

Technology and computing

The expensive downward thrust of third-

FIRST-rate people in third-class institutions is how many people see the research and development aspects of New Zealand universities. In a recent report, Professor Dick Matthews, a distinguished microbiologist from the University of Auckland, said our universities are third, or even fourth, class.

Included in the first class are a few outstanding institutions such as Oxford, Cambridge, Harvard, Yale and Stanford universities. They have major facilities and most staff should be world leaders in their field.

In the second class are a large number of universities with many outstanding staff. They would expect to have a small number of people with Nobel prizes, or to be seriously in the running for future ones. This category includes dozens of north American and many European universities, but none from New Zealand. When it comes to research, New Zealand is in the next category.

What are the problems with

the New Zealand universities? I have limited my comments largely to the graduate and research level — honours, masters, and doctorate studies.

Undergraduate education

Strengths: New Zealand undergraduate education is in general equal to the quality and standards of any other country.

Our best graduates can go with confidence to any overseas university. The system is aided by flexibility: the universities are reasonably equal, new courses can be developed as demand changes, and students may usually attend the university of their choice.

Many applied degrees are strengthened by practical requirements over the long vacations.

Problems: The number of young people at the senior levels of high school, univer-

Our universities may be more efficient in getting research to completion than Government laboratories, but they are not top world-quality research institutions. Many problems can be solved by reforms that will cost little or nothing, others will require a larger share of the money spent on research in New Zealand. University scientists must now be allowed a fair chance for access to money spent on both basic and applied research. **David Penny** continues his series.

sities and polytechnics is low by world standards (for one measure see Table 1) and this particularly affects students from less affluent families. As usual, we are more smug than the figures justify.

We are being slow to introduce computers into general use for teaching (that is, outside computing courses).

We are still too inflexible in our degree structures with too much emphasis on training, rather than combining it with education and flexibility.

We try to produce specialists at the undergraduate level.

Medical, dental and veterinary students do not do a general degree before starting their specialist degree.

This problem is becoming worse with applied faculties trying to interfere with even one year's basic science.

Very few students in humanities, social sciences, law and business studies will take any science courses. This is a major problem when considering the importance of research for economic performance and decision-making.

Accountants and lawyers may run industry, but in con-

trast with their counterparts in successful economies, they will have virtually no science subjects past the fifth form.

Even in the fifth form students take a narrow range of subjects. New Zealand has the most narrow education of any country that I have seen.

There are weaknesses in some subjects vital to New Zealand. It is unbelievable that a country that depends on primary production (agriculture, horticulture and forestry) has virtually no plant molecular biology in its universities. We may also be somewhat slow in developing Asian studies.

Too many of our most able students go into physical science and medicine. Nearly all scholarship winners go into these two areas. But the subjects making the most striking advances are computing and molecular biology.

Graduate post-doctorial

I am unable to find any particular strength in graduate education. The system as a whole is competent but not good.

Problems: Graduate education has too inflexible and specialised degree structures. It is being recognised that more flexibility is required in research groups, whether Government, university or industry. In many areas, both basic and applied, there is the need for interaction among people with different backgrounds and talents.

There is little movement of students between universities; usually students do their undergraduate and graduate work in the same department. This is considered extremely undesirable elsewhere in the world.

The problem cannot be solved by universities acting singly because if any one university decided to go it alone, and the others did not follow, then it would be left without graduate students.

Honours are over-emphasised. Employers and students have all the information they need from grades of papers and theses.

The present system restricts students from moving into new areas. That is, the award of honours is at present more important than the education or the research results. I believe we should abolish the award of honours from all degrees.

Far too many students are submitting massive and boring theses that fail to synthesise the important results of their work. Fortunately some overseas examiners have refused to examine these monstrous theses, but the student gets punished for the weakness of the supervision.

There must be more emphasis on synthesis and on publishable papers, and on meeting deadlines.

There are too few graduate

Table 1
Percentage of
15 to 19-year-olds
in fulltime education.
OECD figures from late 1970s.

Rank	Country	%
1	United States	75.4
2	Japan	71.4
3	Switzerland	70.1
4	Finland	68.5
5	Norway	65.0
5	Netherlands	65.0
7	Canada	64.9
8	Belgium	61.3
9	Denmark	57.4
10	Sweden	56.3
11	France	55.9
12	Ireland	50.5
13	Britain	46.3
14	W Germany	45.4
14	Greece	45.4
16	New Zealand	44.8
17	Australia	44.4
18	Italy	43.9
19	Spain	41.3
20	Portugal	33.4

students. The vice-chancellors' committee has pointed out that the percentage of students going on to advanced study has declined over the past 10 years from 36% to 23%. Two of the causes are insufficient support for graduate students, and low research activity in the private sector which leads to fewer jobs for advanced graduates.

Our system is also unusual in that most of graduate student support goes directly to the students who then choose their own area of study. The support for additional students should be for important areas of study.

Too much of the available money is spent to send graduates overseas for advanced education. We are in a catch 22 of sending students overseas because graduate education is weak, and graduate education is weak because so many get sent overseas.

The National Research Advisory Council spends about \$2 million a year on fellowships including graduate study. Money spent on sending students overseas would support about three times as many students within New Zealand.

Very little opportunity exists (outside medical research) for post-doctorate work. This may be less of a problem for people wanting to go into industrial areas, but it is very important to others.

One university department has decided, reluctantly, that it is unlikely to employ a person with a New Zealand doctorate. Overseas applicants will have spent two or three years of full-time research on post-doctorate study, will have experience in several different laboratories, will have eight to 12 papers published and several more on the way.

New Zealand graduates look poor in comparison in that they have not proved they can make the transition from student to independent researcher. In areas with a good supply of people to choose from, it is difficult for New Zealand applicants to get the experience.

University system

Strengths: In an earlier article I reported results that showed that universities appeared to be four times as effective as Government laboratories in getting research completed and published.

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rate universities

This is an important finding that must be studied further if we are to be sure that the best advantage is made of our research funds.

There have been some very good features of the organisation of research in our universities and in any reforms they must be retained.

One of these is that the system allows for ready co-operative research with other staff.

Another is that all staff should be able to maintain at least a small research programme out of university funds. This aspect has been severely eroded over the past 10 years; in one university the real value of maintenance funds fell by 50% in that time.

Problems: Number one is the small share of New Zealand's research funds. It was reported in an earlier article that we spent only 40% of the OECD average on research in the tertiary sector (0.15% of GDP compared with the OECD average of 0.37%).

There has been a decrease in staff numbers in relation to student numbers. Over the past five years there was one new academic staff member for each 122 new students. Support staff declined, despite the increase in student numbers.

It is essential to maintain international standards in areas important to the country, but these areas are important to other countries as well.

In a recent case, the three top applicants for a genetics position (all currently overseas) turned down their offers and so no appointment was made. This is one of the most important research areas for New Zealand.

An excessively rigid hierarchical system places a strain on universities.

In the post-war era we have added grades to the salary scale so that the 19th century status of professors can be maintained.

We need a flexible system where cases are dealt with on merit, not on seniority. One solution is simple and costs no money — keep the same salary scale and give everybody the title "professor". Many problems would simply disappear!

There are too few technicians for maximum efficiency. A recent report gives the ratio of support staff to scientists as 0.92 in universities (and mostly involved in teaching), 1.23 in the DSIR, 1.98 in forestry and 4.28 in the Ministry of Agriculture and Fisheries.

With very few technicians, and an unpredictable supply of graduate students, it is difficult

to maintain major research projects. The alternative is to find some nice wee corner of a research problem, potter around in it, and keep a few publications coming out!

Major projects

A competitive grant system for major projects is lacking. The present system has been described as an inverse pork-barrel method where everybody must have a little bit.

The existing system has been designed more for the needs of physical scientists than biologists or the applied sciences.

The contract system with Government departments depends too much on individual contacts to be sufficient by itself. Nor does it allow sufficient input of ideas from universities.

We must be careful to avoid the problems of the United States system. Their universities do not have research funds built into their basic grant and it has become very difficult to carry out research without external finance.

The system makes it difficult to get new projects started, discourages co-operation between different groups, and makes it difficult for established researchers to move into new areas.

Most New Zealanders only have experience of the British and north American systems and tend to advocate one or the other.

However, as figure 3 makes clear, both these systems are unusual in that a high proportion of their research funds come from external grants and only a small proportion from university funds.

A significant proportion of research funding from the university grant would be an important part of a reformed system.

New Zealand does need a proper research grants system for major projects of national significance.

As an example, at present we may require only one major laboratory working on the X-ray crystallography of proteins. But any such lab should be funded as a national resource so that any other scientists who need work done will have access as of right.

New Zealand universities are still not up to world standards in the graduate and research area.

Why was this problem not solved years ago?

During the 1960s, after the Parry Commission report, there were many improvements, particularly in buildings

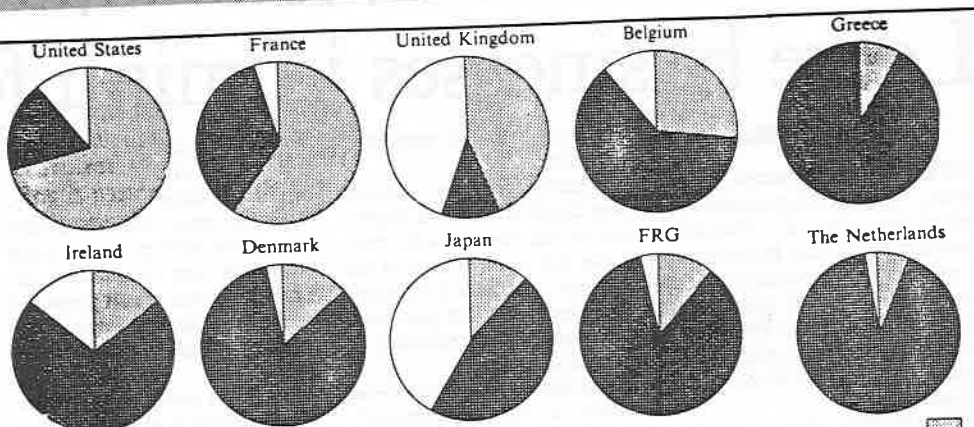
and in undergraduate education. But the Parry Commission also recommended the establishment of the NRAC and the improvement in research in the universities.

Most of the responsibility for the present situation lies with the universities, or rather with the previous generation of administrators.

The "universities" opted out of the NRAC and have suffered ever since. Apparently those administrators preferred little research and keeping control to themselves.

The time is ripe for a major reform of the level of research funding in the tertiary sector. The new generation of university leaders is sympathetic to ensuring that the tertiary sector meets international standards. But the universities should be asked to examine their graduate programmes before any extra money is fed into the system.

From the country's point of view we must get the best return from our research expenditure. It is essential for good management that all Gov-



Research spending OECD countries:

Specified government grant
General university support
Others

Figure 3. The proportion of research money from university funds, contracts (public and private), and Government research grants. Both the United States and Britain have a large percentage of research funds from Government agencies. The other countries shown leave more to the universities to determine priorities.

ernment research programmes be available to offers from both university and Government laboratories.

One new Government member of Parliament has had a distinguished career as a Government research scientist. In a recent speech he strongly criticised the over-comfortable attitude among Government scientists.

But he pointed out that Government scientists were

dispirited but would respond to a challenge. Both groups could benefit.

New Zealand has become a country with a small research effort, and living standards falling with respect to other OECD countries.

We need a major commitment to R&D, and we cannot afford a university system that is weak in graduate education and research. We cannot afford third-class universities.

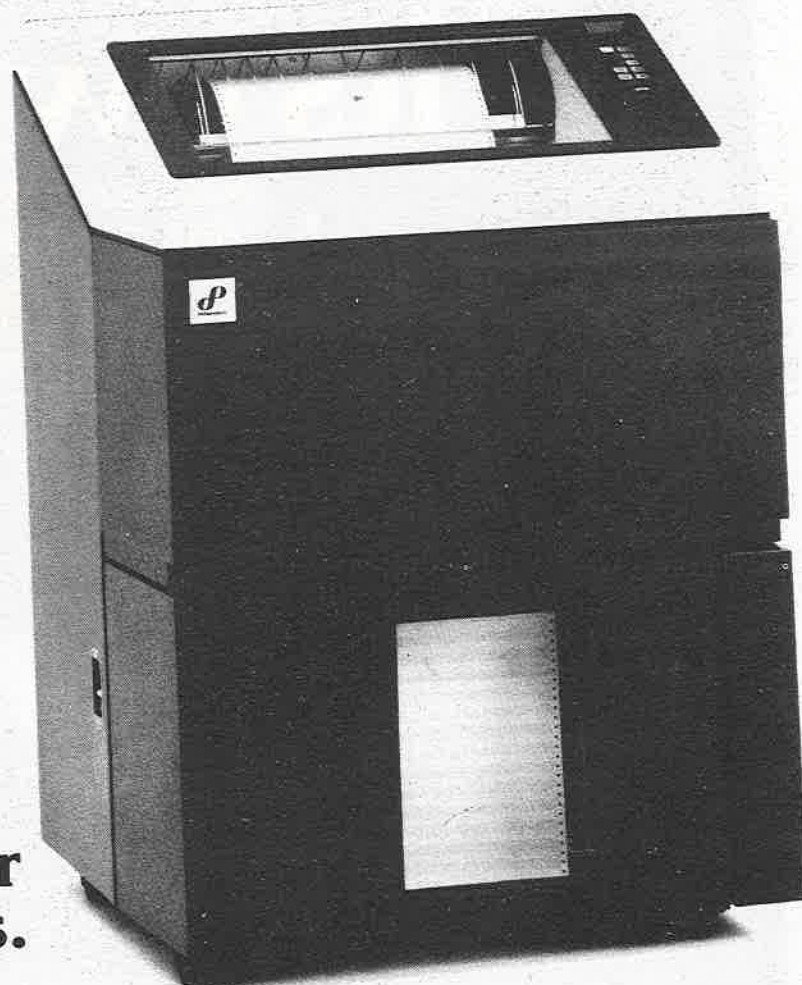
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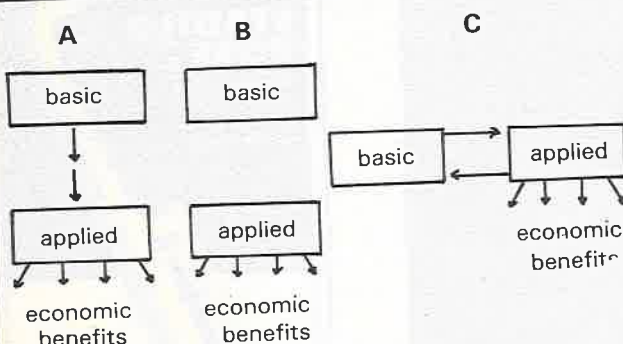


Figure 2. Three models of the relationship between basic and applied research.

A. The 19th-century English model as adopted by a previous generation of our university administrators. Basic research is "superior" to applied, there may be some flow downwards to applied areas, but we don't really want to know about it.

B. The New Zealand self-made-person model. There is no connection between the two areas and all we need is things that are practical. Pure research is at best irrelevant, at worst seditious.

C. The north American model. Problems can start in either area and there is a continual flow of ideas and information between applied and basic research.