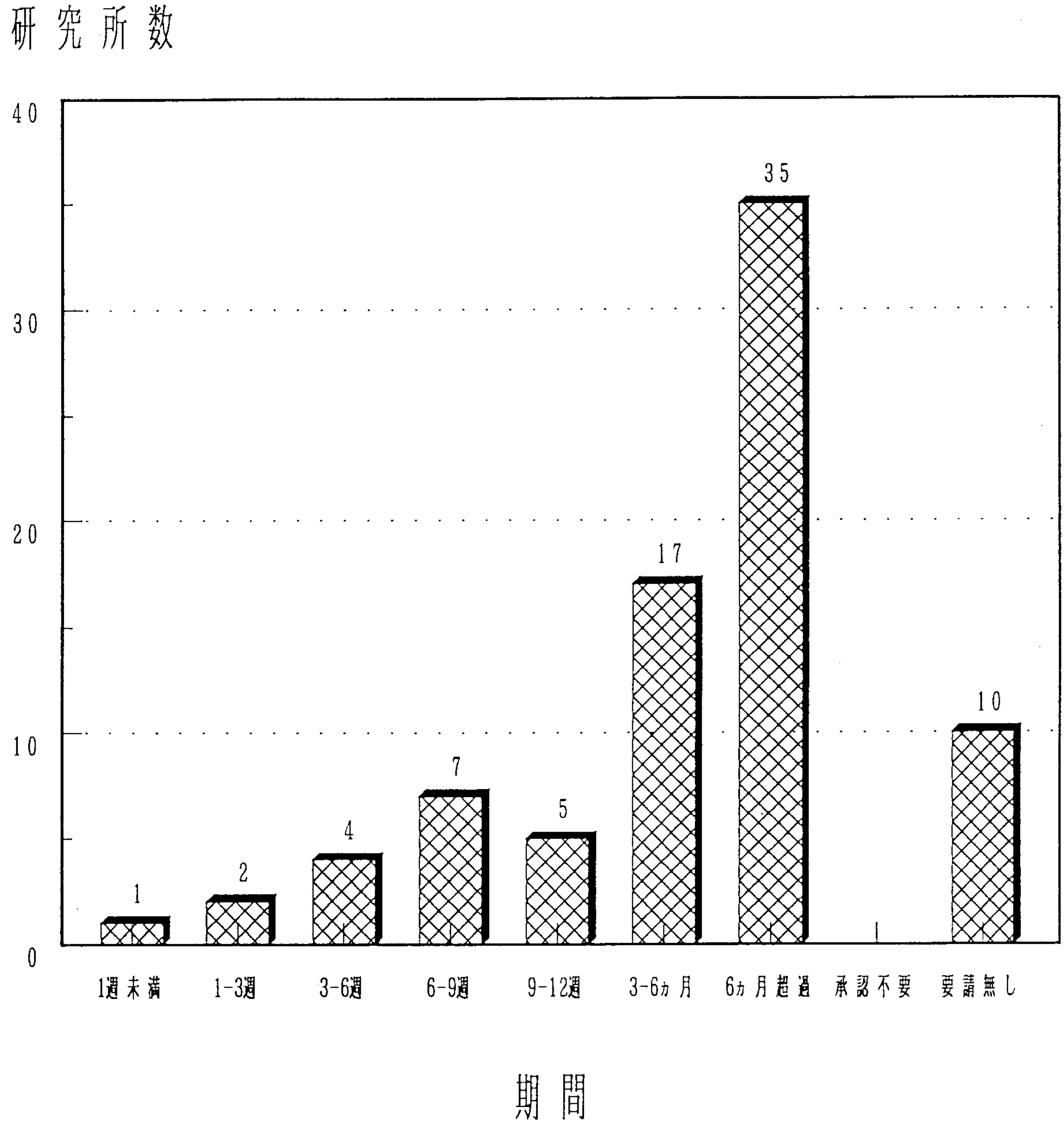
回答	８１
回答無	７

１０．研究所総予算の任務別割合配分表

	構成割合別研究所数										計	回答無
	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100%		
基礎研究	18	8	18	9	6	3	7	4	2	6	81	7
商業的または前商業的応用研究	51	8	6	7	5	1	0	2	0	1		
開発	35	13	13	7	4	1	2	2	3	1		
所属省庁への技術的支援	50	13	2	4	6	3	1	1	1	0		
所属省庁以外の政府機関への技術的支援	74	7	0	0	0	0	0	0	0	0		
民間産業組織あるいは民間人への技術的支援	77	3	0	1	0	0	0	0	0	0		
民間組織への技術移転	81	0	0	0	0	0	0	0	0	0		
政府機関への技術移転	80	0	0	1	0	0	0	0	0	0		
その他	78	1	1	0	1	0	0	0	0	0		

１１．承認に必要な期間

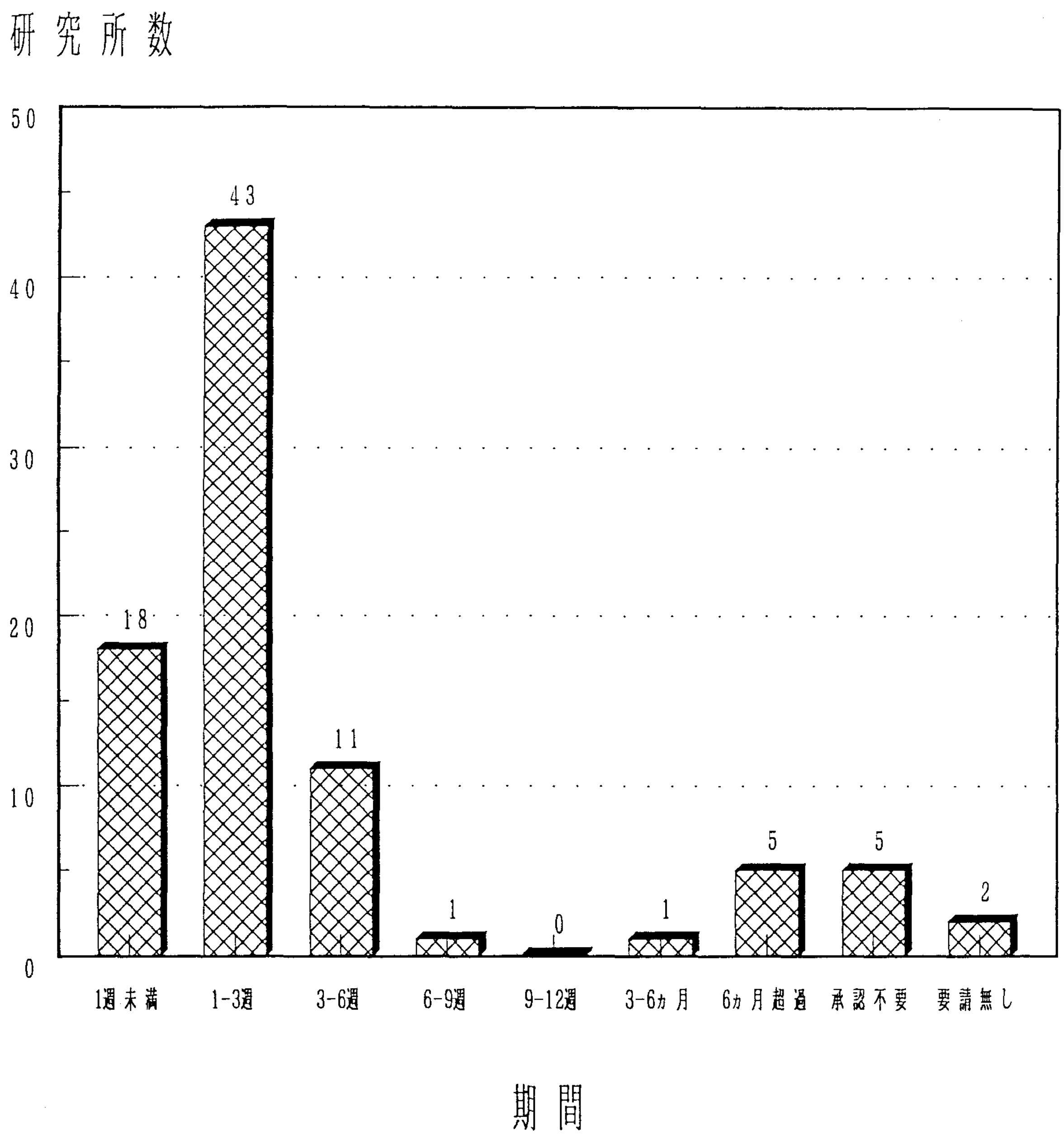
(1) 常勤職員の雇用



回答	８１
回答無	７

１１．承認に必要な期間

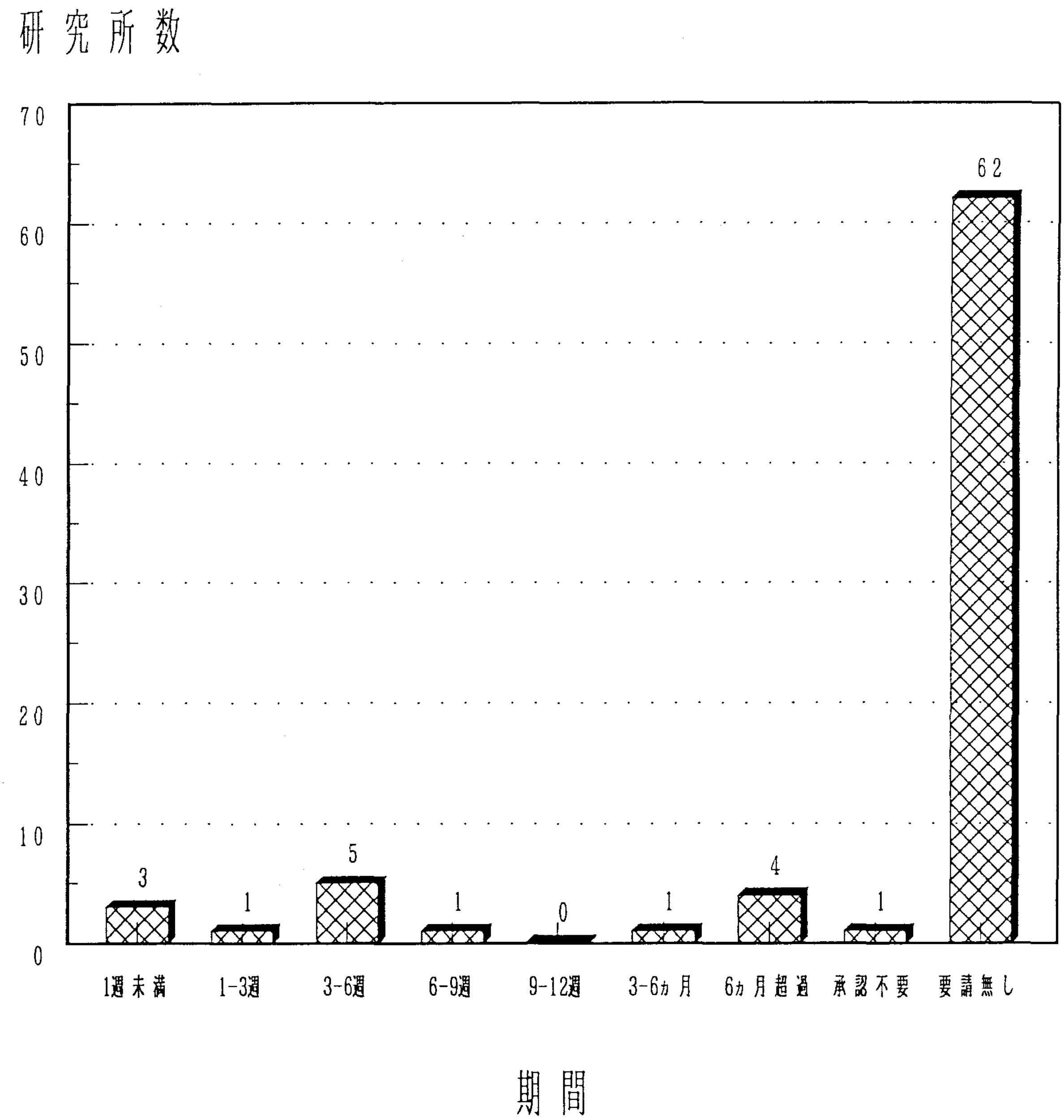
（２）非常勤職員の雇用



回答	８６
回答無	２

１１．承認に必要な期間

（３）常勤職員の解雇

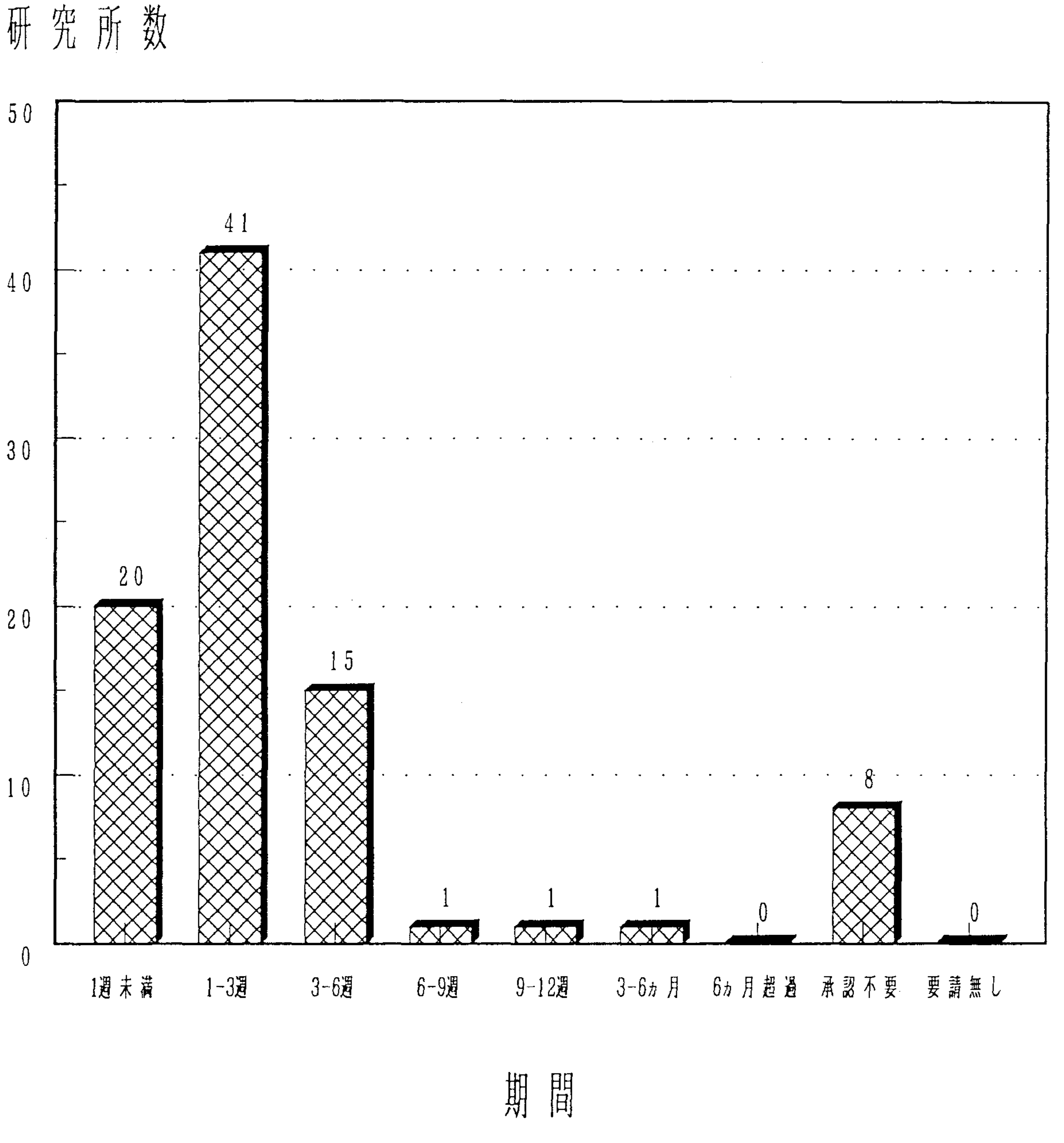


回答　７８

回答無　１０

１１．承認に必要な期間

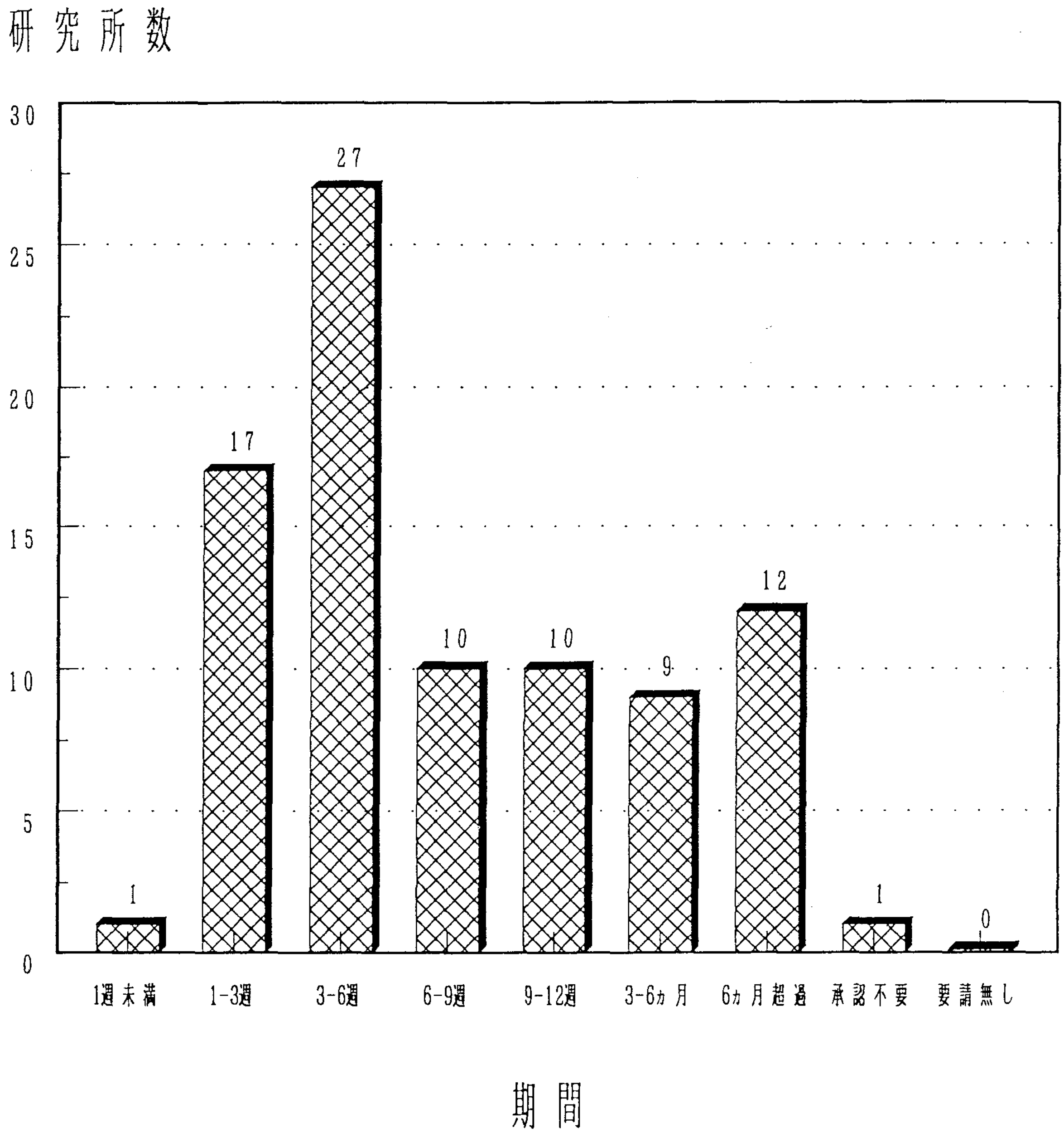
（４）低価格装置の購入



回答	８７
回答無	1

１１．承認に必要な期間

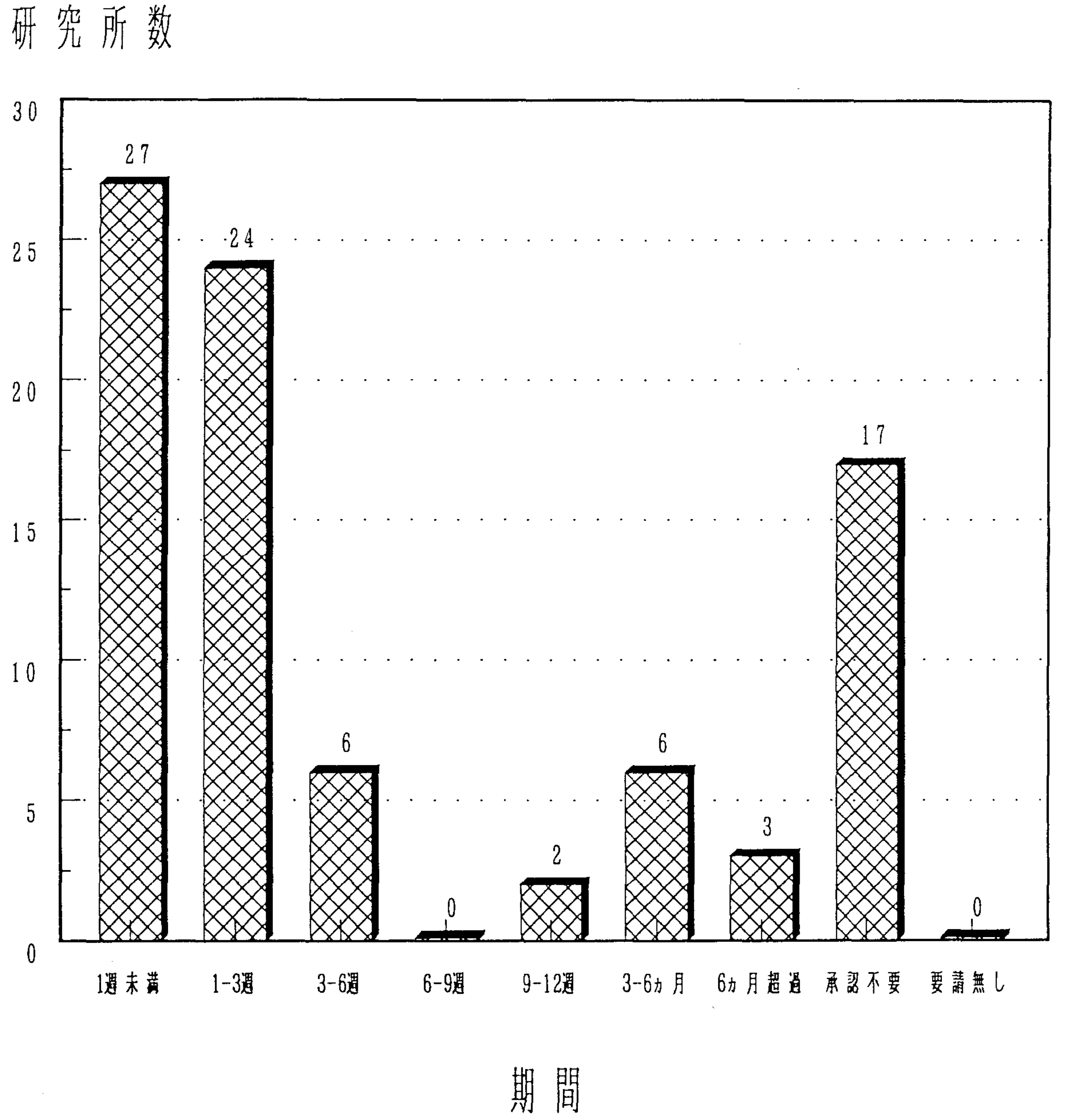
（5）高価格装置の購入



回答	８７
回答無	1

１１．承認に必要な期間

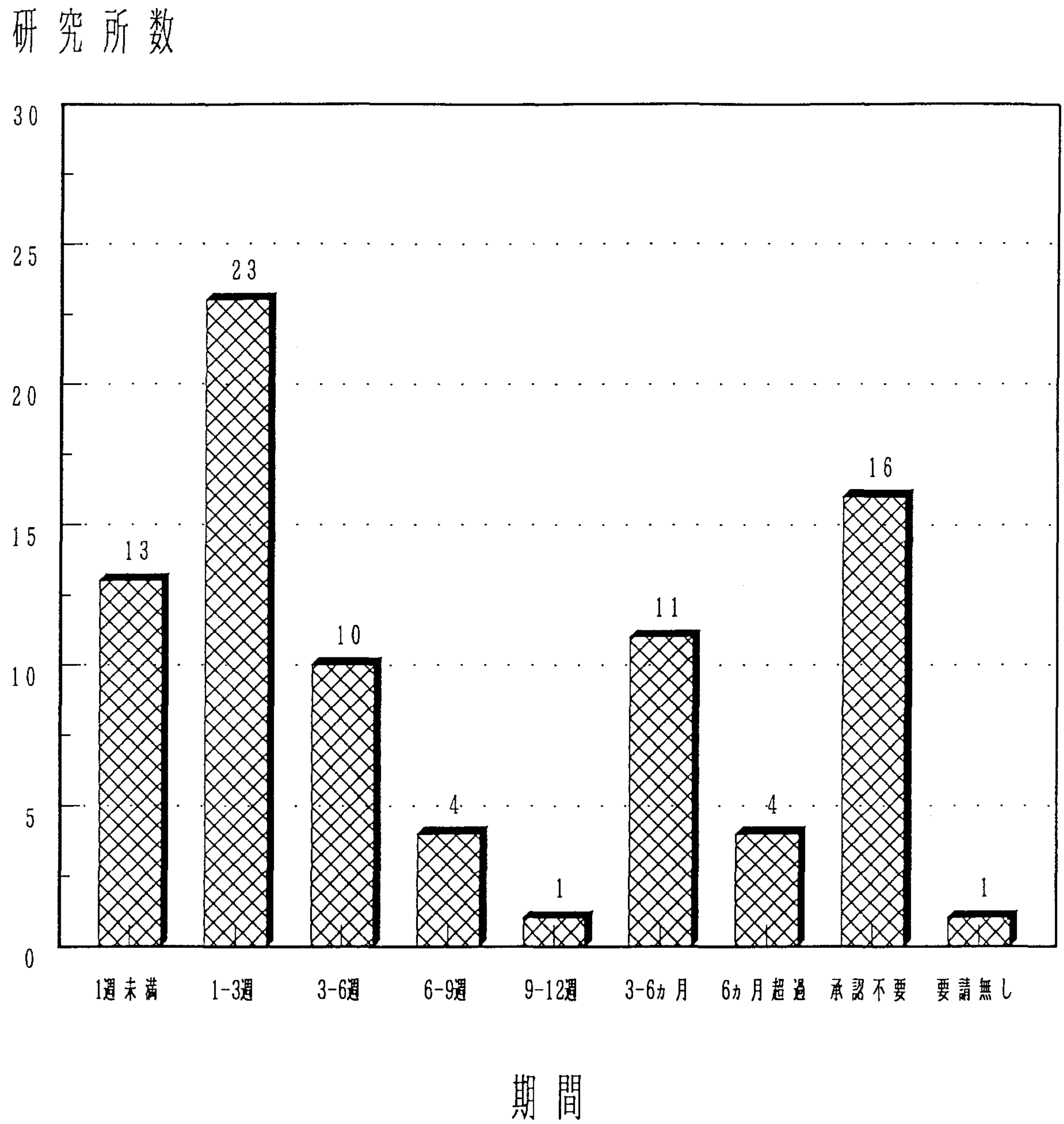
（6）研究成果の発表



回答	８５
回答無	３

１１．承認に必要な期間

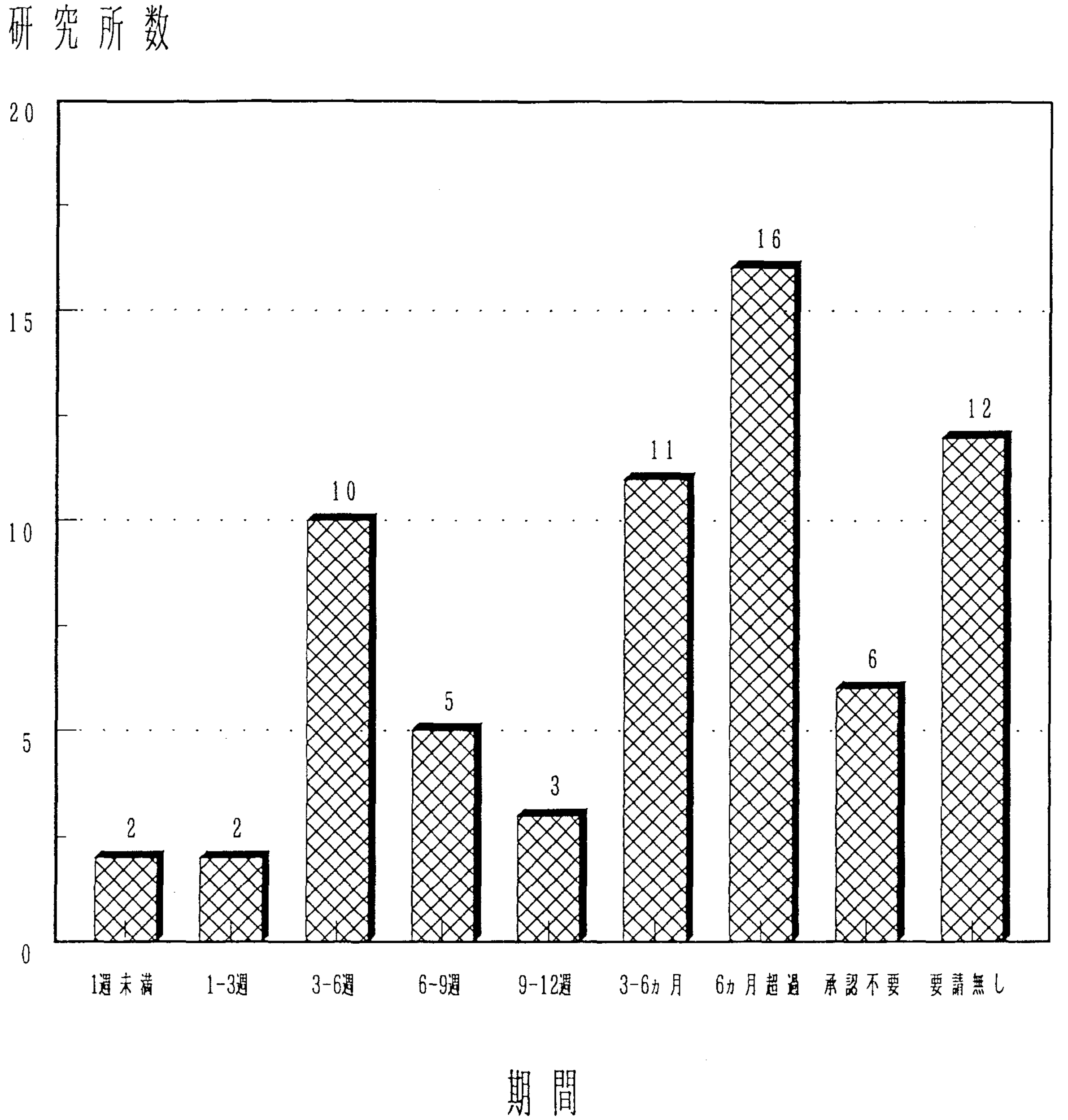
（7）研究成果の研究所外への配布



回答	８３
回答無	５

１１．承認に必要な期間

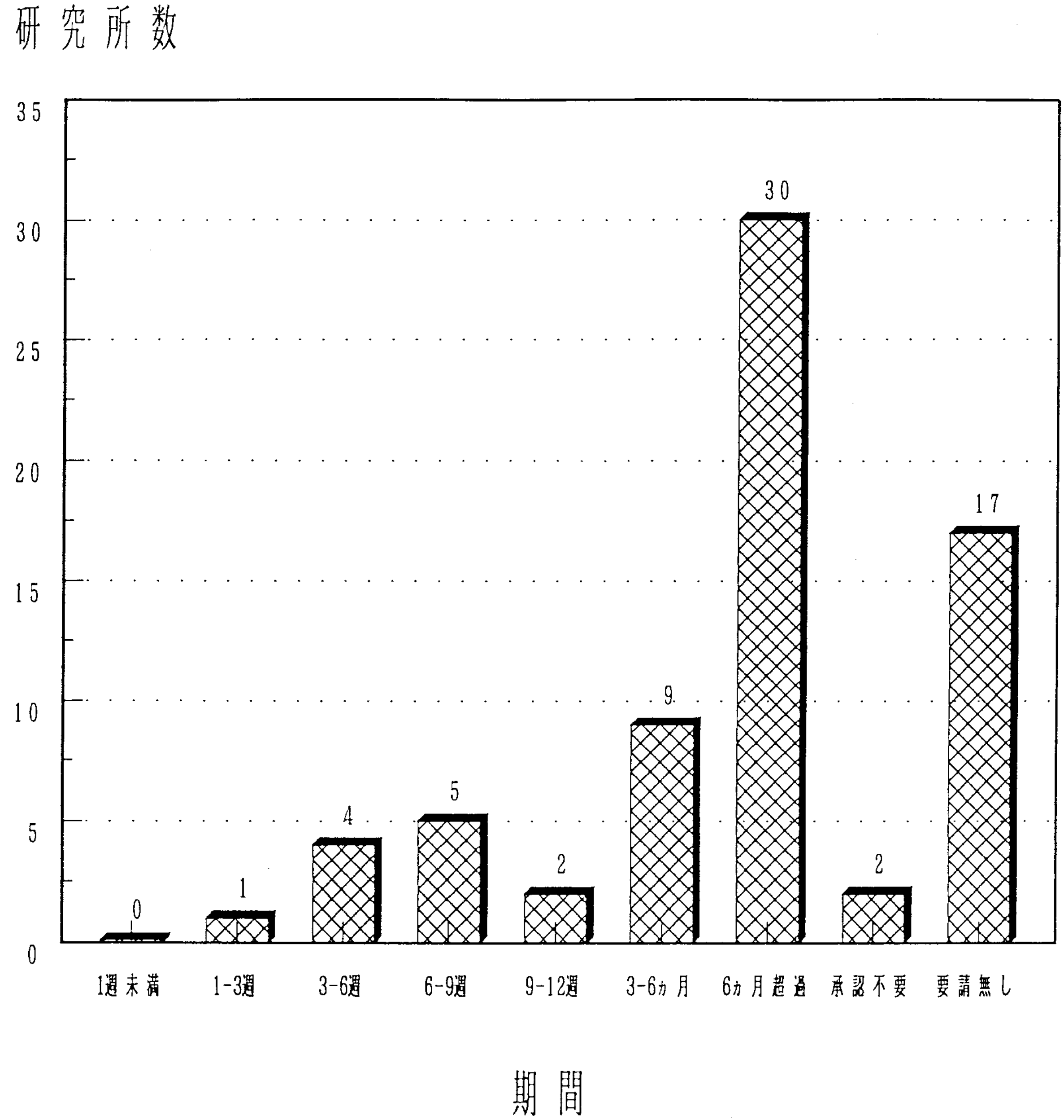
（8）個々の研究者による内部資金の確保



回答	６７
回答無	２１

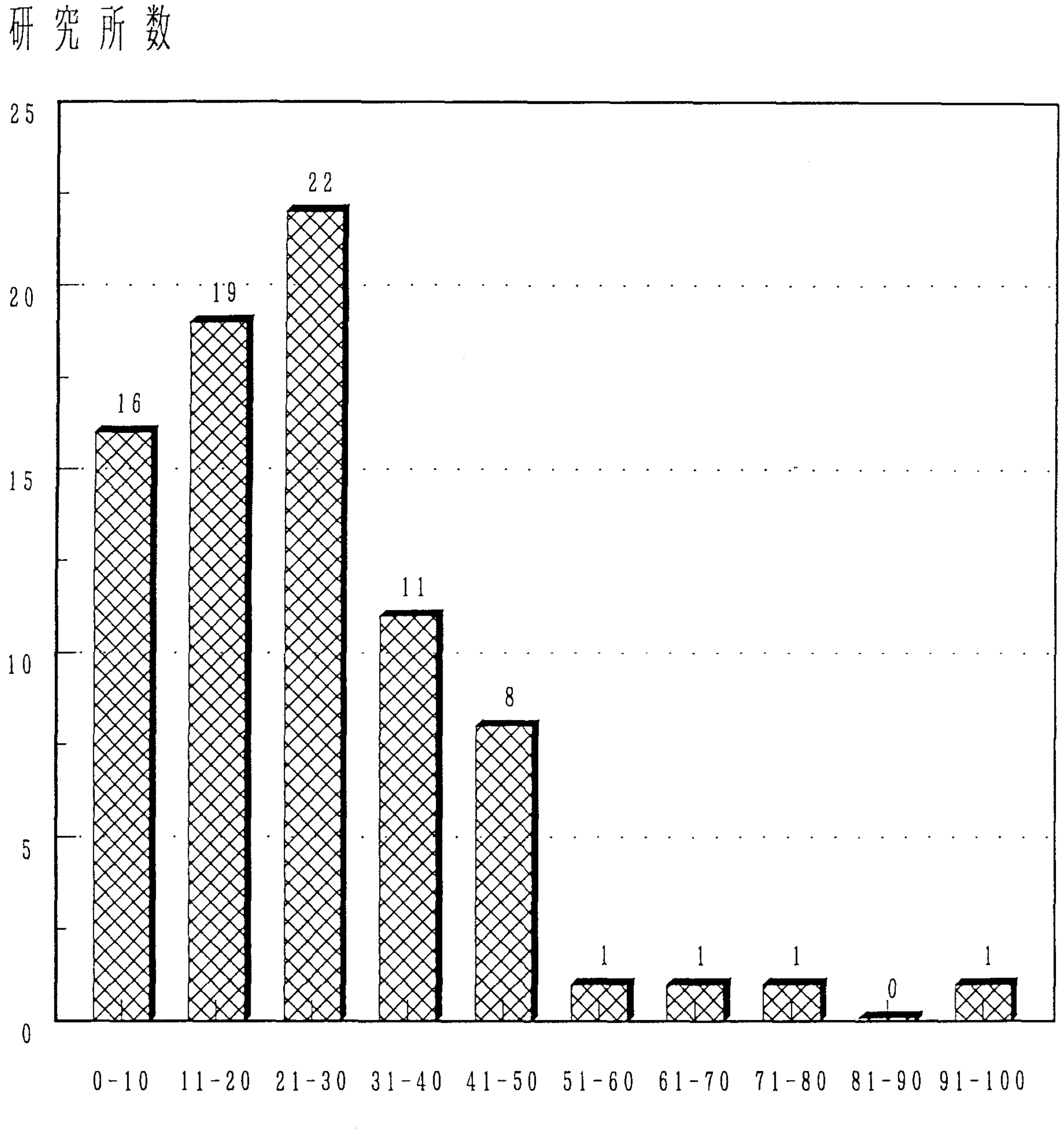
１１．承認に必要な期間

（9）チームによる内部資金の確保



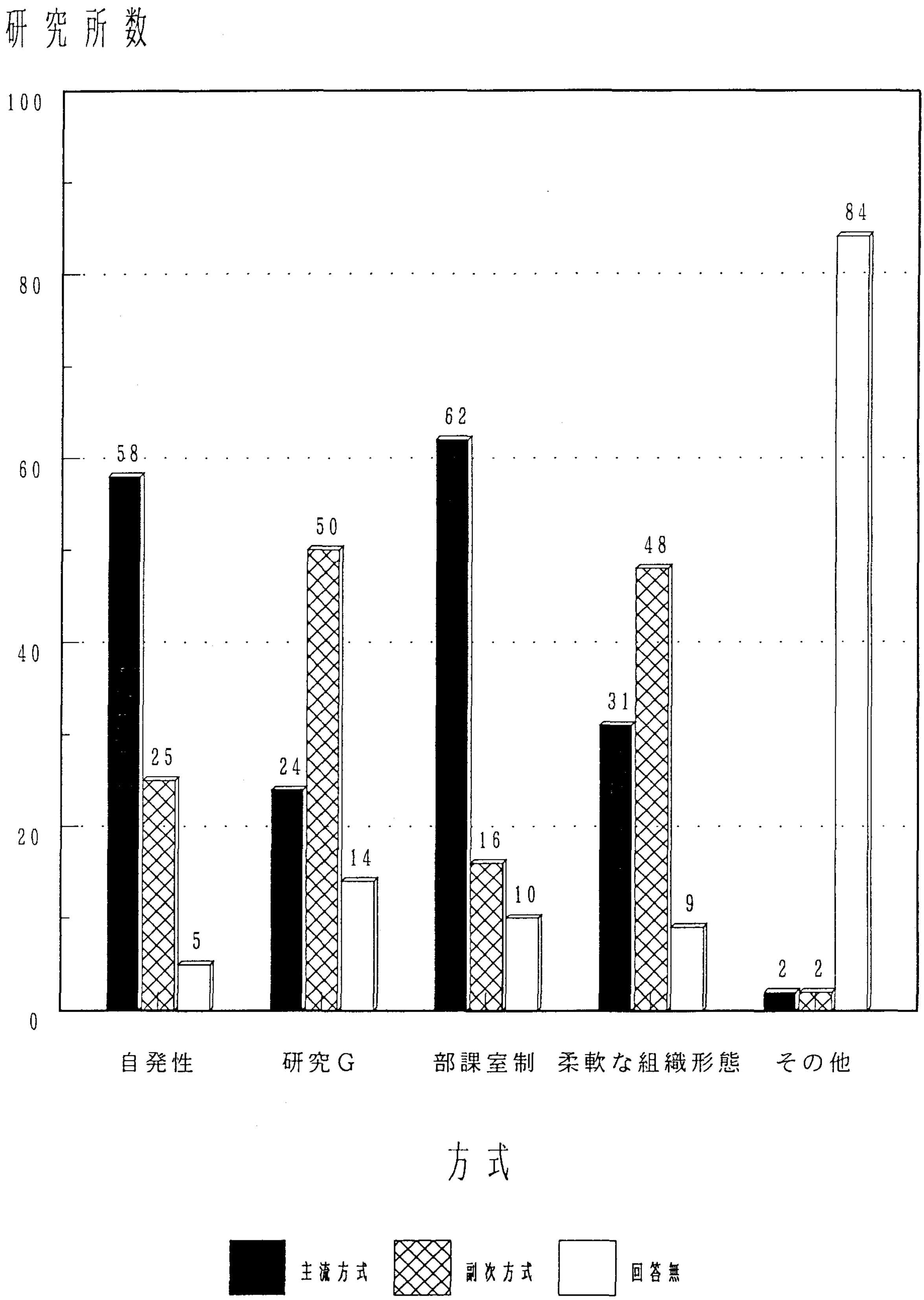
回答	７０
回答無	１８

１２．他組織との関係維持の割合



回答	８０
回答無	８

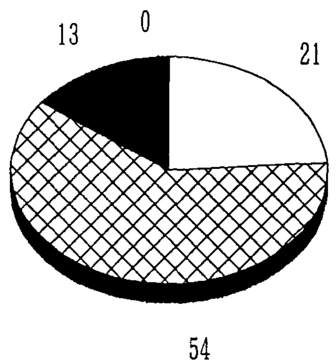
１３．研究を行う方式



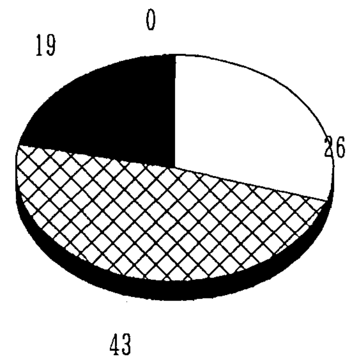
研究所数
100
80
60
40
20
0
58
25
5
24
50
14
62
16
10
31
48
9
2
2
84
自発性
研究G
部課室制
柔軟な組織形態
その他
方式
主流方式
副次方式
回答無

１４．研究に従事する頻度

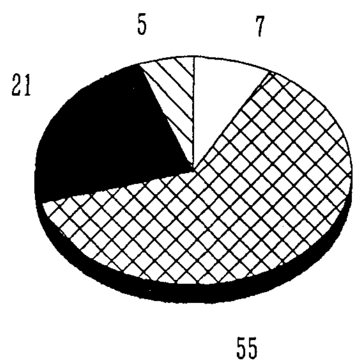
（円の数字は研究所数）



大学の研究者

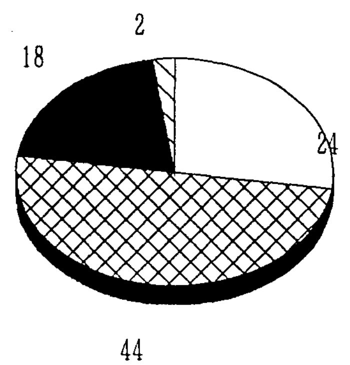


産業界の研究者



所属省庁に属する

他研究所の研究者

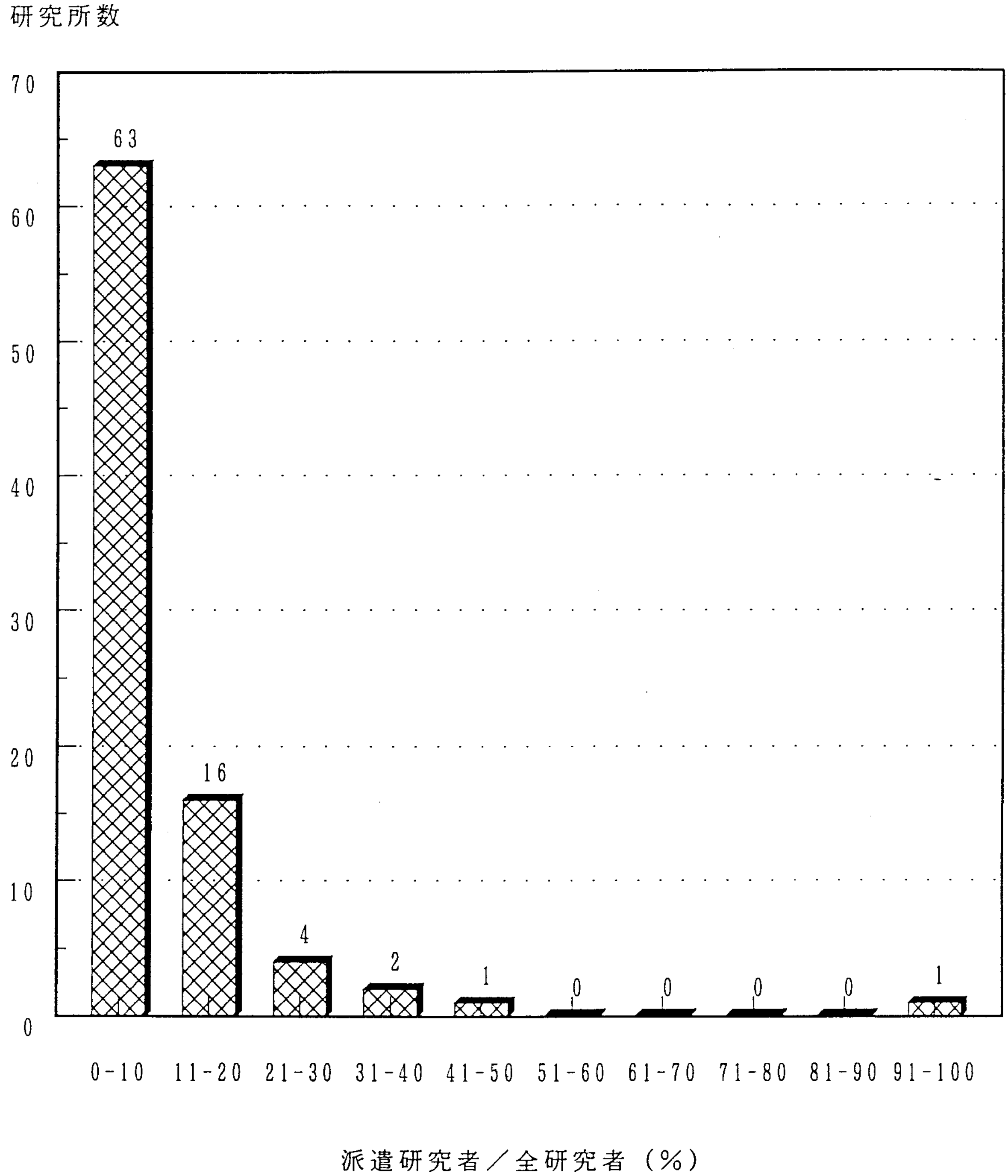


所属省庁以外の

研究機関の研究者

頻繁に　時々　全くない　回答無

１５．派遣研究者の割合

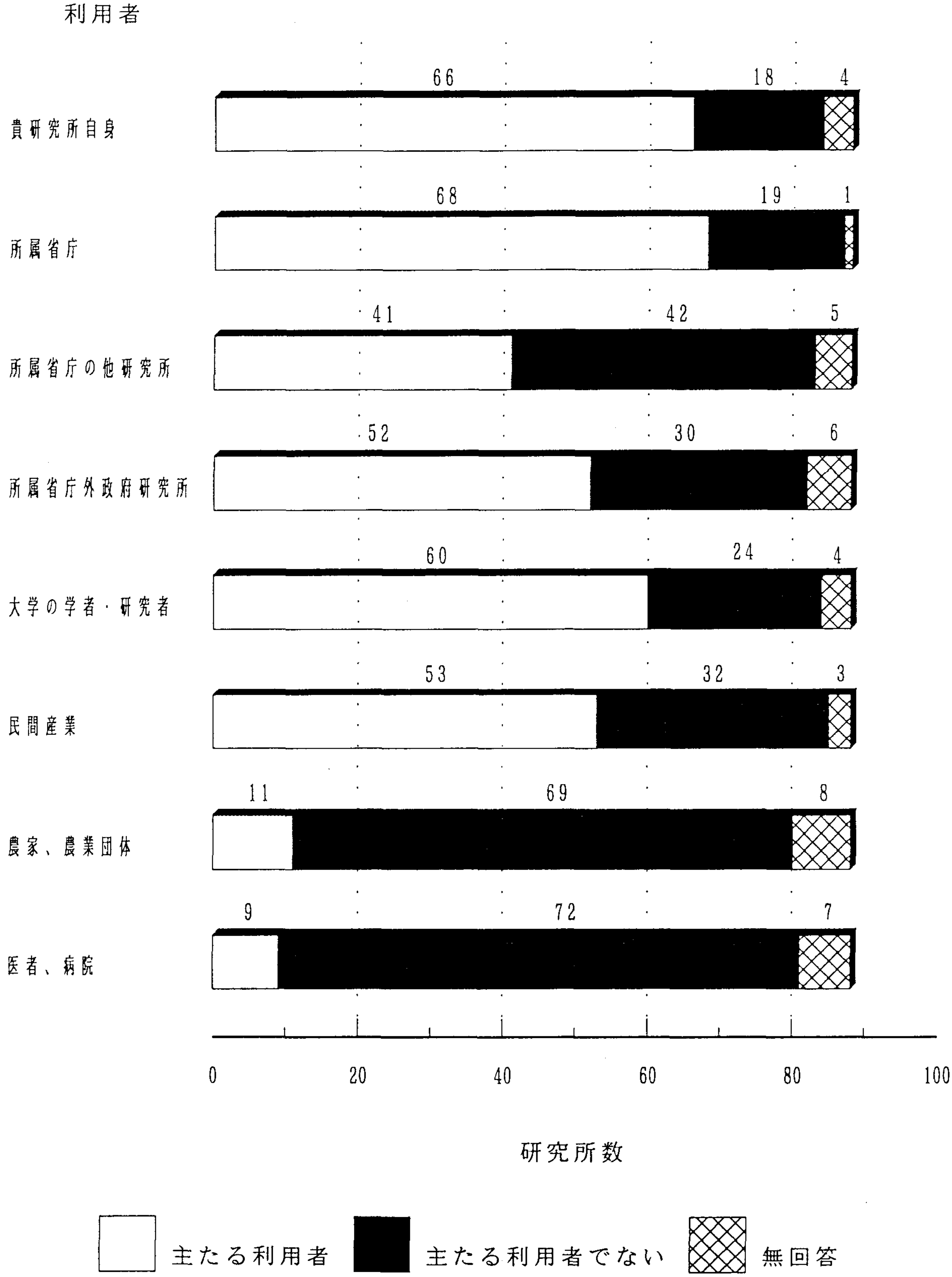


回答	８７
回答無	1

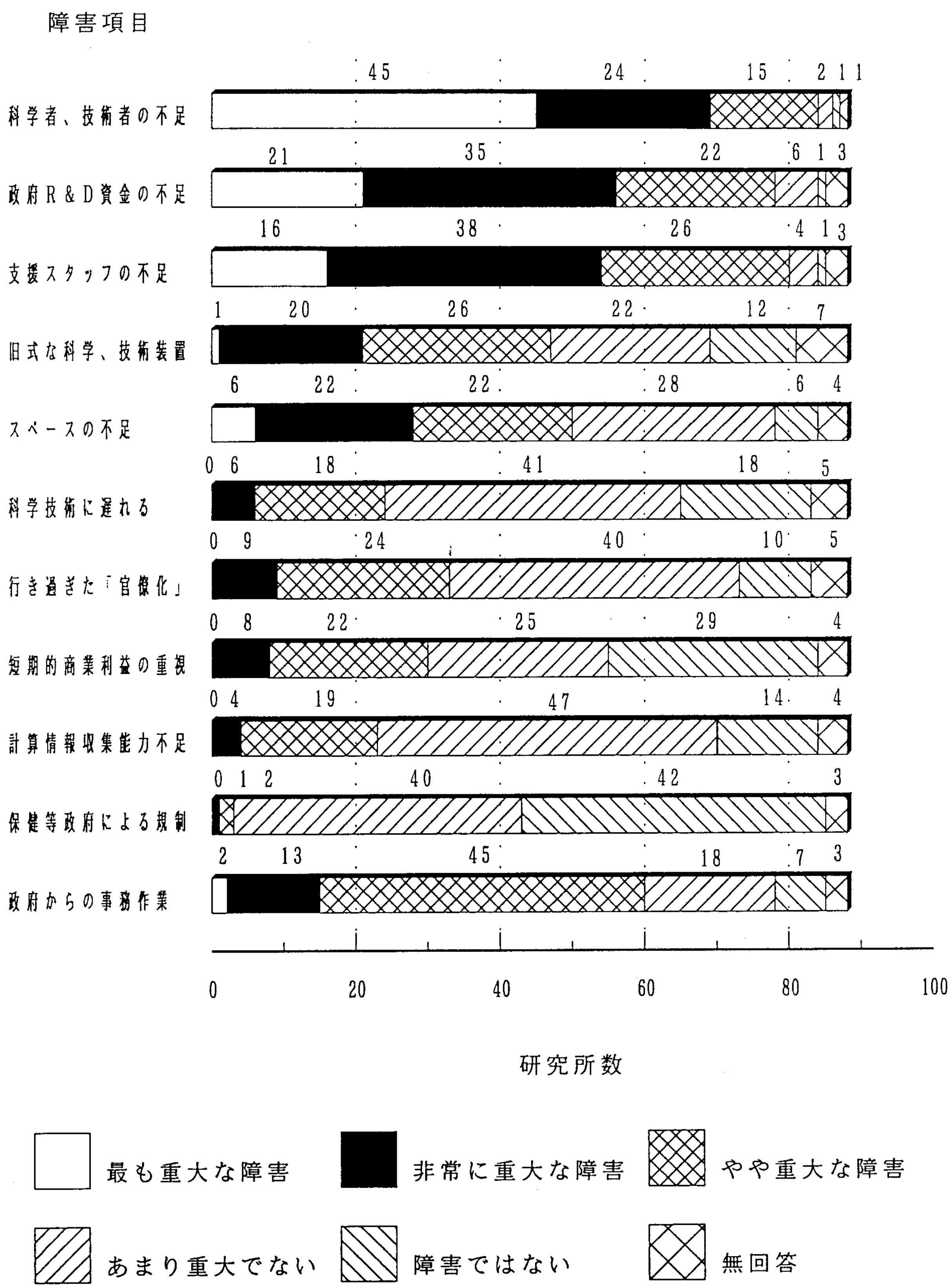
１６．研究成果の構成割合表

	構成割合別研究所数										計	回答無
	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100%		
論文発表及び書物の出版	２４	8	１３	１０	1	１１	6	0	5	0		
特許取得及びライセンスの許諾	７４	2	2	0	0	0	0	0	0	0		
アルゴリズム及びソフトウエア	６７	8	3	0	0	0	0	0	0	0		
内部利用のみのための技術的及び科学的レポート	３８	２５	9	2	2	1	1	0	0	0		
所属省庁外での利用のための技術的及び科学的レポート	６９	8	0	1	0	0	0	0	0	0	７８	１０
装置及び材料のプロトタイプ	６５	4	5	1	1	2	0	0	0	0		
外部の会議で発表するための論文	４１	２５	9	1	0	1	0	1	0	0		
技術装置のデモンストレーション	７５	2	0	0	1	0	0	0	0	0		
その他の成果	７４	3	1	0	0	0	0	0	0	0		

１７．研究成果の利用者（数字は研究所数）

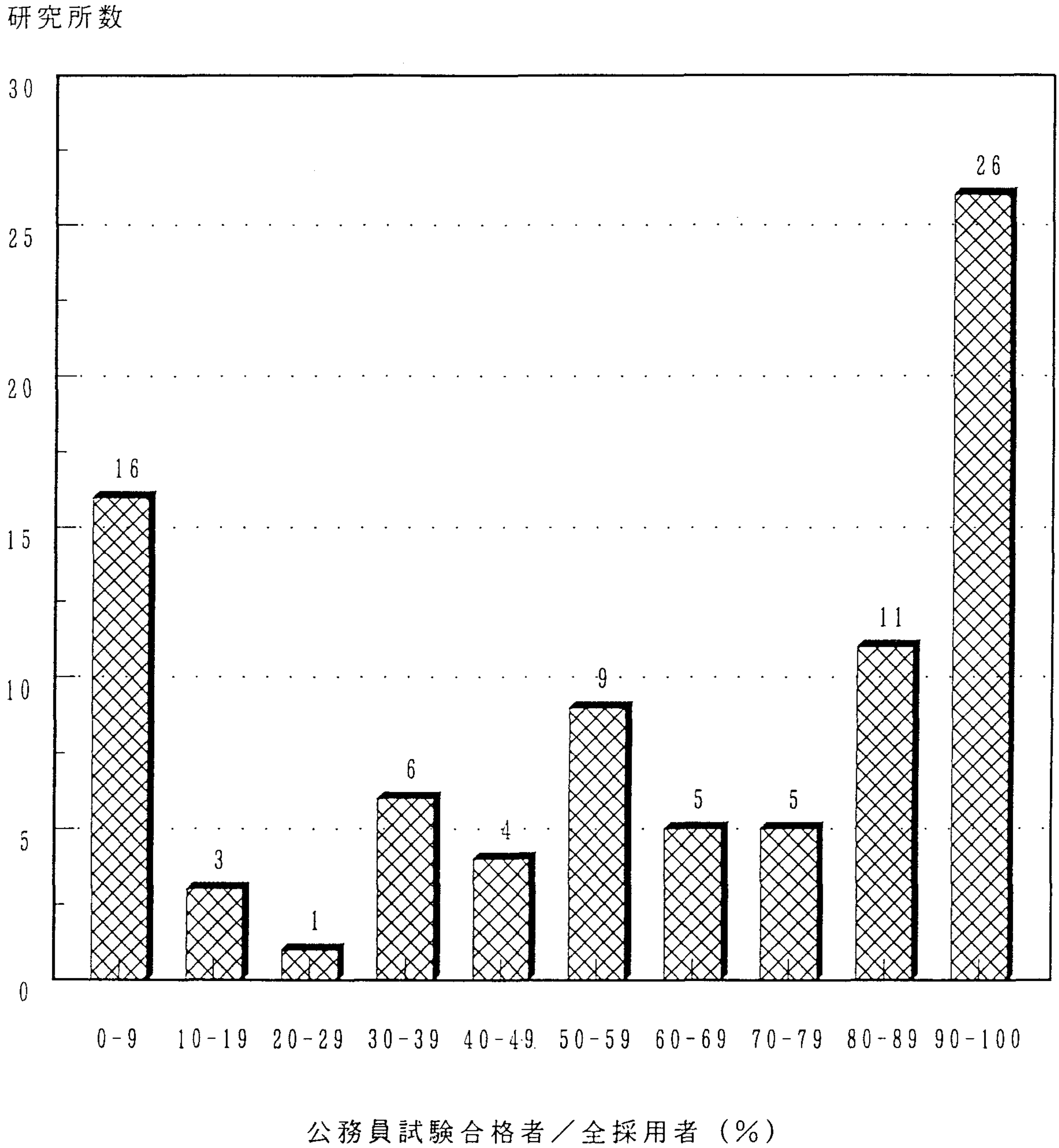


１８．Ｒ＆Ｄに対する障害（数字は研究所数）



１９．研究者の採用割合

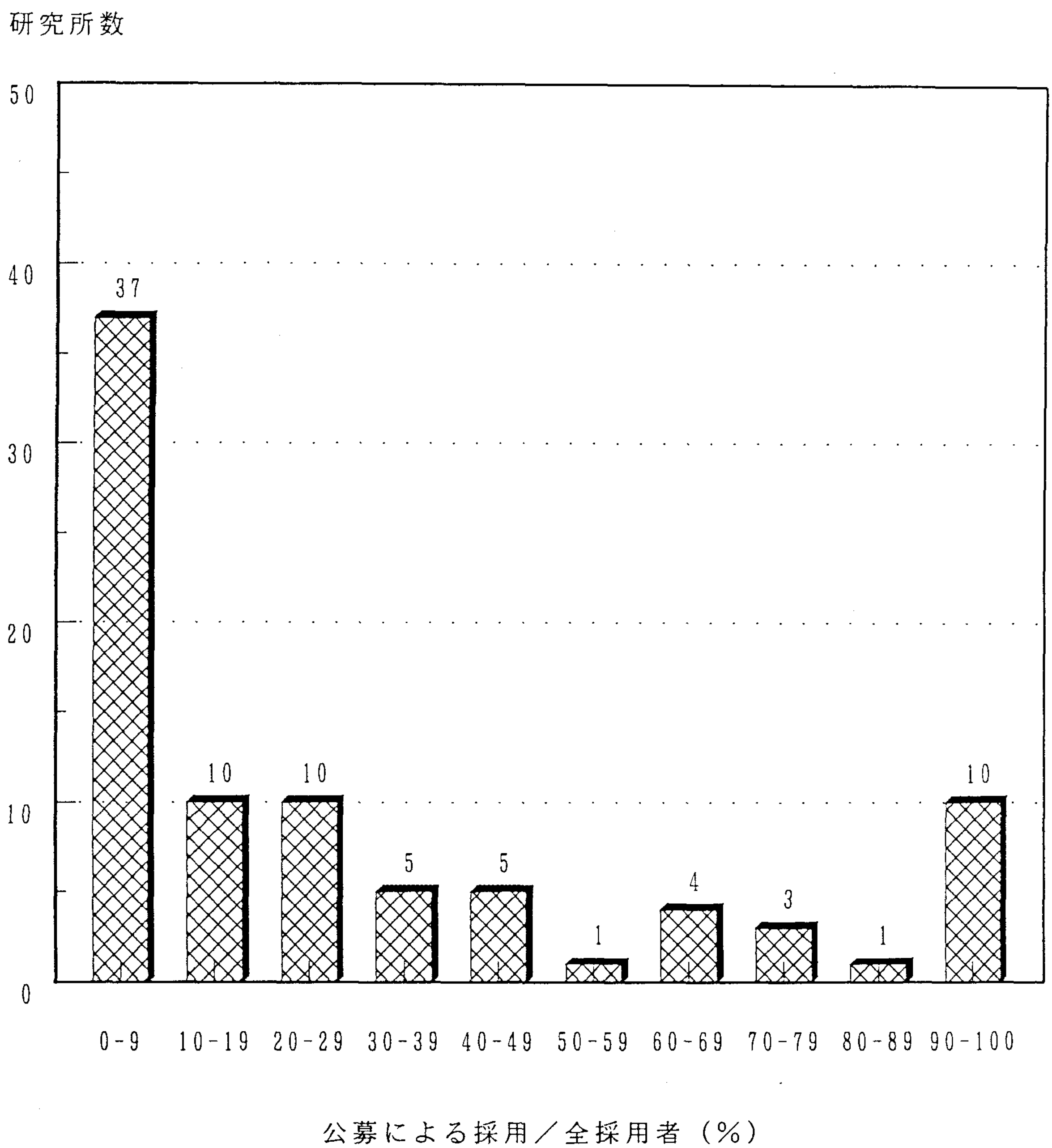
（1）人事院による公務員試験



回答	８６
回答無	２

１９．研究者の採用割合

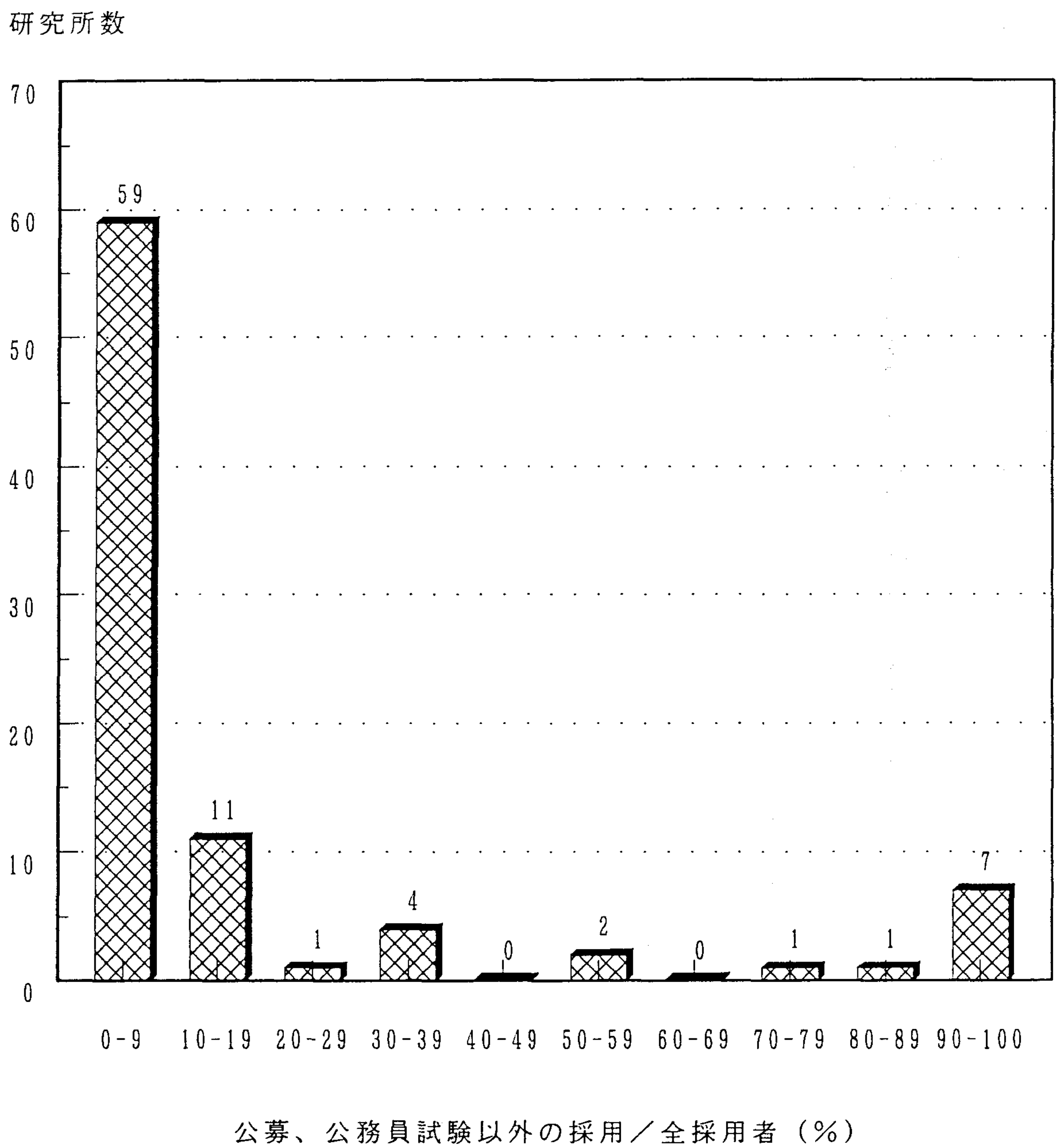
(2) 公募による採用



回答	８６
回答無	２

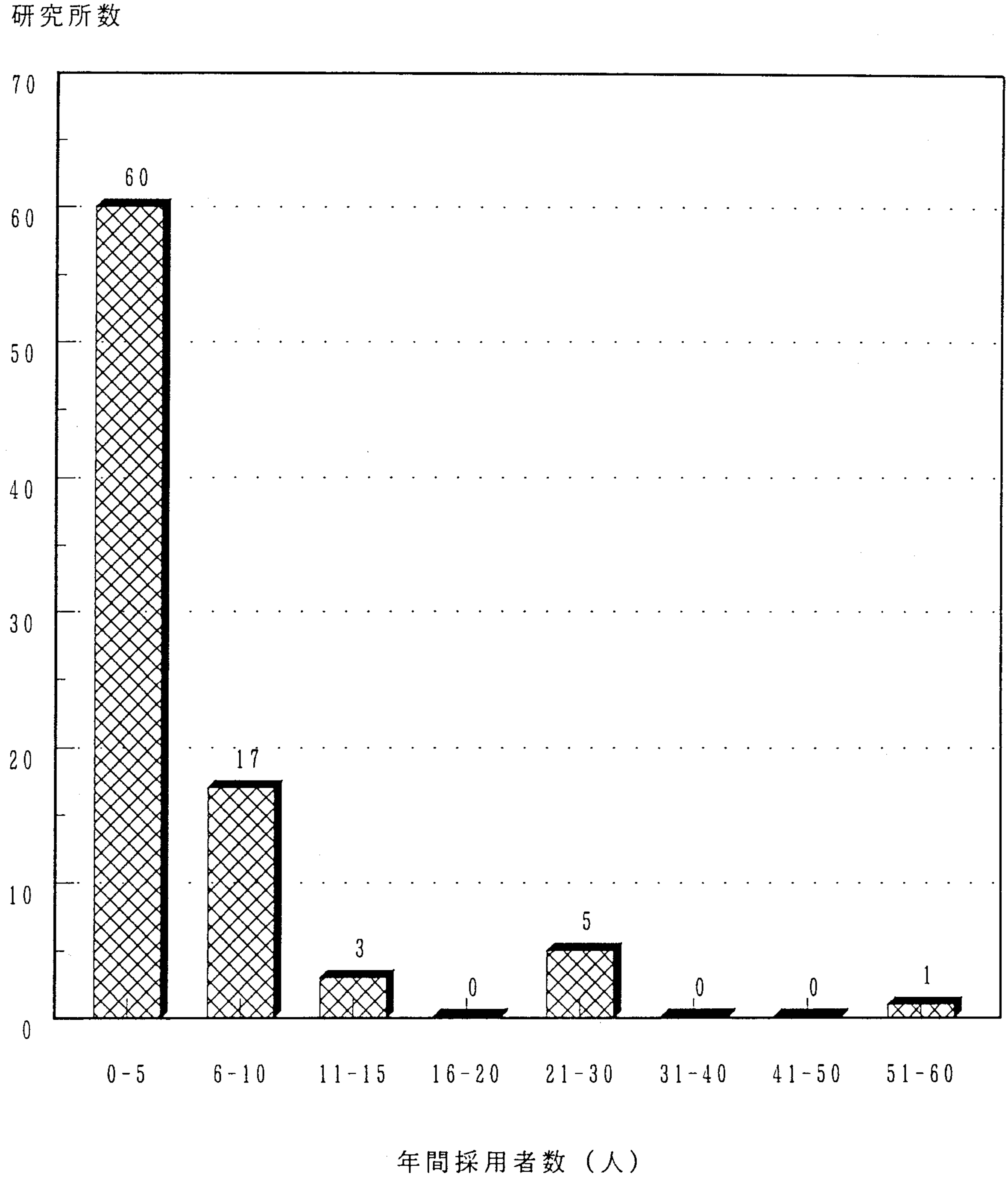
１９．研究者の採用割合

(3) 公募も公務員試験もなし



回答	８６
回答無	２

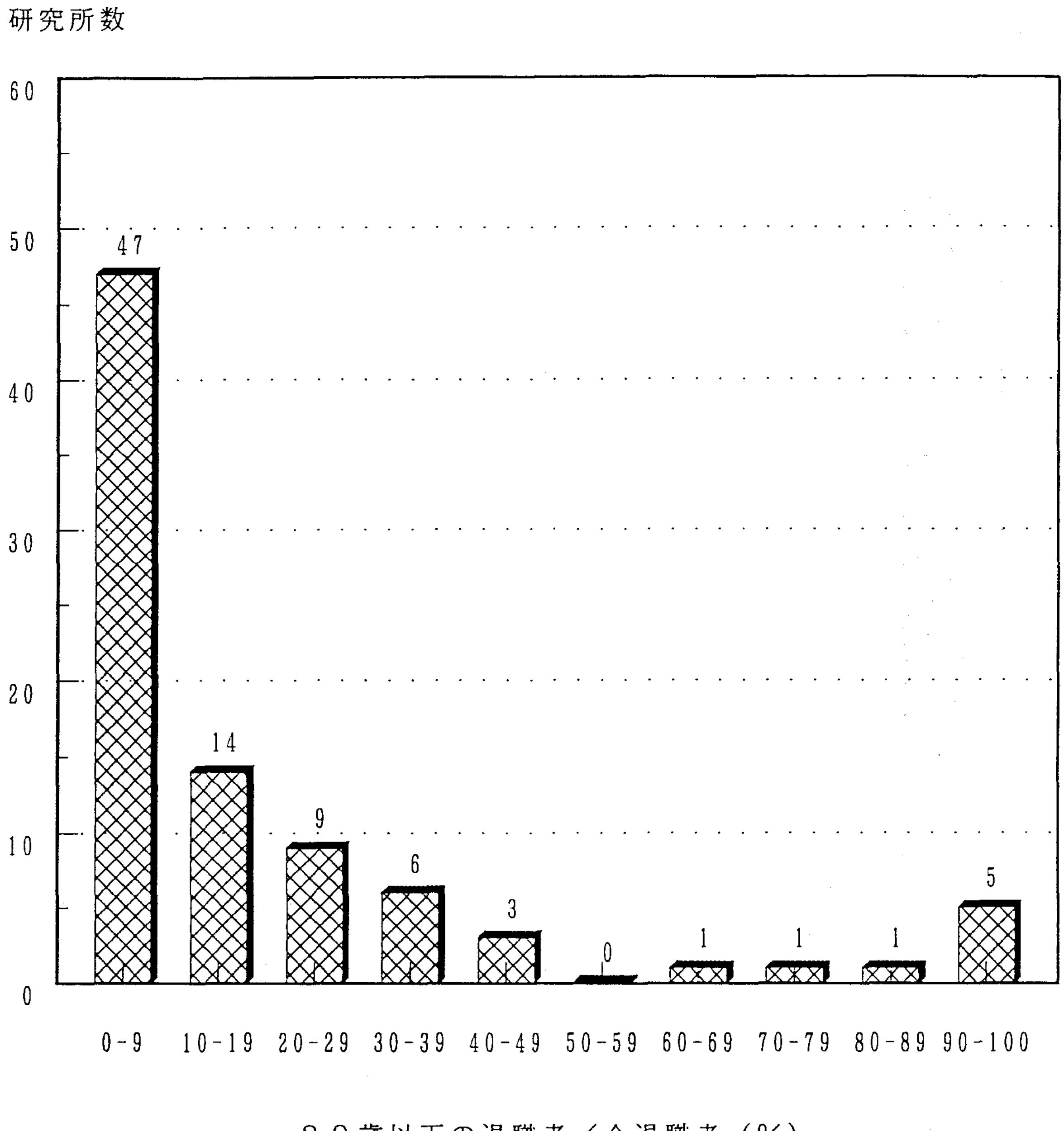
２０．年間採用者数



回答	８６
回答無	２

２１．退職者の年齢分布

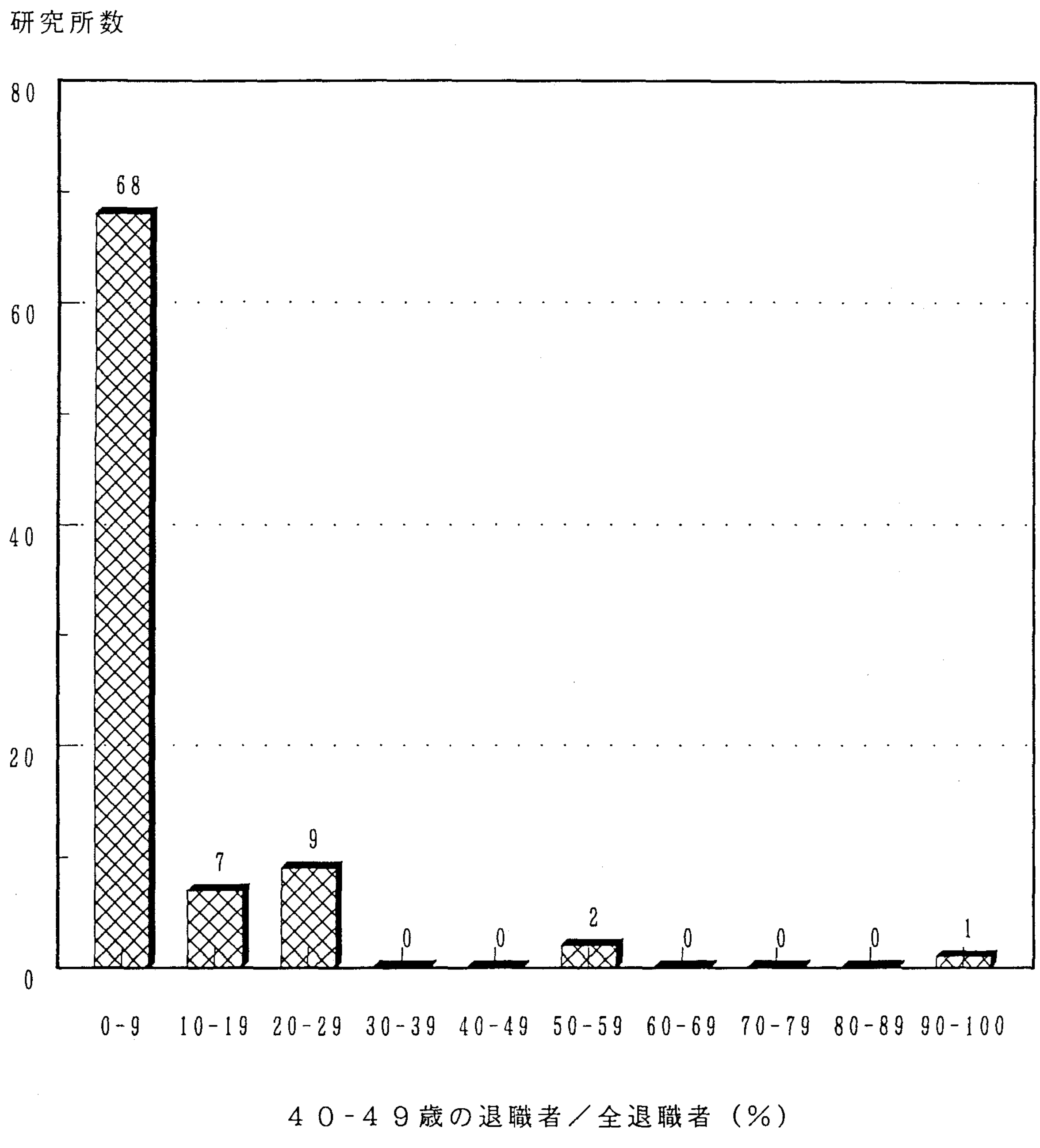
(1) ３９歳以下



回答	８７
回答無	1

２１．退職者の年齢分布

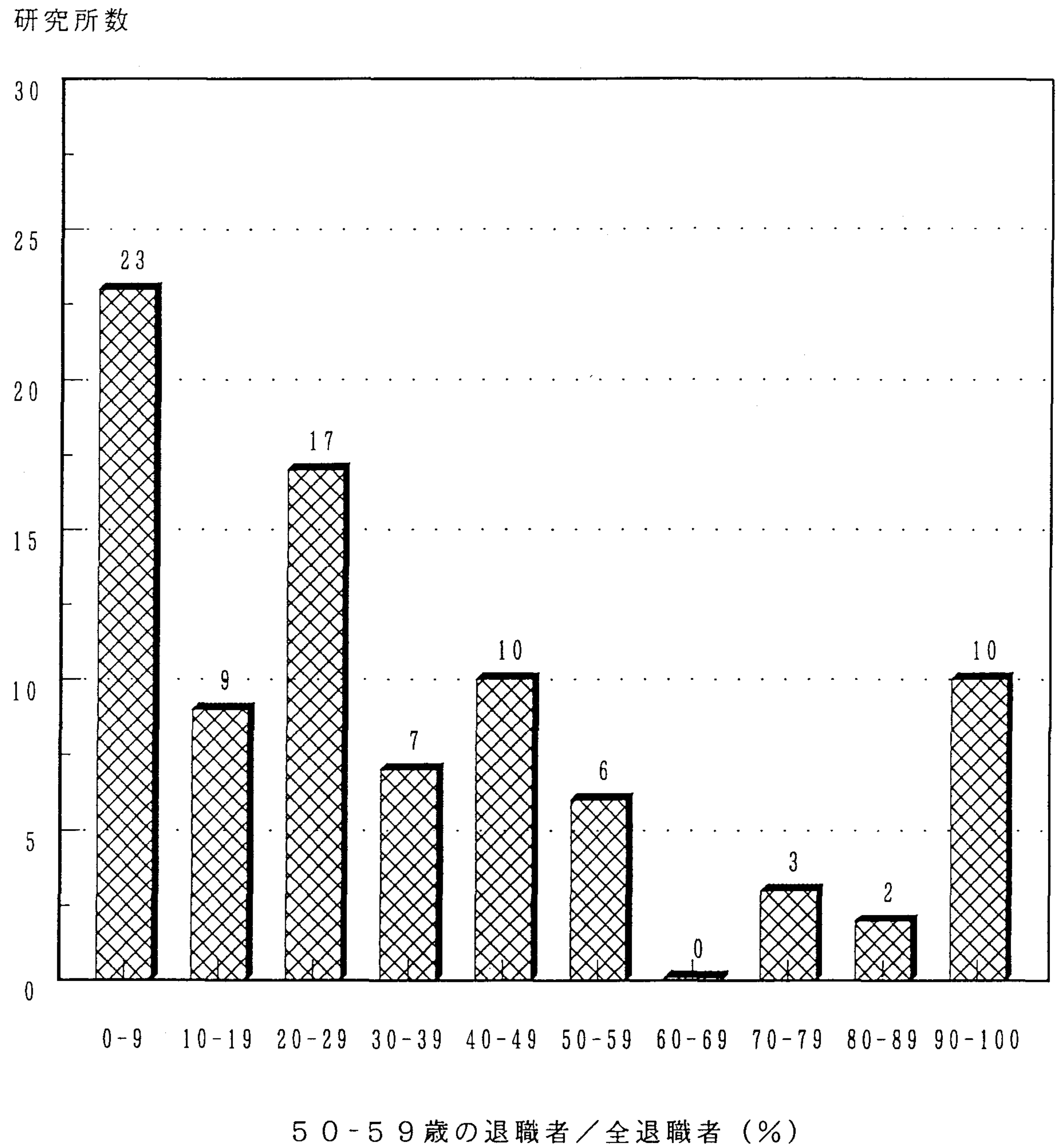
(2) ４０－４９歳



回答	８７
回答無	1

２１．退職者の年齢分布

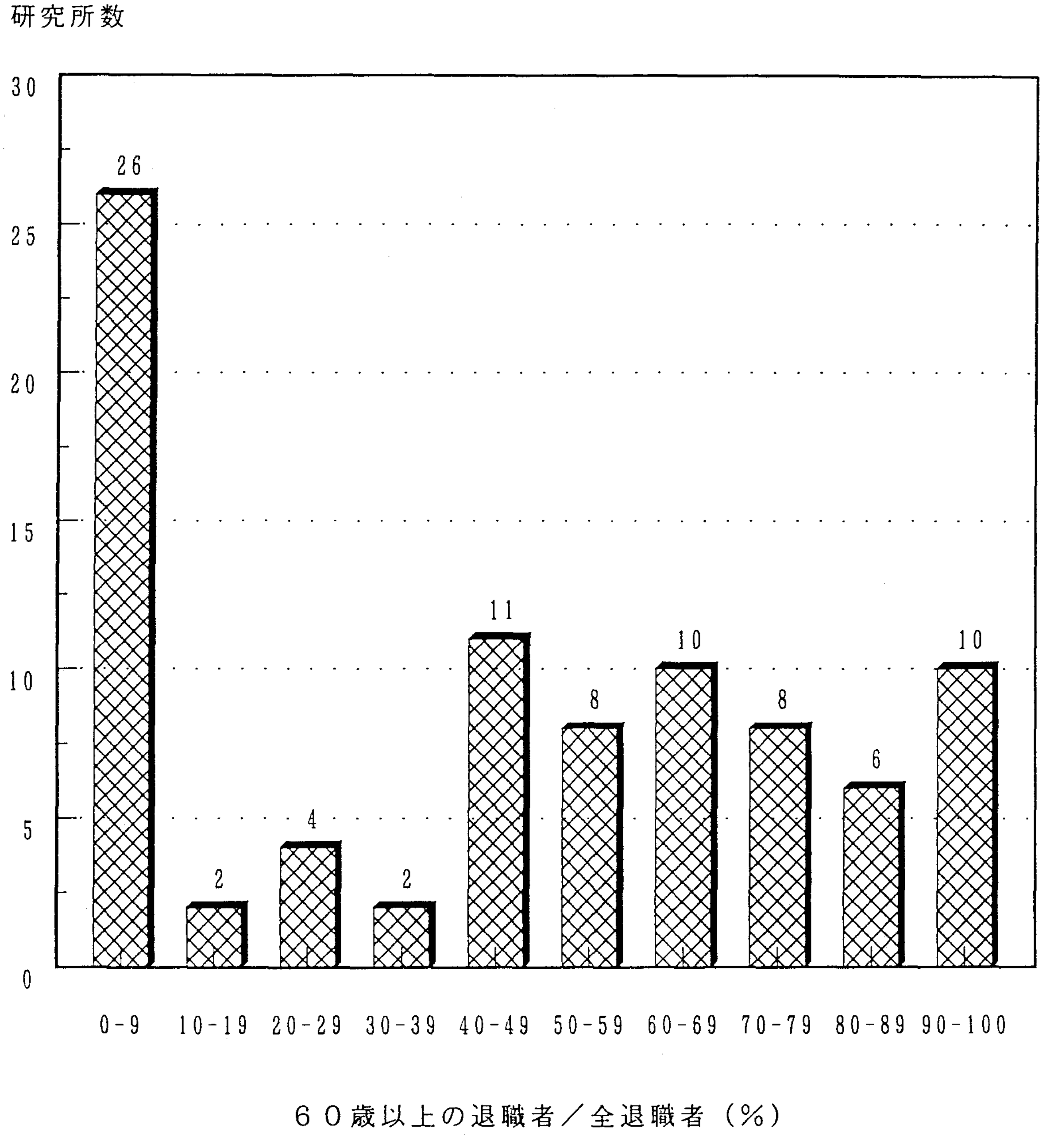
(3) ５０-５９歳



回答	８７
回答無	1

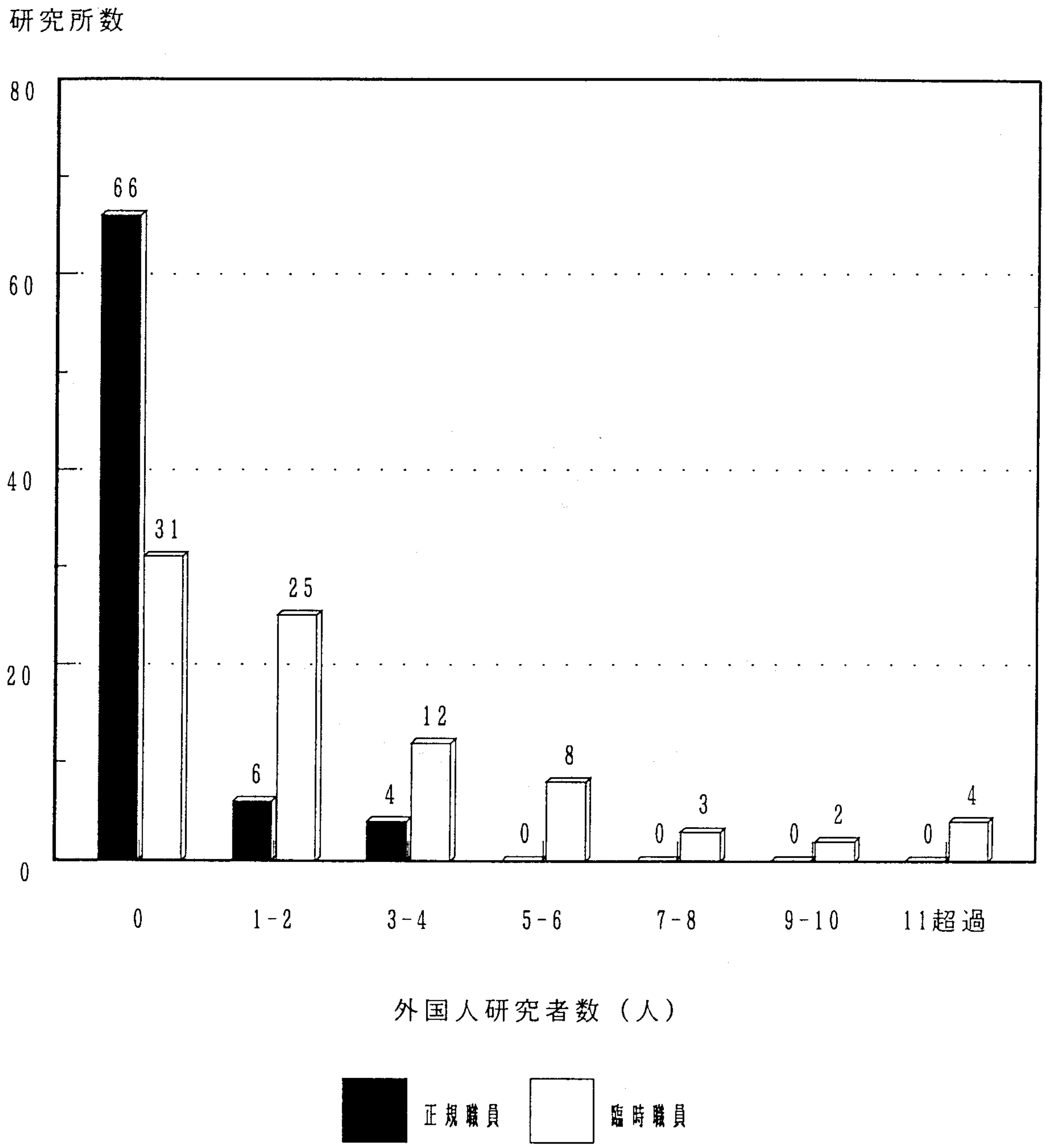
２１．退職者の年齢分布

（4）６０歳以上



回答	８７
回答無	１

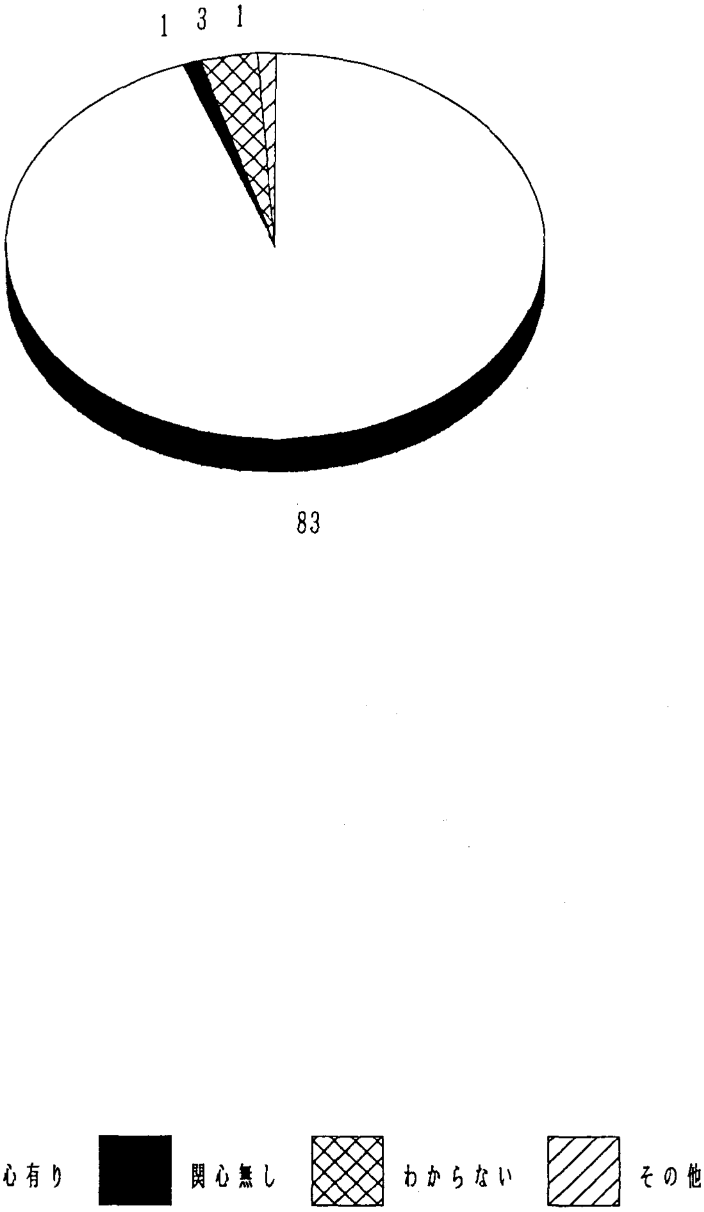
２２．外国人研究者数



正規職員		臨時職員	
回答	７６	回答	８５
回答無	１２	回答無	３

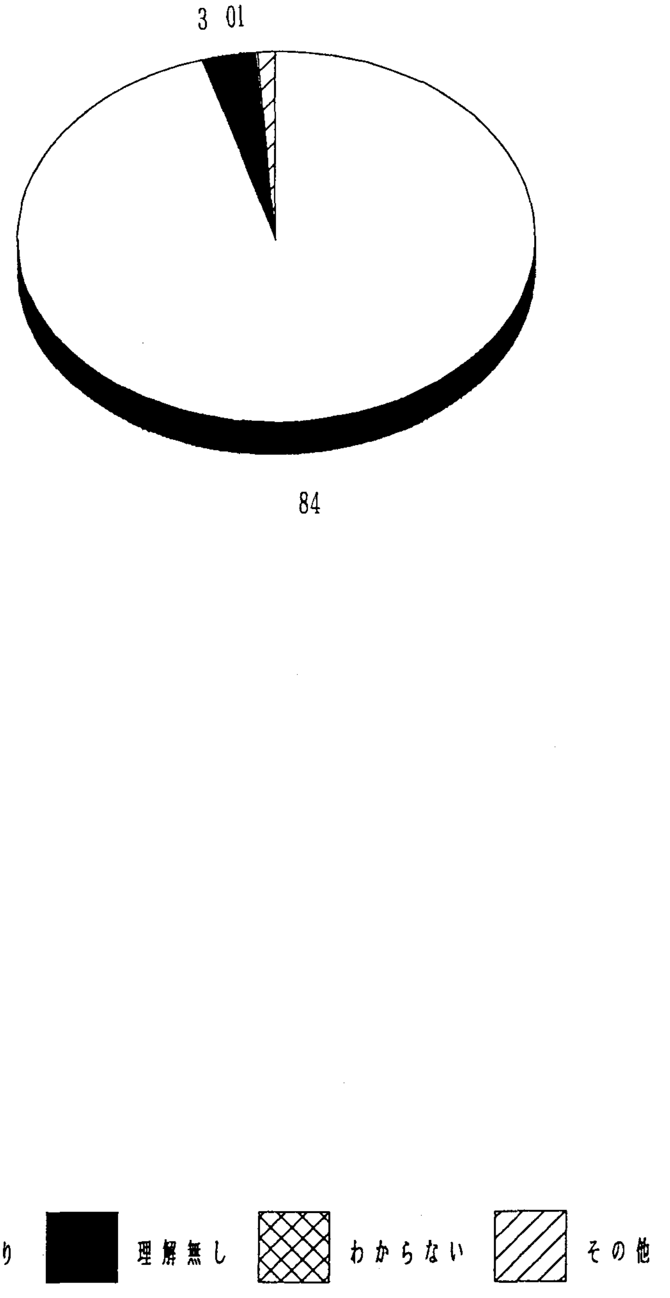
２３．所属省庁の幹部の関心

（円の数字は研究所数）



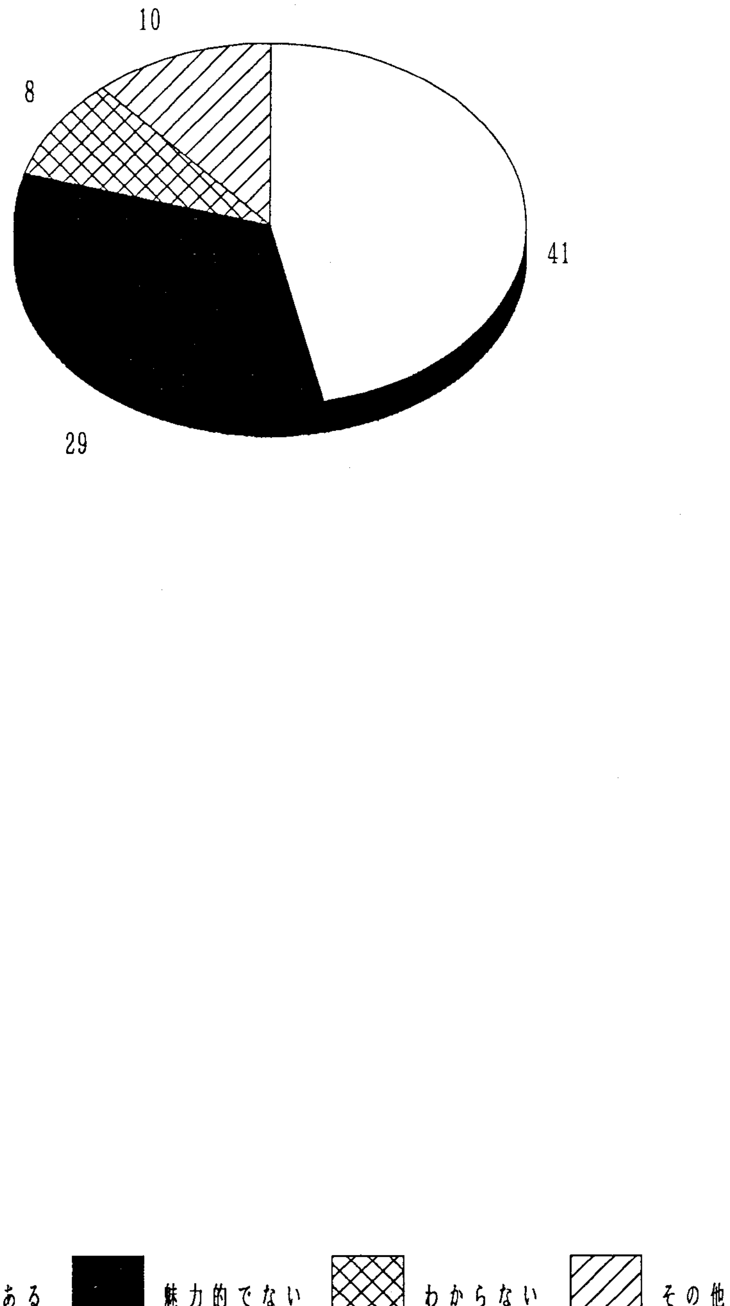
２４．管理部門の活動に対する理解

（円の数字は研究所数）



２５．研究環境の魅力について

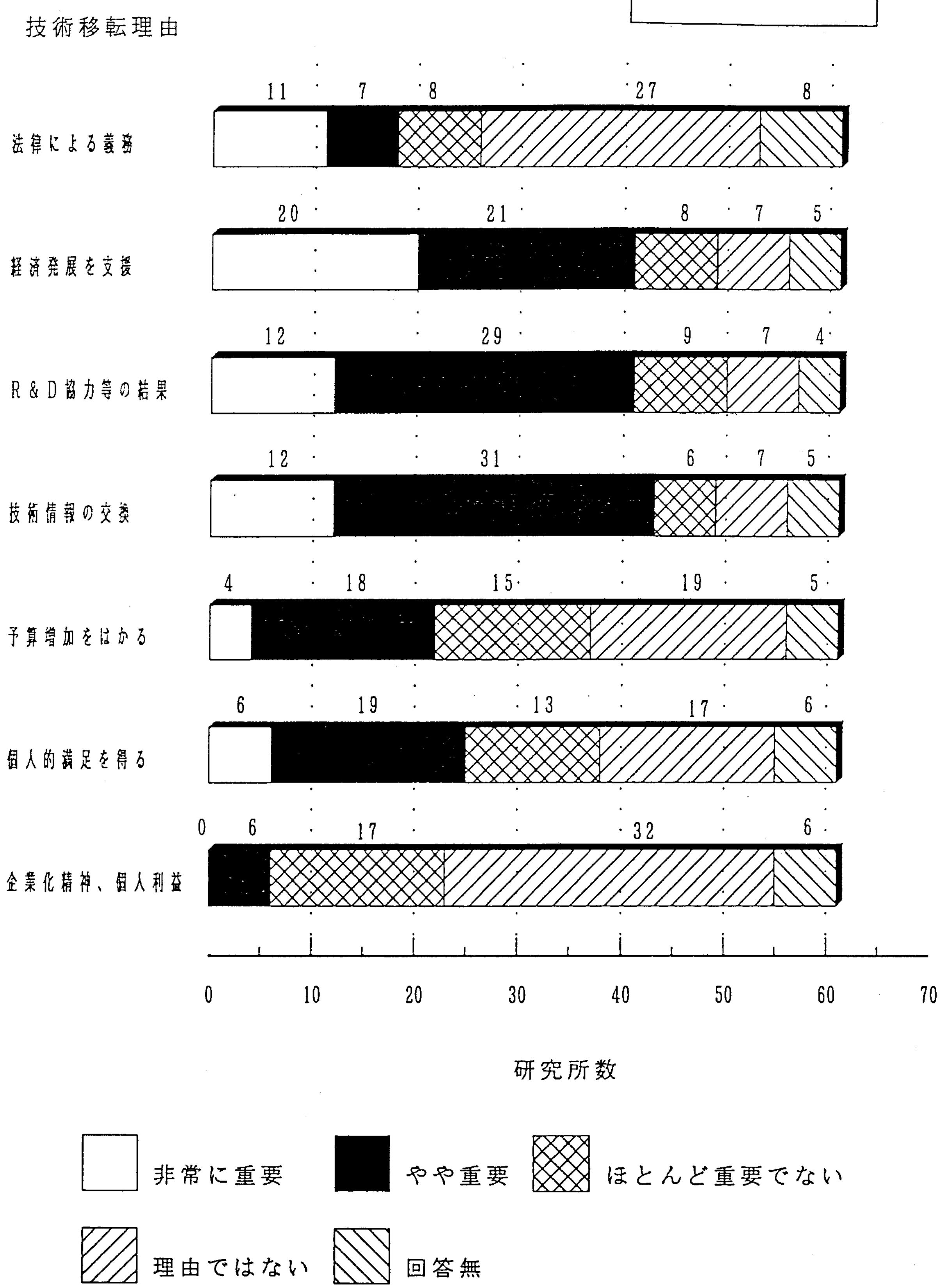
（円の数字は研究所数）



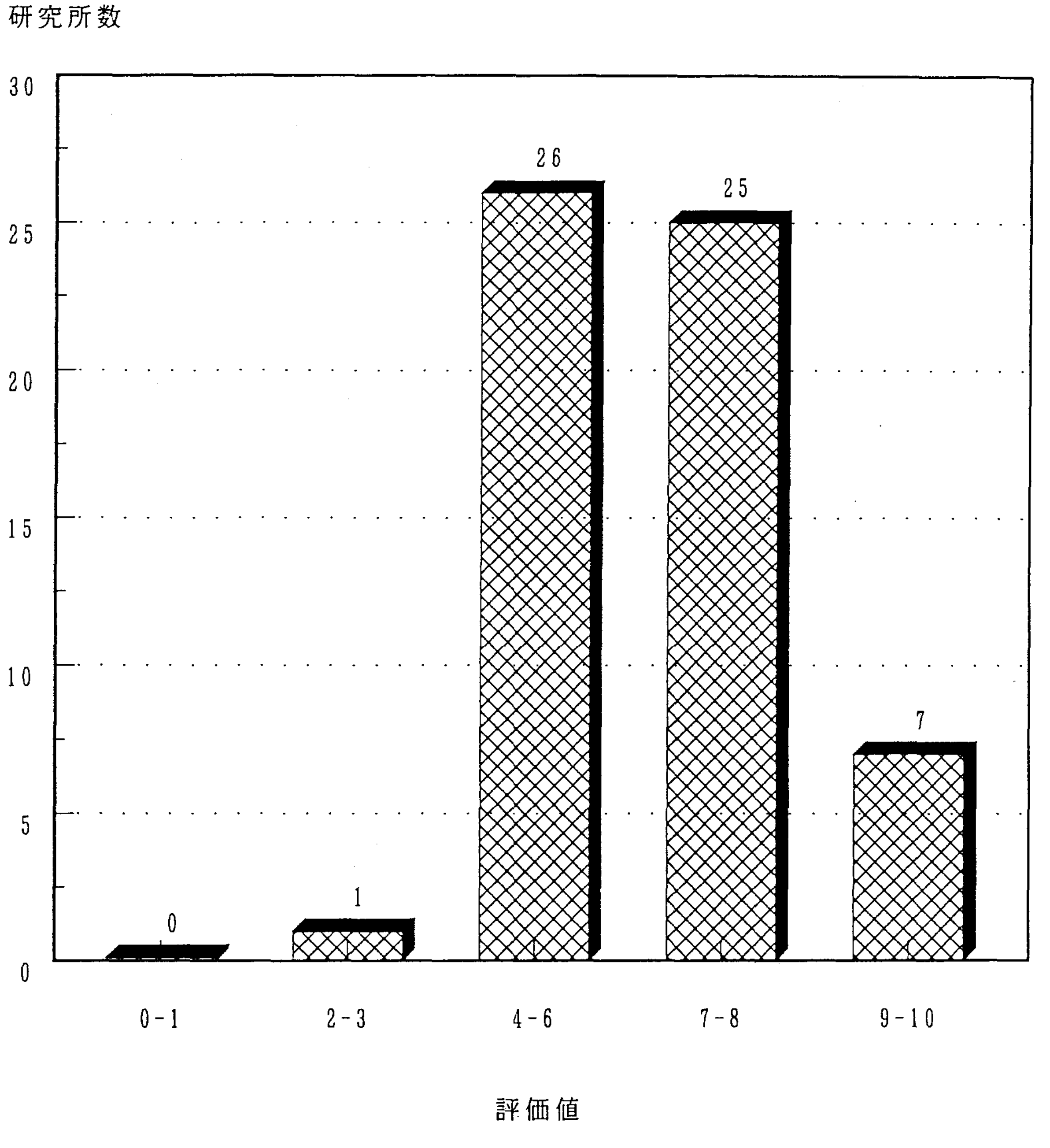
２６．技術移転理由（数字は研究所数）

回答　６１

該当無　２７

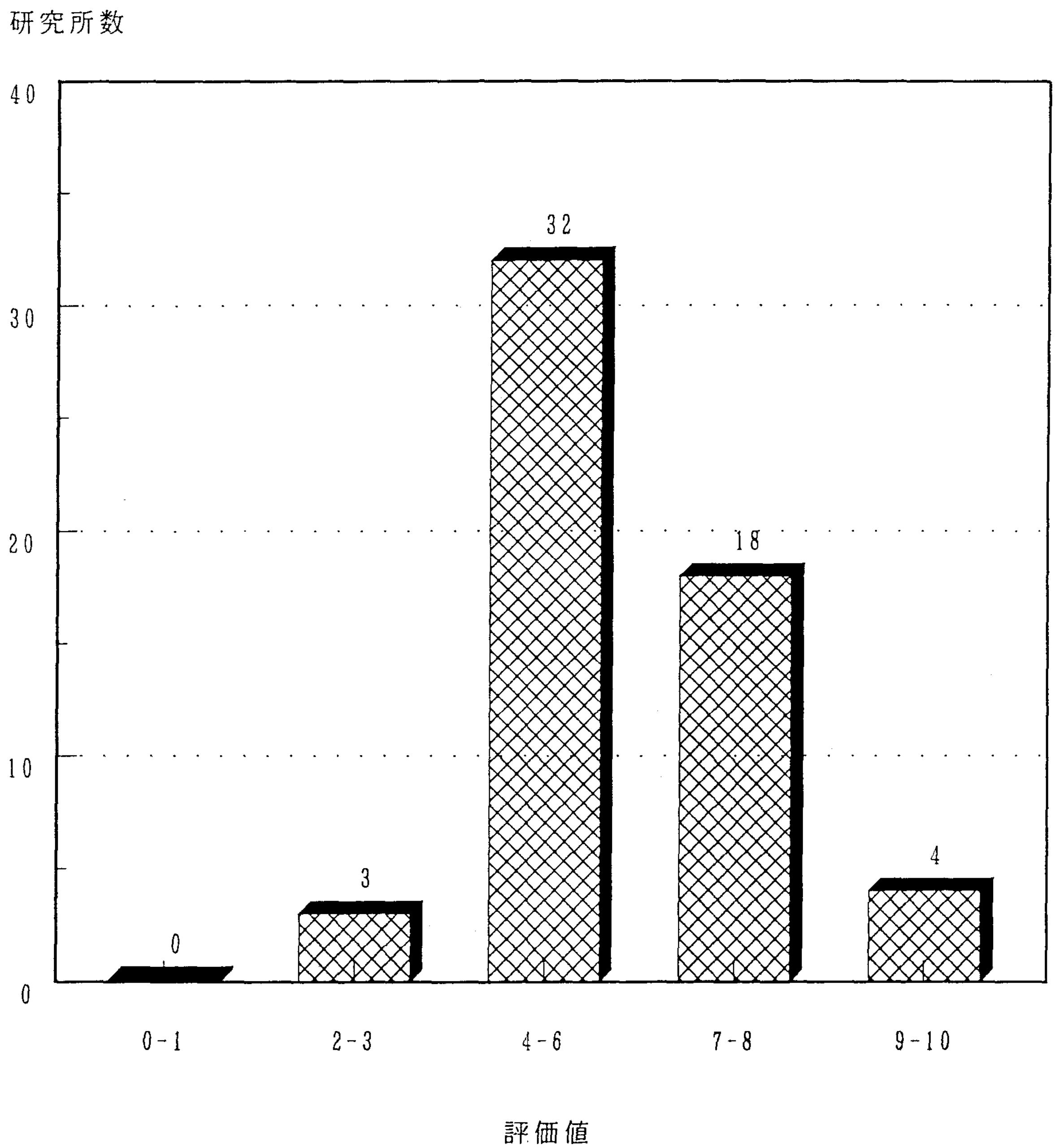


２７．技術を外部に出した評価



回答	５９
回答無	２
該当無	２７

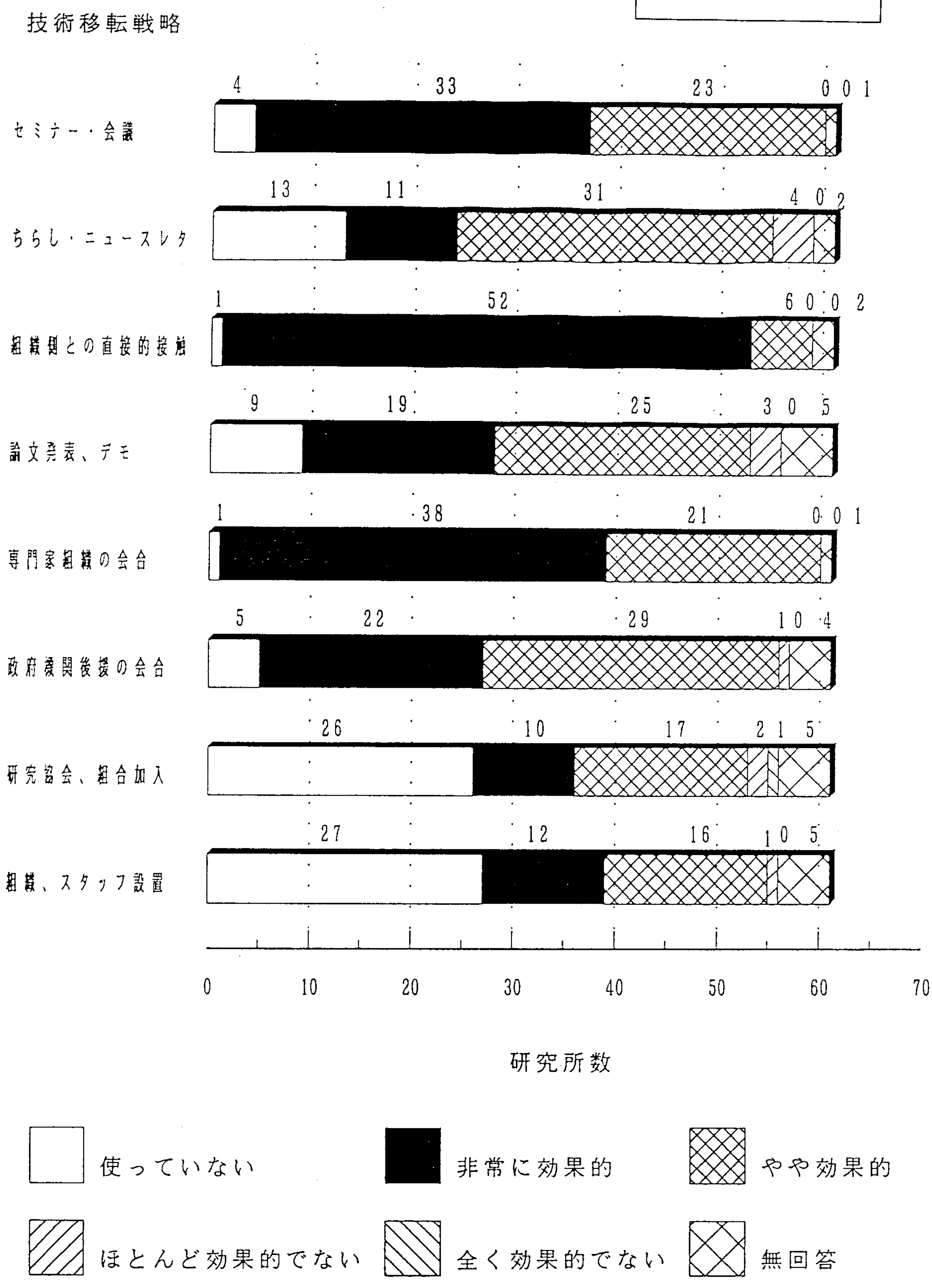
２８．営利的効果の評価



回答	５７
回答無	４
該当無	２７

２９．技術移転戦略（数字は研究所数）

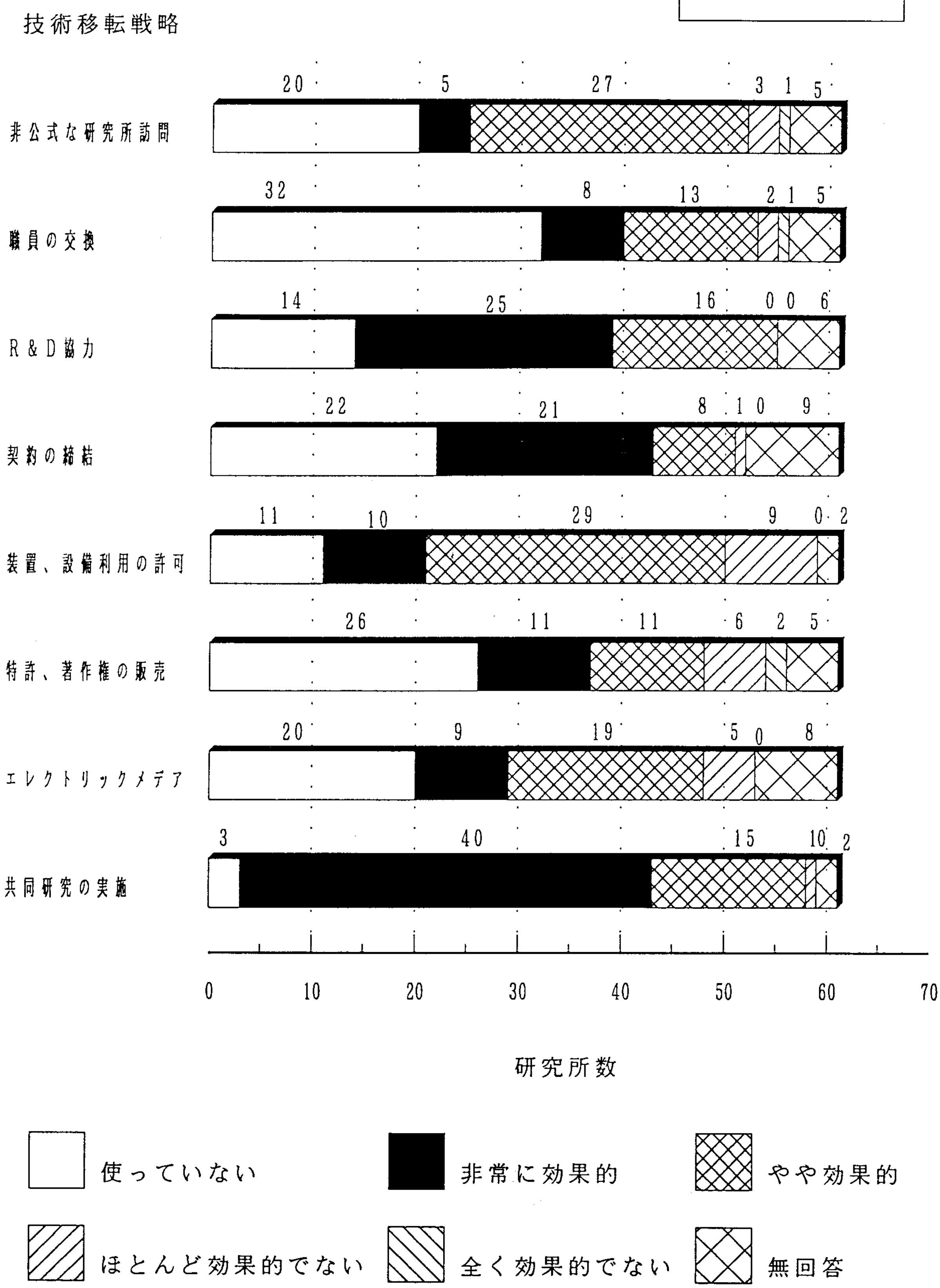
回答　６１
該当無　２７



２９．技術移転戦略［続］（数字は研究所数）

回答　６１

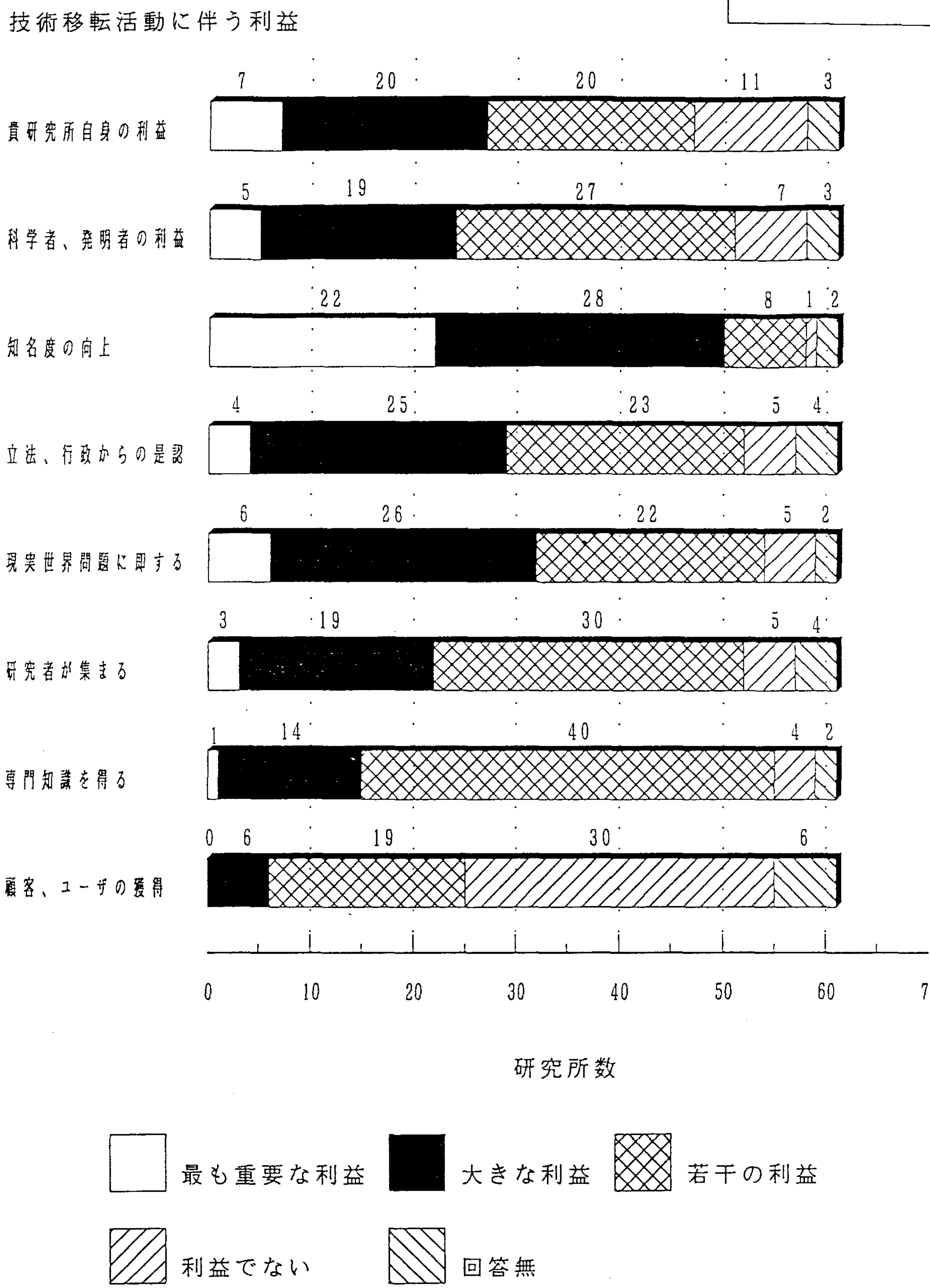
該当無　２７



３０．技術移転活動に伴う利益と問題点

（１）利益（数字は研究所数）

回答　６１
該当無　２７



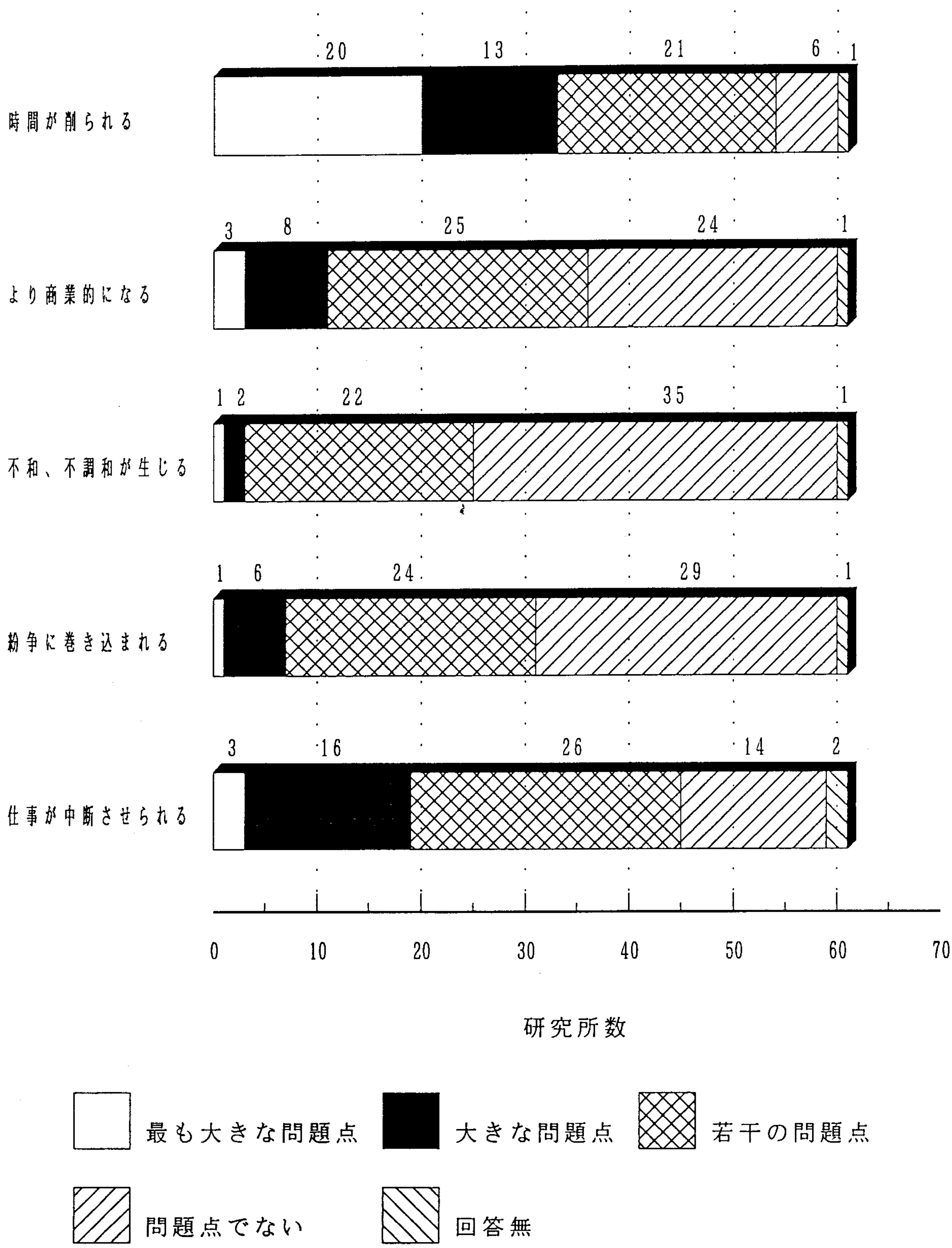
３０．技術移転活動に伴う利益と問題点

（２）問題点（数字は研究所数）

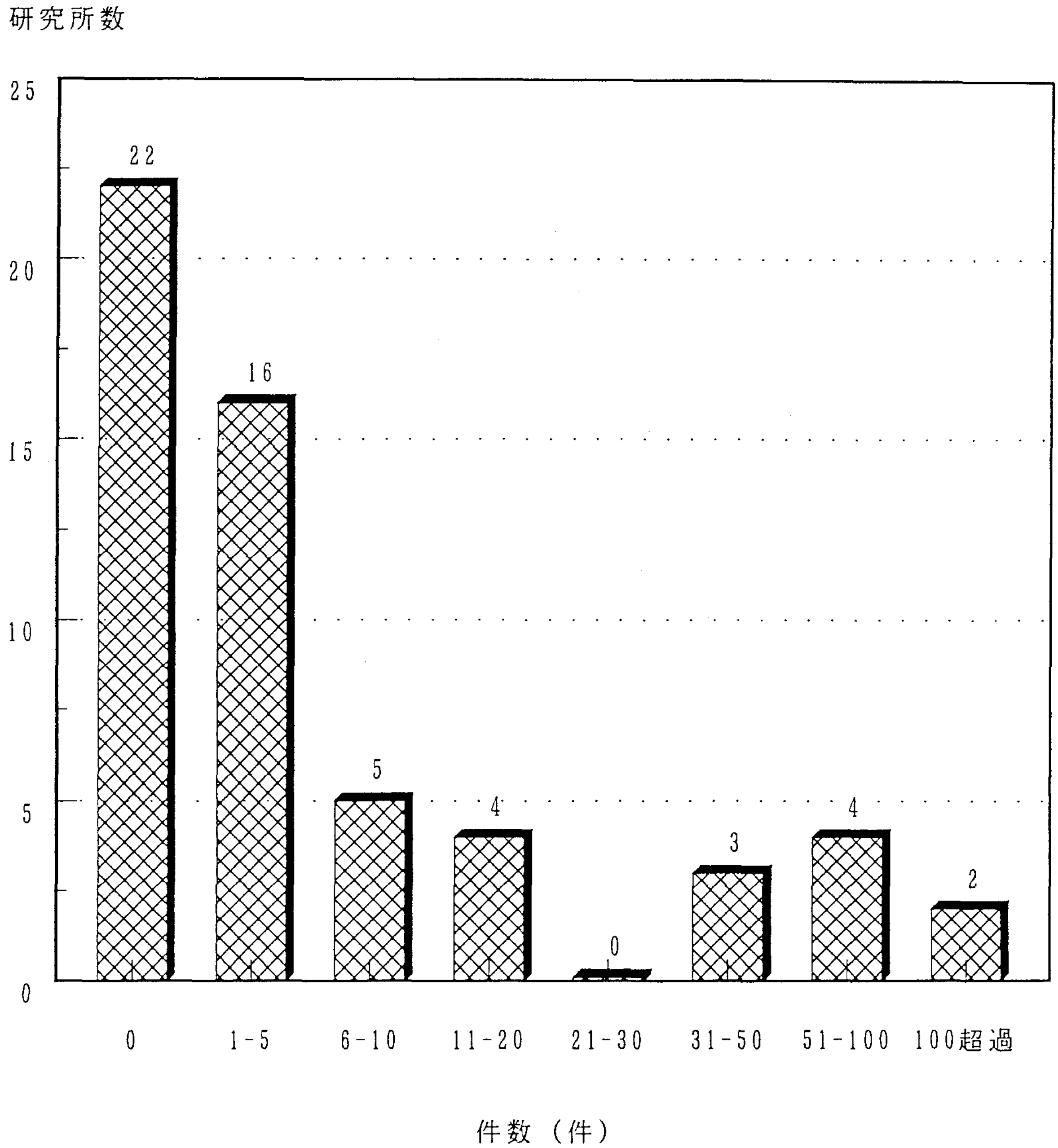
回答　　６１

該当無　２７

技術移転活動に伴う問題点

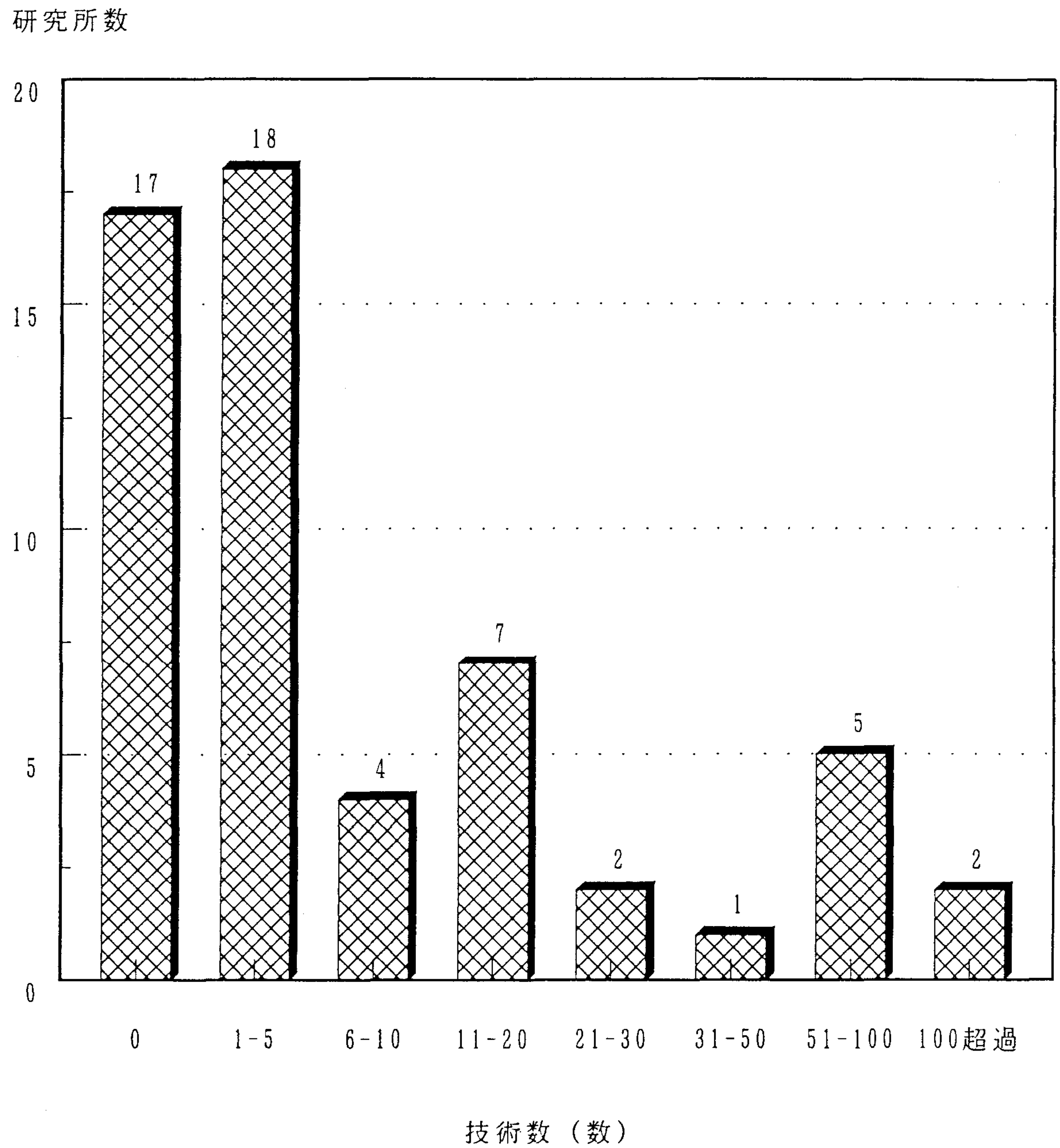


３１．特許・著作権の許諾件数



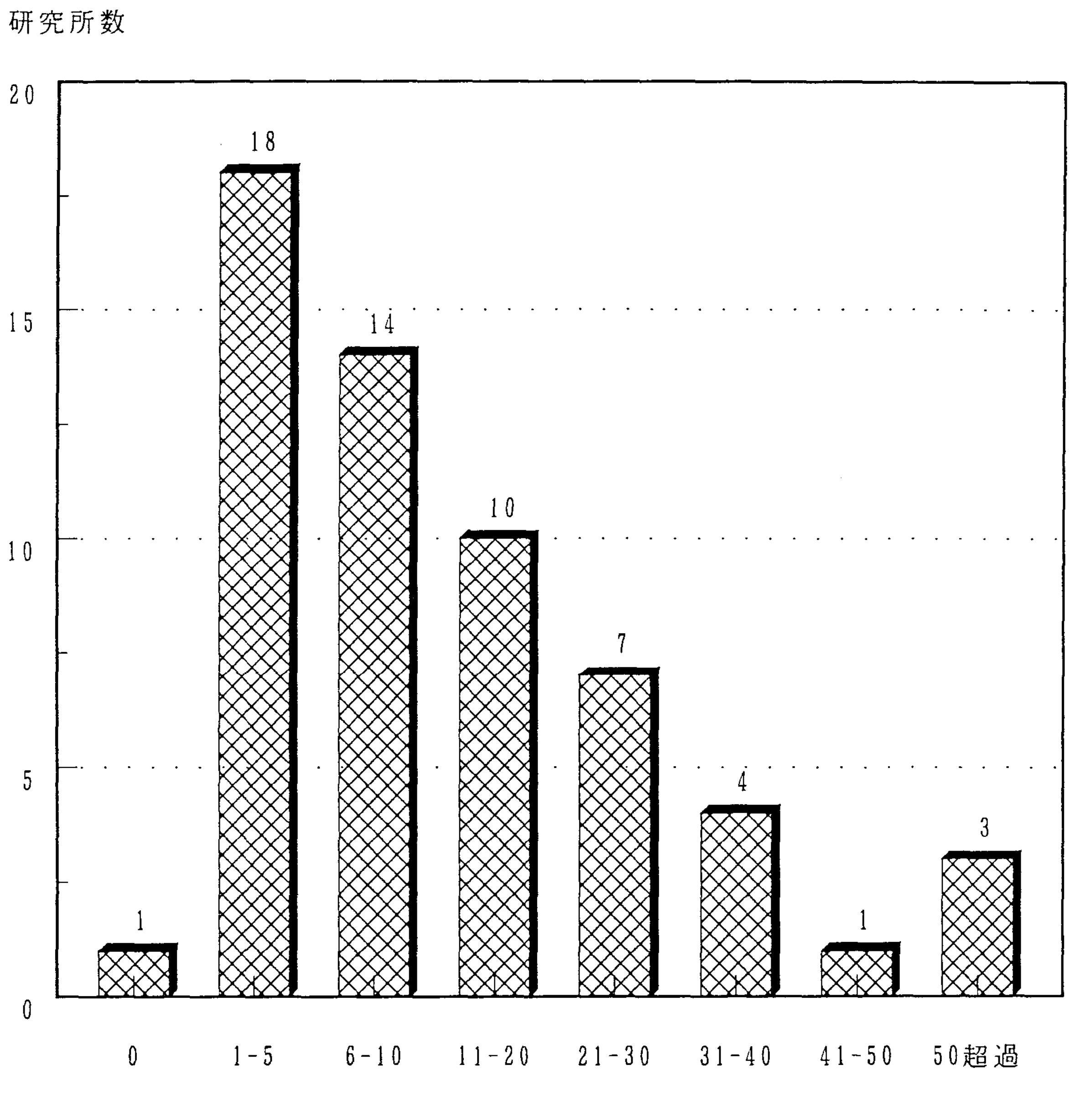
回答	５６
回答無	５
該当無	２７

３２．特許が与えられた技術数



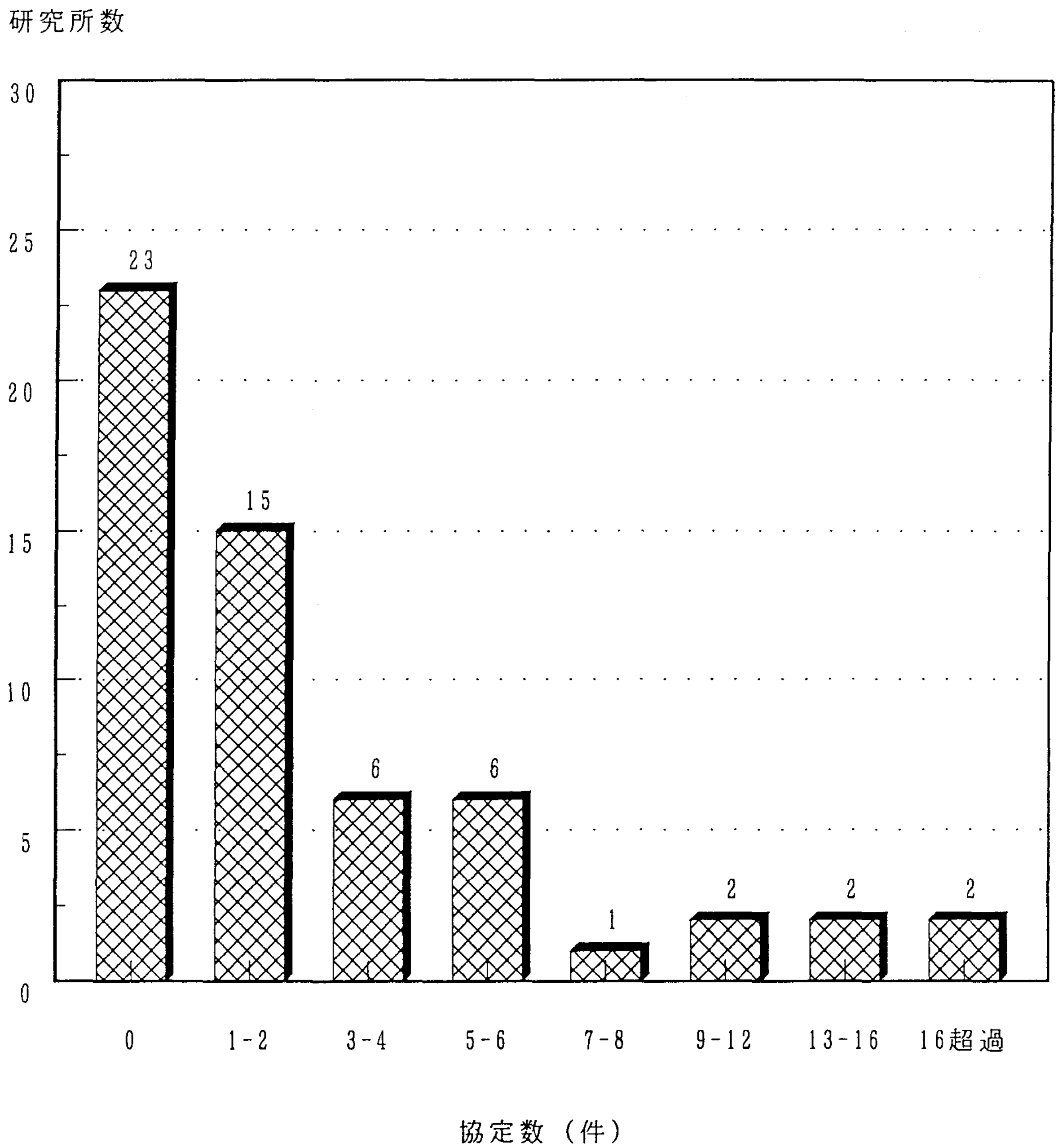
回答	５６
回答無	５
該当無	２７

３３．Ｒ＆Ｄ協力協定数



回答	５８
回答無	０
該当無	３０

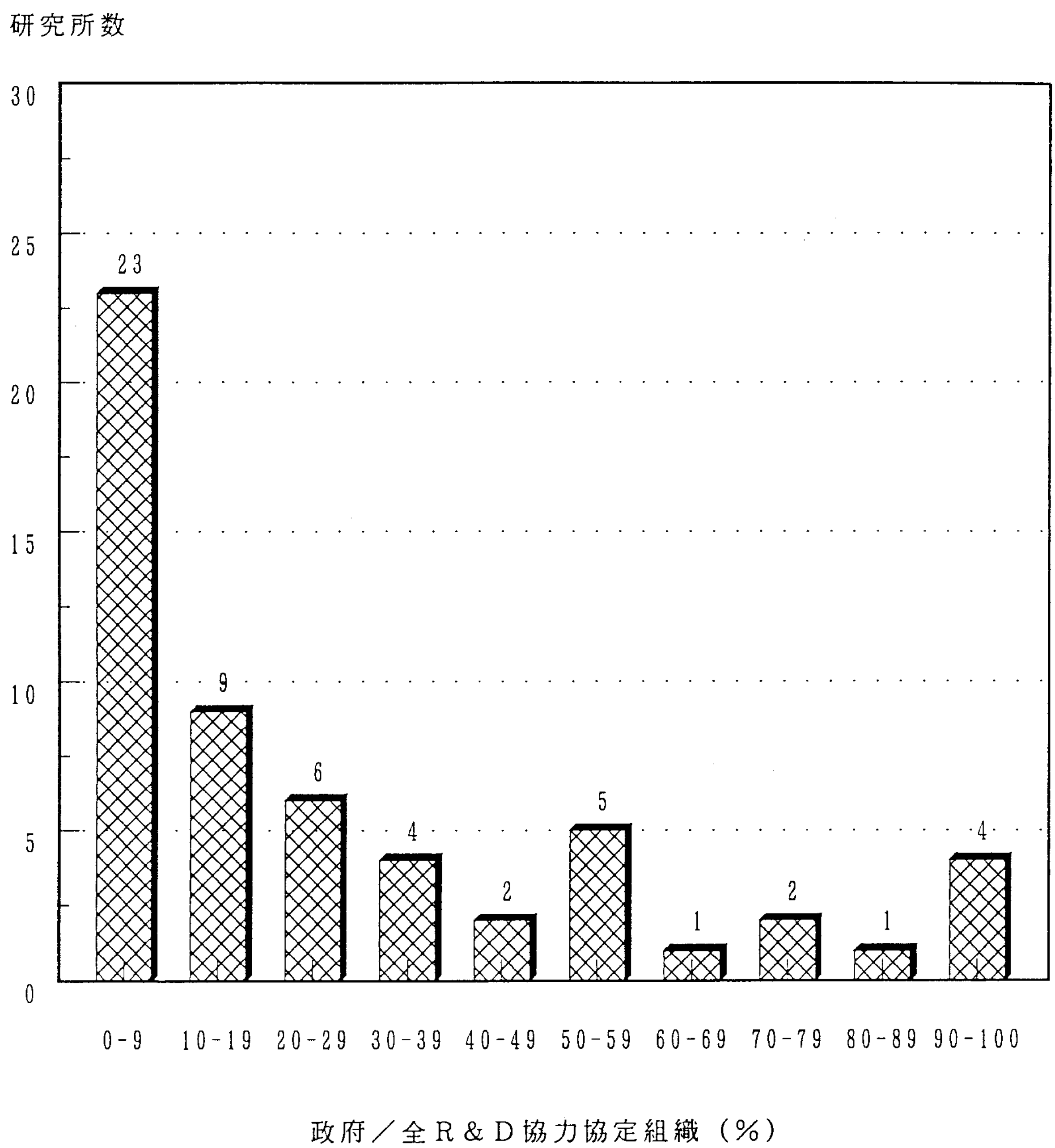
３４．外国組織との協定数



回答	５７
回答無	１
該当無	３０

３５．Ｒ＆Ｄ協力協定組織割合

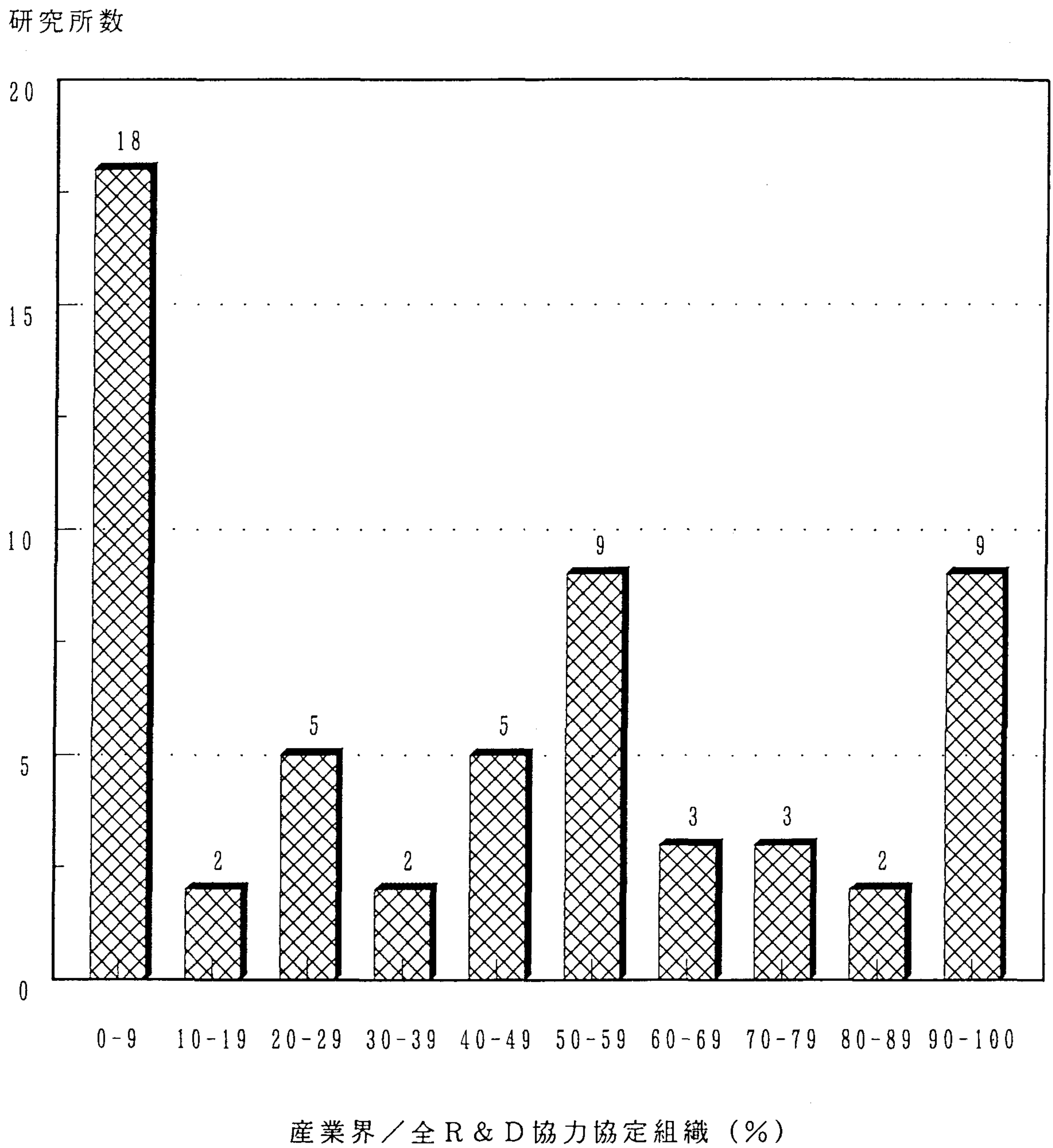
（１）政府



回答	５７
回答無	３１

３５．Ｒ＆Ｄ協力協定組織割合

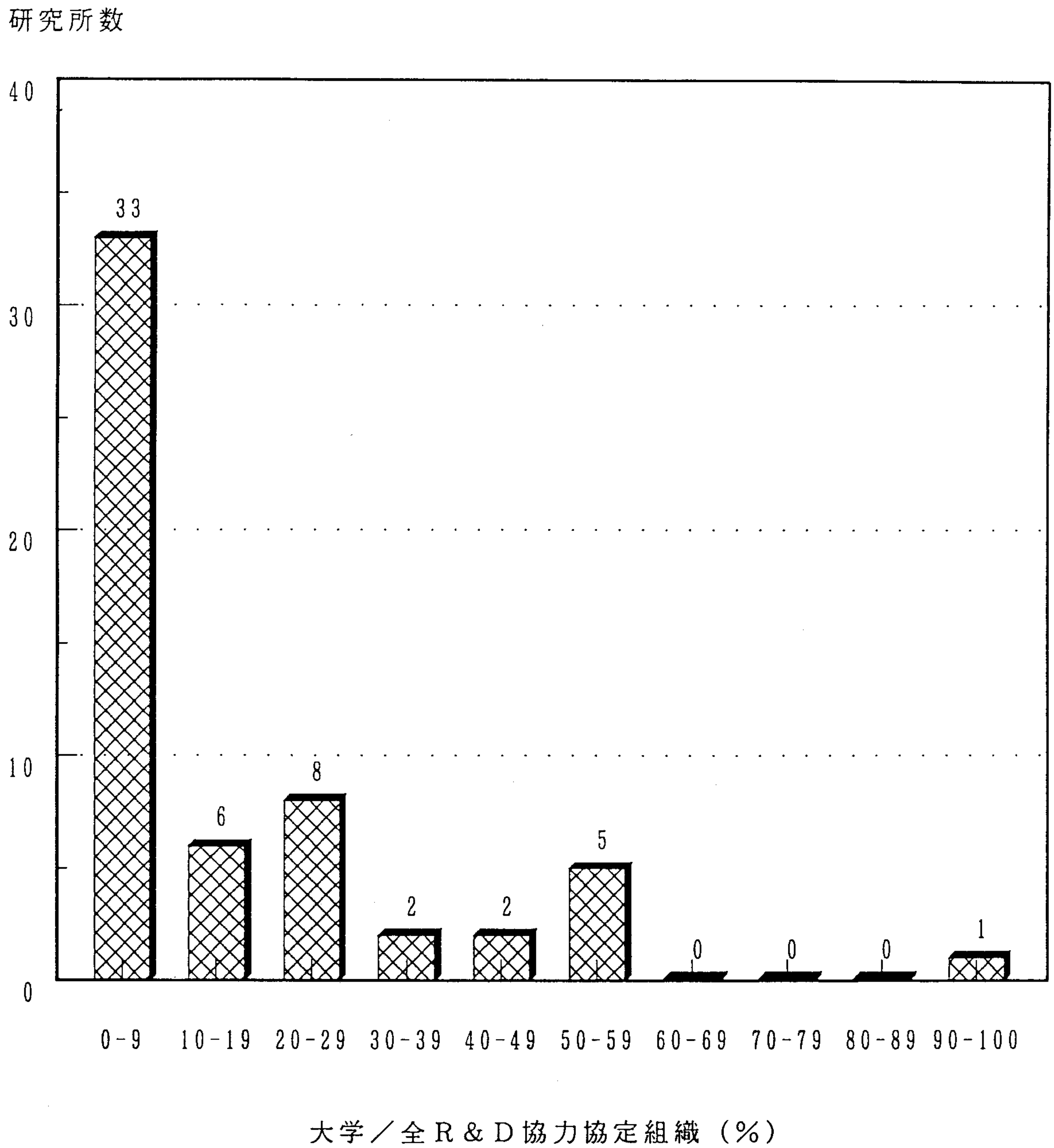
(2)産業界



回答	５８
回答無	３０

３５．Ｒ＆Ｄ協力協定組織割合

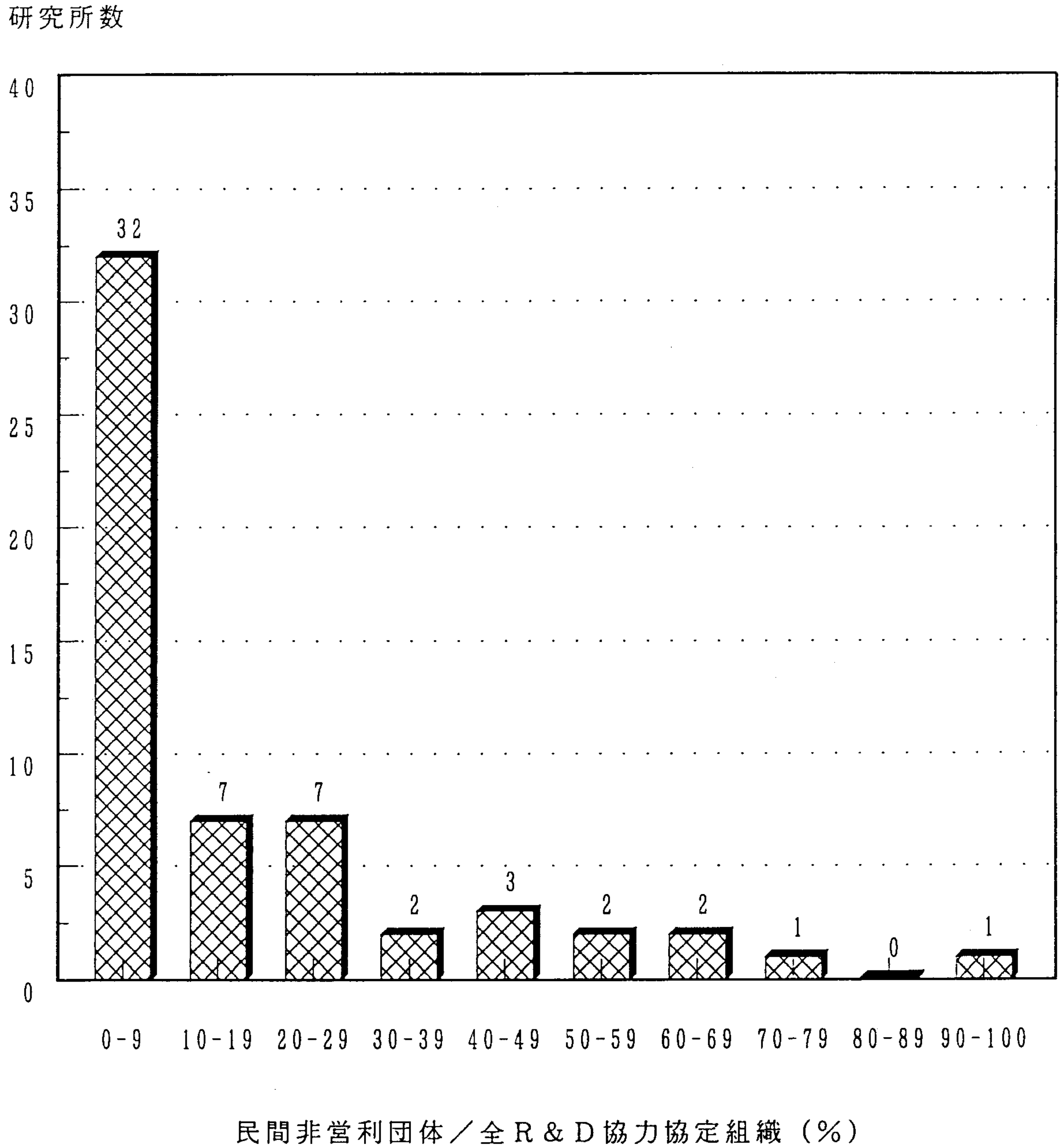
（３）大学



回答	５７
回答無	３１

３５．Ｒ＆Ｄ協力協定組織割合

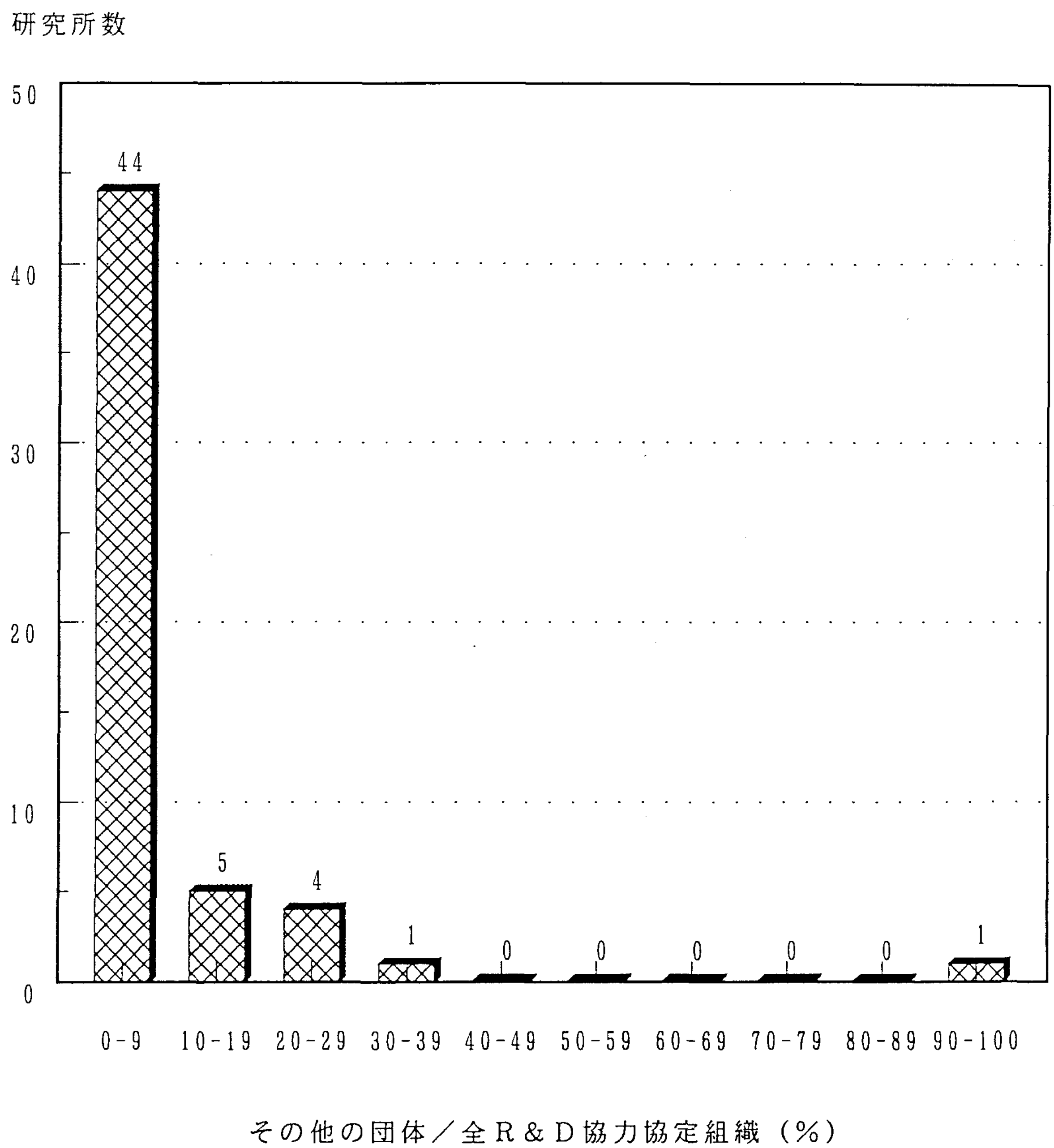
(4)民間非営利団体



回答	５７
回答無	３１

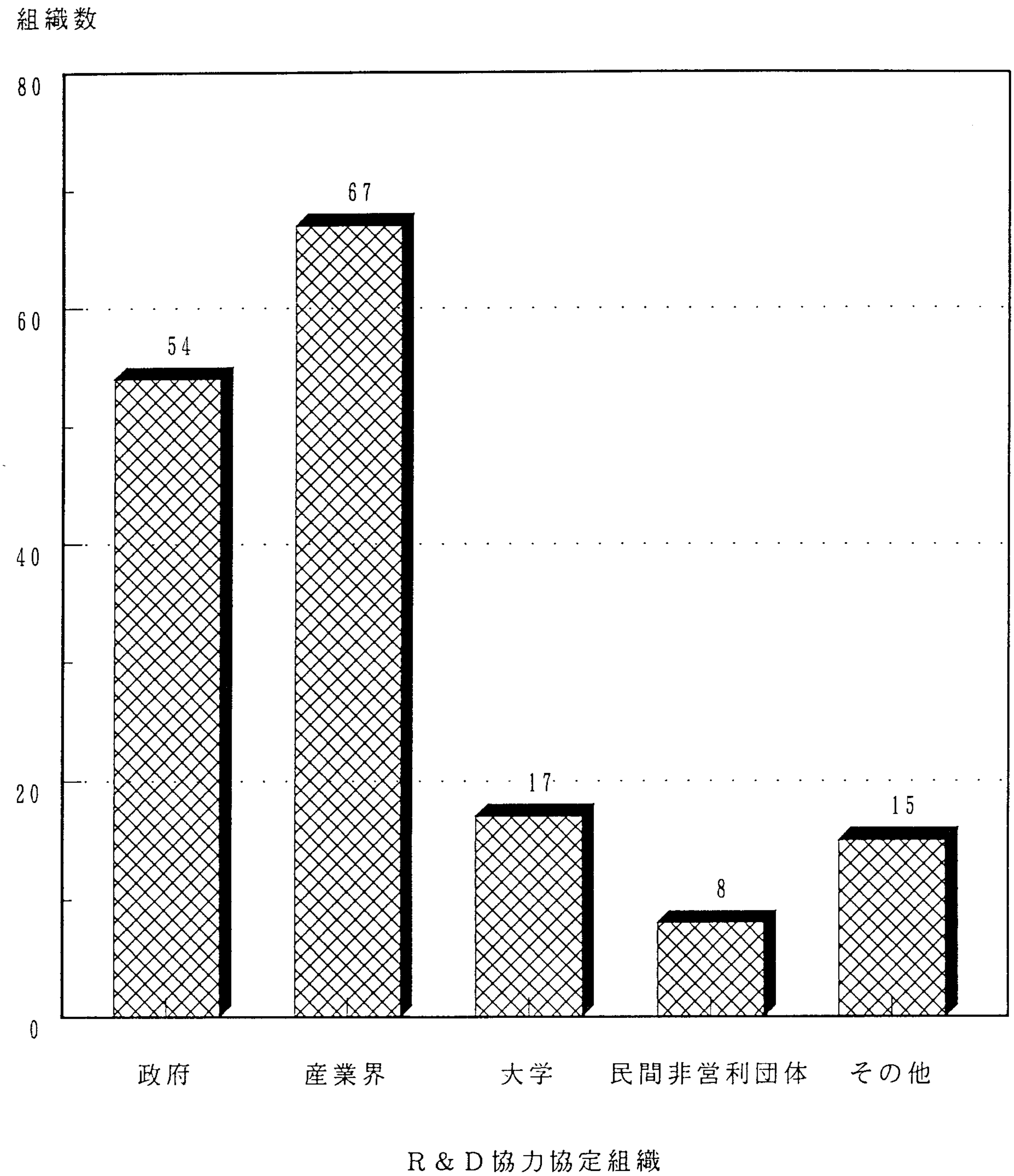
３５．Ｒ＆Ｄ協力協定組織割合

（5）その他



回答	５５
回答無	３３

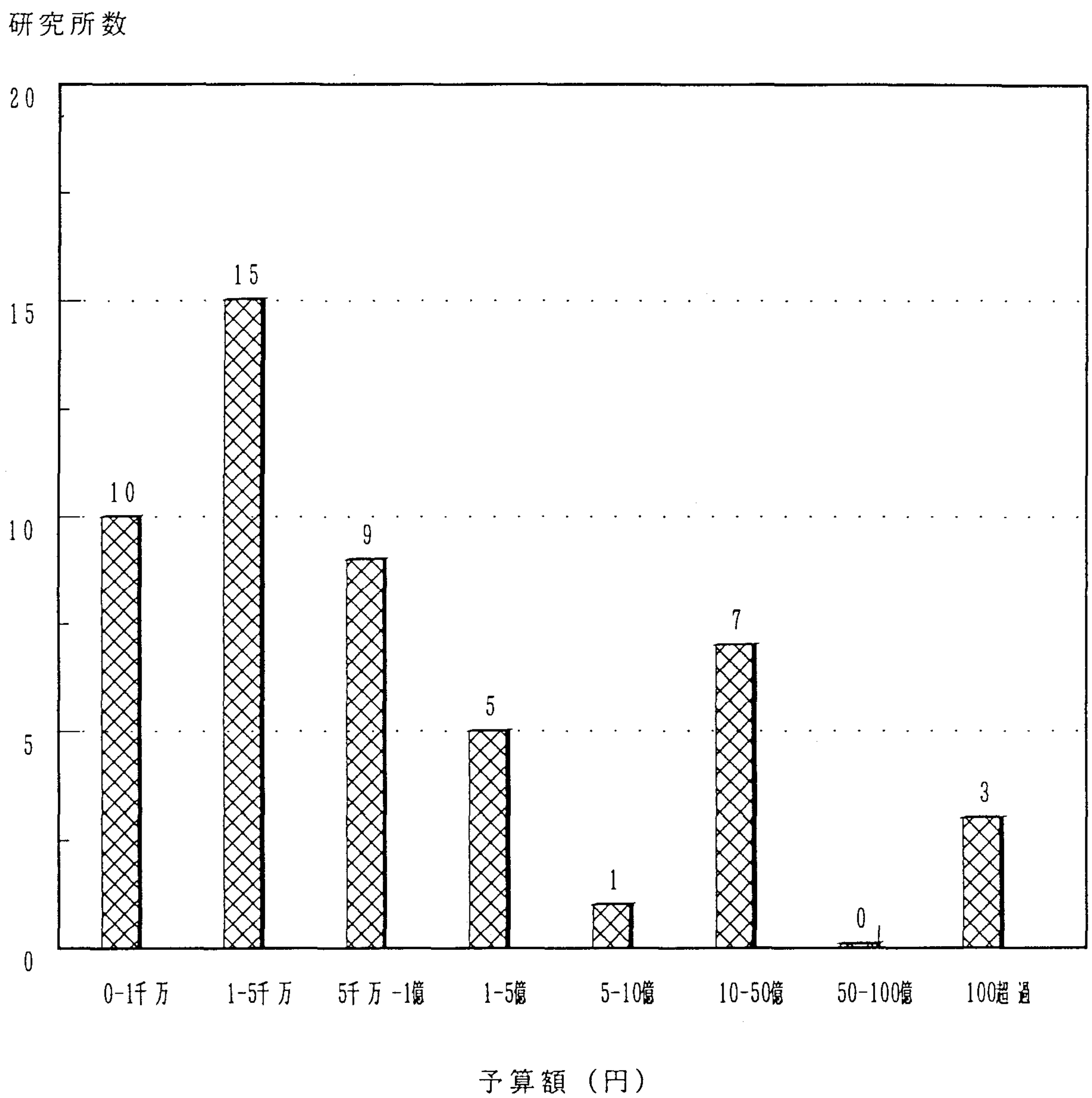
３６．重要なＲ＆Ｄ協力協定組織



回答	５５（３組織まで回答可）
回答無	３３

３７．Ｒ＆Ｄ協力協定予算

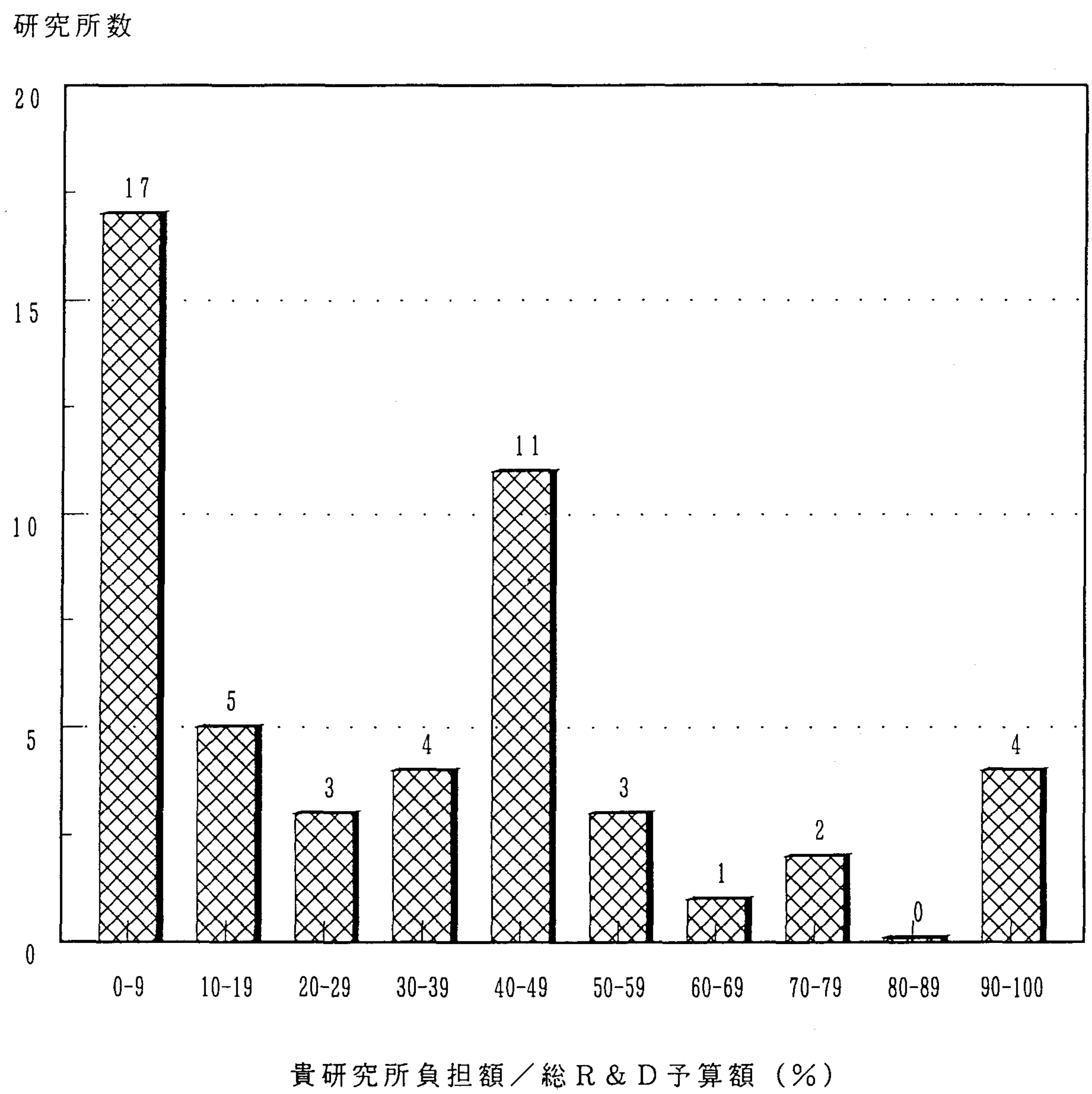
（１）総Ｒ＆Ｄ予算額



回答	５０
回答無	８
該当無	３０

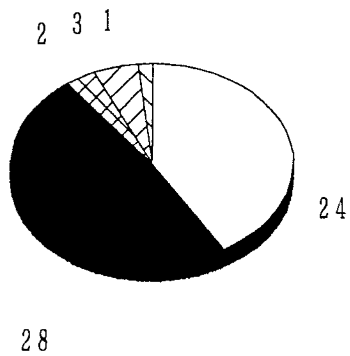
３７．Ｒ＆Ｄ協力協定予算

（２）研究所の負担割合

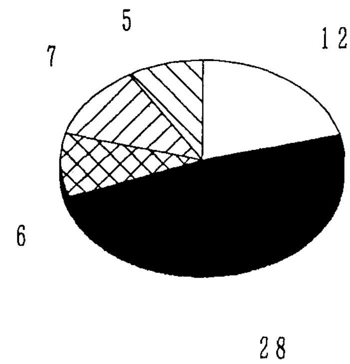


回答	５０
回答無	８
該当無	３０

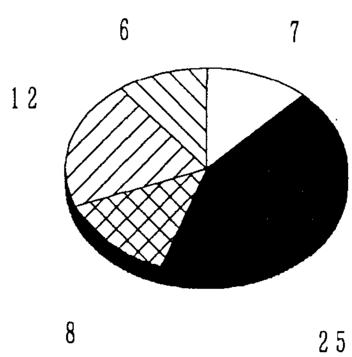
３８．研究成果に対するＲ＆Ｄ協力協定の貢献



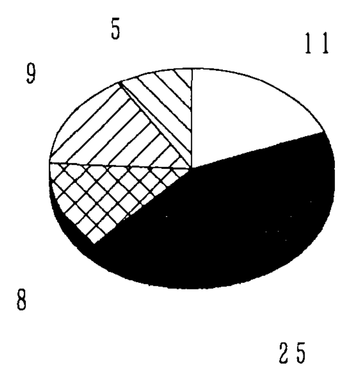
基礎研究、新知識の開発



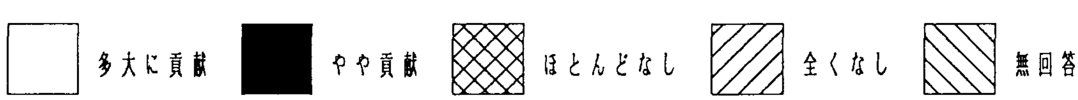
前商業的応用研究



商業的応用研究と開発



技術移転活動



回答　５８

該当無　３０

３９．Ｒ＆Ｄ協力協定を締結する動機

（数字は研究所数）

回答	５８
該当無	３０