Japan's research predicament revealed in society's survey

Tokyo

JAPAN's university researchers are worse off than they were 20 years ago, according to a report just released by the Chemical Society of Japan. Research funds for university researchers have failed to keep pace with inflation, and there is a chronic shortage of space, equipment and technicians which is getting worse every year. To rectify the situation, the report calls on the government to invest an extra ¥1,000 million per year in the university research system.

Outlays for research and development in Japan have soared 20-fold since 1965, making the nation second only to the United States in total research expenditure. But nearly all of the increase has been in private industry. The government's share of research spending has dropped from 30 to 20 per cent and university researchers have become much poorer than their cousins in private industry. According to the society's survey, the average researcher in industry now receives the equivalent of ¥20 million in research funds per year (on a 1980 yen basis), 46 per cent up in real terms on 1965, while a university researcher has to make do with ¥8 million per year, 16 per cent less than in 1965.

The real situation is worse than these figures suggest. University researchers receive government funds from two main sources: competitive research grants from the Ministry of Education, Science and Culture and 'regular' research funds from their university which are automatically allotted to each department or teaching unit (called *koza*). The latter funds are awarded according to the nature of the *koza*'s research (experimental or theoretical) and teaching responsibilities (the number of graduate students, for example).

Division of funds

About half of these regular funds are held back to cover university administration costs and the remainder are divided up among the members of the *koza* according to rank (a *koza* is typically headed by one professor, under whom there is one assistant professor and two research assistants).

Koza research funds (excluding university administration costs) have decreased 50 per cent in real terms between 1970 and 1985. Competitive research grants, on the other hand, have trebled during the same period. But as there are only a limited number of large grants many *koza* are suffering from a chronic lack of funds. And, according to Akio Yamamoto of Tokyo Institute of Technology, who heads the

committee that compiled the report, the "average" university researcher receives only about ¥300,000 (\$2,400) per year in discretionary research funds.

Lack of funds is not the only problem. In the 20-year period from 1965, the ratio of technical staff to researchers has plummeted from one to one to less than one to three. The ratio in industry has also decreased but still stands close to one to one.

As a result, many young university researchers spend their time repairing equipment and carrying out manual tasks rather than doing productive research.

Many departments also lack new equipment. For example, the report points out that in the United States, chemistry departments typically have several superconducting NMR (nuclear magnetic resonance) machines but in Japan only 3 out of 10 departments have such machines. The situation is particularly bad in new and provincial universities which do not have the same support as the old 'imperial' universities, such as Tokyo and Kyoto.

The picture is not all gloom. Funds for facilities for 'big science' (accelerator physics, fusion and space research) have trebled between 1975 and 1985. And the research institutes for joint university research, such as the High Energy Physics Laboratory in Tsukuba, the Institute of Space and Astronautical Science in Tokyo and the national research laboratories in Okazaki boast world-class research facilities. But these are the exception rather than the rule.

A questionnaire sent out by the society to 262 chemistry department heads received a 70 per cent response, and nearly all those replying (99 per cent) said that facilities in their department were "insufficient" to some degree. Thirty-five per cent said laboratory space is "desperately inadequate". According to Yamamoto, university regulations for laboratory space were made thirty years ago before there were graduate students, foreign researchers or large equipment and the rules only allow for "test tubes and benches".

Last year, however, saw a remarkable improvement in the situation in some laboratories. As a result of Western pressure, Japan ploughed several million million yen into the domestic economy and about ¥40,000 million (\$325 million) of this was allotted to the upgrade of university facilities. The sudden influx of new funds was like a "divine wind", according to Yamamoto. Professors were "flabbergasted" by the unexpected opportunity to buy new equipment. Many chemistry departments bought superconducting

NMR machines. But some departments simply did not have space for new equipment.

The report calls on the government to take the following measures: competitive research grants from the ministry of education should be doubled from ¥50,000 million per year to ¥100,000 million; "regular" *koza* research funds should be increased by ¥50,000 million per year; and funds for equipment and maintenance should be increased by about ¥40,000 million per year. In addition, the number of postdoctoral fellowships for foreign (that is, Western) researchers should be increased, the budget for books, periodicals and computer networks expanded, and more space made available for laboratories.

Unprecedented increase

Such increases in research funds would be unprecedented but are "not so large", says Yamamoto, when compared, for example, with recent increases in Japan's overseas development aid. And in the present political climate, with Japan under pressure from the United States and other Western countries to improve its basic research system, the "wind is not so unfavourable" for this kind of change, he says.

But money may not be the only problem with Japan's universities. The *koza* system has recently come under severe criticism by Japanese Nobel prizewinner Susumu Tonegawa, now at the Massachusetts Institute of Technology. He says the rigid hierarchy within Japan's university departments destroys creativity. Young researchers are stifled by the university research system which demands subservience to elders. Tonegawa left Japan in the 1960s and he advises "bright" young Japanese researchers to do the same.

The rigid *koza* system has also been attacked frequently for being wasteful of resources. Each department acts like a little independent "kingdom" with its own budget and facilities. As a result, there is tremendous duplication of equipment and facilities and very little interaction between research groups in related fields.

Yamamoto, however, thinks the *koza* system has advantages over the open and competitive research system in the United States. He says that although Japan's university research system does not produce many Nobel prizewinners, it does provide "shelter" for young researchers and yields a steady stream of good basic research.

He points to statistics in the report that show that the number of publications from Japanese researchers in two important chemical journals, the *Journal of Organic Chemistry* and the *Journal of the American Chemical Society*, increased three- to four-fold between 1970 and 1985 and now accounts for close to 10 per cent of all contributions.

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