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AgScience

Inside

The New Zealand Institute of Agricultural & Horticultural Science Inc

John Lancashire
President

Between a Rock and a Hard Place

In the past month two very senior politicians have asked me, quite aggressively: "Why are you scientists always complaining?" Without being too specific, it was clear that their main problem was hearing the continual pleas for more funding for science, which generally receive considerable media coverage. I pointed out (with little effect, I suspect) that there was a very wide societal consensus in New Zealand that we were not spending enough on research and development.

Public statements to this effect regularly come from manufacturers (most recently in relation to the move offshore by Fisher & Paykel), the rural sector; the Institute, the Knowledge Wave Trust, international accounting firms such as KPMG, the former Parliamentary Commissioner for the Environment, Morgan Williams, and business commentators such as the *National Business Review* and Rod Oram of the *Sunday Star Times*. None of these can be regarded as mouthpieces for the science community. Even the Business Roundtable commented in 2003 that (among other things like lower taxes) government policy can best assist R&D by "focussing on appropriate public goods including basic research."

Clearly this is a very sensitive area for some politicians. It is no secret that some senior scientists have been gagged following their criticisms of the way our science system is administered. One may even have been forced into early retirement. A senior science bureaucrat resigned membership of this institute, because we were continually criticising the over-bureaucratisation and micro-management of science in New Zealand. This is all very interesting, because there is a general feeling that the science community has been pretty reluctant to comment on the big policy issues around science in recent years. Most CRIs have very strict guidelines on who can talk to the media, and there is a clear impression that a reputation for critical "speaking out" may influence funding decisions.

Actually most scientists are too busy trying to survive to complain publicly. But someone has to. I don't want to trivialise the words of the late Pastor Dietrich Bonhoeffer but a slightly edited version of his observation "for bad policy (evil in the original) to flourish, all that is required is that good people do nothing" is relevant. Obviously the science community is caught between a rock and a hard place. If it complains too much it antagonises politicians and policy-makers. If it says nothing then clearly nothing is wrong! Rest assured your Institute will not be threatened, gagged or intimidated. We will continue to strongly press the case for a more rational, better resourced science system, that will then be able to fulfil its potential to drive the development of a better New Zealand.

MEMORIAL

I was privileged to attend the memorial service in March for Alan MacDiarmid, our most recent Nobel Laureate, at the Wellington Cathedral of St Paul. In a very moving service the first lines of an Allen Curnow poem "Landfall in Unknown Seas (i): Simply by sailing in a new direction you could enlarge the world," read by Vincent O'Sullivan, seemed to sum up in a few words Alan's achievements. He also had the common touch. I well remember an address he gave to more than 700 people in the Wellington Town Hall shortly after he received his award, when he invited the audience to come up and look at his Nobel medal which he placed on the edge of the stage. His life also reminds us that there is still plenty of science to be done past the age of 50.

This reality does not fit well in New Zealand where many HR managers seem to regard 50 as a "use-by" date for scientists. Early retirement has been used as a strategy by crown research institutes and universities to downsize, but given the problems in attracting young people to a science career we may simply be creating capability shortages by this policy.

Alan started his Nobel work at the age of nearly 50 and received his award in his early 70s. He was still employed to do science by his US university when he died at nearly 80. It is ironic to think that if he had made a science career in New Zealand he would have been "retired" at least 15 years ago, and in current "management think" would have been regarded as over the hill 25 years ago.

John Lancashire
President

New members

We welcome

Richard Espley (Auckland)
Kris Mohan (Auckland)
Joel Vanneste (Waikato)
Justin Ford-Robertson (Bay of Plenty)
Jim Smith (Bay of Plenty)
Jean-Marc Celton (Manawatu)
Jocelyn Eason (Manawatu)
Claudia Wiedow (Manawatu)
Gabrielle Drayton (Canterbury)

Corporate members

- AGMARDT
- AgResearch
- Ballance Agri-Nutrients
- Catalyst R&D
- Crop & Food Research
- Dairy InSight
- Federated Farmers of New Zealand
- Horticulture New Zealand
- HortResearch
- Lincoln University
- Massey University
- Meat & Wool New Zealand
- PGG Wrightson Seeds
- Ravensdown Fertiliser Co-op

John Lancashire
President, NZ Institute of Agricultural and Horticultural Science
Abridged version of the article in Rural News, 24 April 2007

Can The New Zealand Science System Be Saved?

It doesn't take a genius to recognise that there is something seriously wrong with the science system in New Zealand. And it's not just about the fact that several surveys have shown that most local scientists are totally dissatisfied with the current system, or that our national investment in science is pathetic compared with other developed countries.

The fundamental problem is that this government and previous administrations do not seem to understand a basic difference between government and private sector investment. The main role of government in science is to invest in more basic, perhaps more "difficult" long term research (six to 20 years), while the private sector, because of the demands of its shareholders for quick returns, generally invests in shorter term projects (one to six years).

The highly creditable objective of governments to ensure that their investments are worthwhile has reached ridiculous levels in the case of research. In fact it is corrupting and distorting the whole direction of science in New Zealand. This is because government science has become over-commercialised following the setting up of the Crown Research Institutes in 1992.

Government demands annual dividends and treats CRIs as cash cows. The current CRI operating framework states "CRI net profits should be sufficient to meet the cost of equity capital and balance sheets should be structured to meet a net gearing of 30%".

At the same time, the framework also states that "few CRIs consistently produce profits which meet the cost of equity capital and Directors should note and take the appropriate action." Thus even more financial pressures are being exerted. Currently perhaps only three of the nine CRIs are able to return a profit, and more redundancies are inevitable after the results of this year's funding round.

How have research institutes responded to these pressures? They have increased income and instant cash flow by doing more short term commercial research contracts, consultancies, and a greater involvement in product development.

Some funds have been gained by working with business in various government-funded schemes such as Technologies for Business Growth and research consortia. These are largely targeted at short term private sector goals.

It is significant that 23% of government funding through the Foundation for Research Science and Technology now goes direct to the private sector, an increase of 44% in four years.

CRIs have also argued for more government expenditure on science with very limited success. The overall increase that has been achieved has barely kept pace with inflation. In fact, as pointed out previously (*Rural News* 19 December 2006), the real level of government investment in the pastoral sector has declined by 40% since 1992.

And how have these policies contributed to the most important indicator in the 1992 CRI Act: that CRIs do research "to benefit New Zealand"?

Undoubtedly there been some short term successes, but the fact remains that despite very substantial government grants to business to increase their R&D investment and a heavy commercialisation of the CRIs, the objective of improving the private sector's contribution to research in New Zealand has been a spectacular failure. (It has remained at about a third of the OECD average for decades.)

The downside of all this is that a lot of government money has been drained out of long term targeted research into very short term objectives.

The primary sector should be very concerned about this. Why? Because a recent New Zealand Treasury working paper showed that there was an 17% return per year on an investment in long term agricultural research over 70 years in New Zealand. In other words, the current policies are destroying the backbone of much future innovation in the primary sector, and arguably therefore the main business of our economy.

So what can farmers and the primary sector do about this? How can they persuade this government and/or its successors and their supportive bureaucrats that there is a better way? For starters, if primary sector levy payers are largely interested in shorter term solutions, there must be an expectation that government will work in a complementary way to pick up the long term big picture stuff such as climate, water and environment.

I respectfully suggest that despite major concerns about the growth of the science bureaucracy (MoRST and FRST), the performance of the private sector and the failure of the science community to sell its remarkable achievements to the community and policymakers (or is it just not politically expedient for policymakers to listen?), there are more critical fundamental issues. These are found in government itself and the Treasury and the Ministry of Economic Development.

Government must work out its role in supporting targeted long term R&D in New Zealand and actually talk to the science community, rather than restricting its communications to business and its bureaucrats.

It is incredible that the taxpayer spend on science is still regarded as a cost by Treasury, when every other developed country on earth sees it as an investment.

Despite its own reports (see above), Treasury's behaviour appears to be unsupportive of science. This is reflected in current government statements that there will be no extra government money for science in the foreseeable future. Increases will have to come from the private sector. Given the total failure of government policy to stimulate private sector investment, this looks like a vain hope.

There is much talk of a R&D tax credits scheme in the May budget. Don't hold your breath. Australia has had similar but more widely based schemes for years, yet still has major concerns about low level of private sector investment in R&D.

If the government tidies up its act and follows the intent of the CRI Act; avoids "tinkering" which is evident in the latest MED paper "Science and Industry"; increases its own investment and encourages more from the private sector; and – above all – does not try to fix things by restructuring yet again, then science in New Zealand can be saved.

What does the private sector spend on R&D?

The level of Government expenditure on R&D is well established. The Government invests about $465 million through the Foundation for Research Science & Technology (FRST) and lesser amounts through other instruments such as the Marsden Fund. However, the private sector's R&D expenditure is much harder to establish unequivocally. Public funding of R&D in New Zealand is in line with the OECD average, but there is a perception that the private sector significantly under-spends. This is based on statistics showing private-sector spending being closer to a third of the OECD average (Table 1) and this has been labelled the "missing billion" that the private sector is not spending.

	NZ 2004	OECD 2002
Business Expenditure on R&D	0.49	1.53
Government expenditure on R&D	0.34	0.25
Higher education expenditure on R&D	0.33	0.41

Table 1 : Comparison of R&D expenditure between New Zealand and OECD as a percentage of GDP

The missing billion is based on a 2002 calculation that New Zealand's private-sector spending was about a quarter of the OECD average and that the difference amounted to about $1 billion. On this basis, the missing billion would now be at least a substantial $1.4 billion – in other words, equivalent to around 1% of GDP. To put this in perspective, Fonterra has an annual R&D spend of about $95 million.

However, direct comparison with average OECD data does not tell the whole story. It overlooks the fact that New Zealand has substantially fewer R&D-intensive industries compared to OECD countries. In addition, New Zealand's industry-shares in globally R&D-intensive industries – for example, motor vehicles, electrical equipment and pharmaceuticals – are lower than for the OECD as a whole. There are a number of possible explanations for our perceived low level of business R&D, including the size and structure of our economy, the absence of very large firms and our distance from major markets. In fact, New Zealand's level of business R&D may be broadly in line with what would be predicted after accounting for our unique characteristics. This finding is based on a study that investigated the sources of cross-country differences in R&D across 22 developed countries.

Furthermore, those of us who work in R&D in the private sector have first-hand experience of a much more active sector than these numbers portray. This is also supported by unofficial estimates of real growth in business R&D spending over the last decade which suggests it grew at a faster rate than the OECD average between 1994 and 2004 – 6% a year, compared with 3.7% a year for the OECD. For a number of years we have been analysing the available information to better understand private-sector investment in R&D and how to maximise returns to businesses that invest in it. This is not an academic activity, since there is a linkage between innovation, wealth creation in the private sector and economic well-being for New Zealand and an accurate understanding of this is necessary to drive good policy initiatives.

What information is available?

The general sources of information for the analysis of New Zealand's R&D investment are:

- Statistics New Zealand R&D statistics. These were most recently reported in *Research & Development in New Zealand, 2004*. These data are based on a sampling of economically significant New Zealand businesses, with a number of exceptions.
- Statistics New Zealand Innovation statistics. These were most recently reported in 2005. These data were based on a survey but excluded businesses with fewer than six employees.
- Ministry for Research Science & Technology (MoRST) – *Research and Development in New Zealand a Decade in Review* a joint publication with Statistics New Zealand. Also based on a survey and excludes businesses with fewer than 10 staff.

What is measured?

The terms "R&D" and "innovation" are often used interchangeably, since they are part of a continuum. However, R&D and innovation have specific meanings for Statistics New Zealand, based on OECD guidelines.

The definition of R&D is:

"Research and experimental development comprises creative work undertaken on a systematic basis in order to increase the stock of knowledge. Any activity classified as R&D is characterised by originality. Investigation is a primary objective."

The definition of innovation is:

"An innovation is the implementation of a new or significantly improved product (goods or service), or process, a new marketing method, or a new organisational method in business practice, workplace organisation or external relations" Four types of innovation are identified – product, process, organisational and marketing.

Thus the gold standard for data collection is the Frascati definition of R&D that focuses predominantly on the investigative nature of work. While this is the standard for international comparison, in New Zealand it is highly unlikely that many businesses undertake any research predominantly for investigative purposes. In fact it would not make commercial sense to do so and most businesses undertake R&D with a very clear commercial goal in mind. The definition and the issues related to it – that businesses often may not keep records in a manner that enables accurate data to be collected, for example, are well highlighted by Statistics New Zealand and have been noted by other authors.

It is interesting to note that R&D carried out with investigation to increase the stock of knowledge as its primary objective would not meet the current investment criteria for either Technology New Zealand or the Public Good Science Fund. But it would meet the funding criteria of the Marsden Fund.

Leaving aside the technical definition, the general perception

– the invisible statistic

of R&D is that it is an investigative activity, the "white coated scientist peering down a microscope". Valid or not, this perception influences reporting. We would expect a survey that asks businesses how much R&D they do to report a figure much lower than if they were asked how much innovation they do. And indeed the surveys on R&D versus innovation in New Zealand show this (Table 2).

least comparable with other countries. For example, New Zealand ranked ahead of Norway, France, Australia and Portugal in terms of total innovation rate.

We believe that the current definition of R&D has significant limitations and a more useful definition would recognise the continuum between R&D and innovation, and the commercial drivers in the private sector.

Business Size (employees)			**Businesses with innovation activity**	**Percentage of total expenditure on innovation**			
				0-5%	**5.1 - 10%**	**10%+**	**don't know**
6	to	9	6,294	41	31	19	9
10	to	19	6,396	46	29	19	6
20	to	49	3,522	47	27	19	7
50	to	99	1,104	43	28	22	7
100	to	or more	918	44	32	17	8
Business Size (employees)			**Businesses with R&D activity**	**Percentage of total expenditure on R&D**			
				0-0.9%	**1 – 1.9%**	**2 – 4.9%**	**5%+**
6	to	9	855	44	23	21	12
10	to	19	909	49	24	16	11
20	to	49	441	53	19	15	13
50	to	99	210	63	14	10	13
100	to	or more	207	74	8	8	11

Table 2: Comparison of expenditure on innovation and R&D (sourced from Statistics NZ, Innovation in New Zealand, 2005)

Key points of the 2005 innovation survey are:

- In 2005, 52% of businesses reported innovation activity compared with 8% performing R&D.
- Not only do significantly more firms innovate, both as a percentage and in absolute terms, they also spend more as a percentage of total expenditure.
- Interestingly, as a proportion of total expenditure, the expenditure on innovative activity does not vary greatly with business size. The level is reasonably consistent in each expenditure category. This would appear to highlight the importance of other innovation activities such as the acquisition of new machinery and equipment, design and marketing activities in addition to R&D.
- There is a significant percentage of businesses of all sizes spending at <2% of total expenditure on R&D, The percentage spending >5% is also consistent across all business sizes.
- Not surprisingly the most common reason for innovating was to increase revenue (92%), not investigation.

Additionally the survey suggests that the level of innovative activity carried out by New Zealand enterprises is at a level at

The recent Inland Revenue Department and Treasury Issues Paper on R&D tax credits offers a more liberal definition of R&D for private sector investment. This definition is a hybrid of:

1. Acquiring new knowledge, or
2. Creating new or improved materials, products, devices, processes or services.

SMEs are under-represented in R&D/innovation statistics

New Zealand business is characterised by a very large number of small to medium enterprises (SMEs) (Figure 1). Eighty-seven percent of the country's enterprises have fewer than five employees, and 5% have six to nine employees. This means that the majority of New Zealand businesses are not represented in R&D/innovation surveys.

Innovation in New Zealand 2005 reported data from enterprises with the more than eight employees. The Statistics New Zealand R&D statistics report on "economically significant businesses" and the MoRST survey excluded businesses with fewer than ten staff. The reason for excluding smaller businesses is the general difficulty

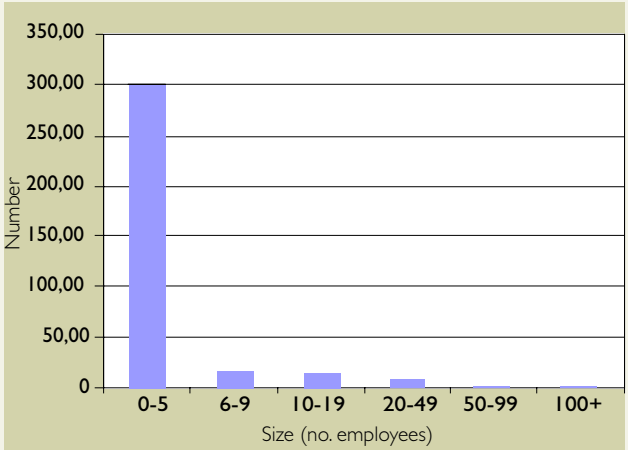

Figure 1: Number of New Zealand enterprises by size.

of getting robust data, and Statistics New Zealand believes its process is robust albeit with the provisos given in its reports.

Notwithstanding the technical difficulties in collecting robust data, any analysis of R&D/innovation activity in New Zealand needs to account adequately for those activities in the SMEs, since they represent the bulk of New Zealand's businesses.

Can we estimate SME expenditure on R&D/innovation?

Despite the difficulties in data collection it can be argued that there is a rich vein of innovation and R&D in the SME sector that is not currently being recognised. For example, start-up companies, and small technology companies, which by their nature have a high innovation/R&D component, will not be represented in the statistics.

Are there some clues to SME expenditure on R&D? The MoRST report estimated the R&D expenditure per company using the Frascati definition, but excluded all businesses with fewer than 10 employees (Table 3).

The report identified that R&D expenditure increases with the size of the business, to an average R&D spend of $161,000 for businesses above 100 employees. (Although interestingly the Statistics New Zealand study *Innovation in New Zealand, 2005* showed the opposite: as a proportion of total expenditure the expenditure on innovative activity does not vary greatly with business size.)

Size by number of employees	Total R&D expenditure $M	Average R&D expenditure
0-5	Not counted	Not counted
6-9	Not counted	Not counted
10-19	$49	$3,233
20-49	$107	$13,000
50-99	$74	$32,300
100+	$312	$161,530

Table 3: R&D expenditure per company (sourced from MoRST report "Research and Development in New Zealand - A Decade in Review")

Let us assume, based on the MoRST trend that smaller businesses spend less, that a business with 0-5 employees could spend $1,000 annually and those with 6-9 employees could spend $2,500 annually. We will also assume that only 50% of businesses innovate (based on data in Statistics New Zealand, *Innovation in New Zealand, 2005*). Under these assumptions, we calculate that businesses of size 1-5 spend $150.2 million annually; and those of size 6-9 spend $22.5 million, a total of $172.7 million. These estimated expenditures are shown alongside the expenditure from the MoRST survey for businesses greater than 10 employees (Figure 2).

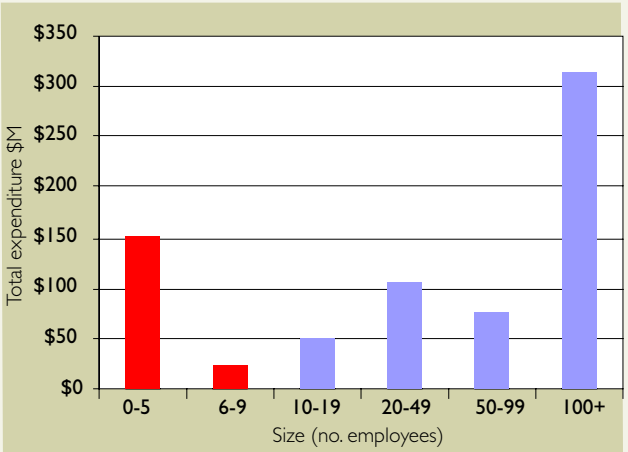

Figure 2: Estimated R&D expenditure for businesses with 0-5 and 6-9 employees (red shading) compared to known expenditure for other size businesses (blue shading).

This is a conservative estimate, because the data were collected using the Frascati R&D definition. The study *Innovation in New Zealand, 2005* reported innovation and R&D by business size as percentages only, so that it is not possible to generate an estimated expenditure for SMEs from it to compare with the MoRST survey.

The debate on private-sector R&D expenditure began with the concept of the "missing billion" of expenditure by the private sector and the implication that the private sector should be doing more R&D. We believe that because of definitional issues, the reports of private-sector activity under-estimate the real state of innovation and R&D in the private sector. We have postulated the existence of a further $173 million by considering the R&D/innovation of SMEs. But this is still short of the hypothetical "missing billion" expenditure. The real number is currently an invisible statistic. The proposed tax credits for R&D, using a more liberal definition, may provide us in a few years time with a more accurate and rigorous statistic of private sector expenditure. We will then be able to have a more informed and evidence-based debate about the level and type of R&D/innovation New Zealand needs for its sustainable growth.

Science committee raises questions about CRI funding

Eighteen months after the launch of its 2020 Science Vision strategy, AgResearch reported on 20 March that it had evaluated the progress of its plan for keeping New Zealand prosperous to 2020 and beyond. Underpinning the strategy is the AgResearch belief that the country's prosperity depends on accelerating agricultural productivity while maintaining environmental sustainability. The institute's chief science strategist, Dr Stephen Goldson, said many New Zealanders were oblivious to the fact the nation's economy was founded on wealth generated by the rural sector. "2020 Science was developed by AgResearch to re-focus attention back to pastoral agriculture and the economic basis of our first-world lifestyle," he explained.

"Achieving these targets will depend on the extent to which New Zealanders can accept emergent technologies, such as the genetic modification of plants and animals, and particularly whether government and industry can be persuaded to step up investment in research and development."

The 2020 Science strategy aims to meet the international market's increasing demand for high-quality food, fibre and health-related products. Its basic goals embrace five areas:

- To double the value of the dairy industry while halving the costs and the impacts on the environment.
- To double the value of the meat and textile industries while halving the costs and impacts on the environment.
- To reduce the risk of pests and diseases gaining a foothold in New Zealand and help effectively manage those already there.
- To work with rural communities, agribusinesses, territorial authorities and policy-makers ensuring evidenced-based decision-making is used to its best effect.
- To work with researchers in New Zealand and around the world using the knowledge gained from research into agricultural systems, plants and animals to create valuable new opportunities in biotechnology and other areas.

AgResearch regards these goals as aspirational. But – as Parliament's Education and Science Committee notes in its recently published annual report on the crown research institute's performance – the success of the programme depends on engaging stakeholders and the sector, and on securing financing.

Moreover, the committee harbours reservations about the achievability of the five big ideas.

"We have reservations about the achievability of the five big ideas," it says in its report. "We would like to see details of how these might be achieved, such as key performance indicators and milestones against which progress can be monitored."

The committee has been conducting its annual financial reviews of the 2005/06 performances and current operations of all the crown research institutes and other science-focused state agencies. Reporting back to Parliament on its examination of AgResearch, it noted that the company had repositioned itself as a pastoral research institute and launched its 2020 Science Vision. But the committee was bothered by the CRI's declining revenue. AgResearch made a $13 million profit in 2005/06, partly as a result of the sale of AgVax. It believes its purchase of Canesis should offset the loss of its income from AgVax, and that Canesis' knowledge of wool processing and products complements its own practical knowledge of sheep.

The committee's report identified two trends regarding the funding of AgResearch. Total revenue has declined over the past three years, and there has been a trend towards commercially-funded contracts rather than direct funding from the Foundation for Research, Science, and Technology. However, overall funding from the foundation declined from around $59 million in 2002 to around $50 million in 2006.

"Despite growth in the economy, AgResearch has been unable to increase its revenue," the report said. "It believes the priority being given to ongoing pastoral research is declining. Furthermore, the rate of private-sector investment is poor. To generate income, AgResearch is working to restore its relationship with sector industries, with a view to becoming the research provider of choice."

The Office of the Auditor-General advised the committee that over the next few years a significant part of AgResearch's funding from the Foundation for Research, Science and Technology was up for renewal or tender.

The wisdom of the sale of AgVax, an animal remedy company, raised questions among select committee members, too. AgResearch's primary focus is research and development, "and its aim is to bring good ideas to commercialisation", the committee's report points out.

At the request of its governmental shareholder, AgResearch sold AgVax to Intervet in 2005, because it had brought the company to the critical size for financial viability. AgResearch believes the sale has been good for New Zealand, because it has brought foreign investment into the country. But the report says some committee members "were concerned that selling this company offshore could be negative for New Zealand". The report does not expand on these concerns.

The committee discussed CRI salaries with AgResearch, too. AgResearch told it crown research institutes' salaries were about 15% below market rates. Over the past five years AgResearch staff have received pay increases of between 5% and 6.5%. The report says AgResearch plans to continue to increase pay significantly in future years "but such pay increases must be balanced by the need to improve productivity against rising costs."

Horticulture and Food Research Institute of New Zealand Limited

The select committee raises revenue concerns with regard to HortResearch, too. And it is bothered by the time spent on bidding for public money. Its report on its monitoring of HortResearch notes that back in 2002 the institute lost $5 million of government research investment, which caused severe problems: there were 40 redundancies, and financial losses were sustained in 2003/04 and 2004/05. But HortResearch returned a profit in the 2005/06 year under review, and increased its profits between July and December 2006. The committee has commended HortResearch on this improvement in performance but notes "that the institute's targets for revenue have been lowered in the Statement of Corporate Intent for 2006/07". It also notes that the amount of revenue sourced from the Foundation for Research, Science and Technology's non-specific output funding (up to 2004/05), and the Capability Fund (in 2005/06)

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has declined every year since 2001/02.

The committee questioned the amount of time spent by scientists in crown research institutes on the process of bidding for funds from public sources. It was told that about 30% of key scientific time at HortResearch was taken up by bidding for funds. The committee reckons this isn't good enough. It says: "We encourage funding agencies to explore ways of simplifying bidding processes, so that scientists can devote more of their time to science."

The New Zealand Institute for Crop and Food Research Limited; Landcare Research New Zealand Limited; and the Institute of Environmental Science and Research Limited

The Education and Science Committee reported very briefly on its financial reviews of the 2005/06 performance and current operations of these three CRI's. It says it has no matters to bring to the attention of the House and recommends that the House take note of its report.

The Ministry of Research, Science and Technology

Science funding issues were further explored when the committee looked into the 2005/06 performance of the Ministry of Research, Science and Technology. The committee notes that Government-financed expenditure in research and development is 0.52% of gross domestic product (GDP) compared with the OECD average of 0.68%. As a percentage of GDP, "expenditure on research and development remains static, despite a growing economy". Current expenditure is approximately 0.55% of GDP, taking into account investments announced in the 2006/07 budget.

"Some of us question how realistic it is for the Government to seek to match the OECD average for expenditure on research and development," the committee says. "We understand that to achieve this goal an immediate injection of $207 million would be required."

The ministry believes research and development investment must be strategic to be effective and to add value, the committee report says. "The challenge is to build a high-technology sector to complement New Zealand's biologically-based economy."

The business sector invests approximately 0.5% of GDP in research and development, a third of the OECD average. But the report says this expenditure as a percentage of GDP has grown by an annualised rate of 9% since 2000. The committee was told the ministry has not set a target for business research and development expenditure.

The majority of businesses in this country are small-to-medium-sized enterprises. The challenge for them is obtaining research and development funding to take ideas to commercialisation. The committee has noted that these businesses can apply for funding from the Seed Co-Investment Fund. "We understand that the ministry is working with Business New Zealand to broker connections between the business and science communities," its report says. "Funding instruments, such as the Pre-Seed Accelerator Fund and the New Economy Research Fund, are available to encourage private-sector investment in research and development".

The committee was interested in the evaluations undertaken by the ministry to determine which funding instruments are effective. It has evaluated elements of individual funding instruments; for example its examination of the New Economy Research Fund found that the number of licences and patents is increasing.

In an evaluation the ministry also looks for gaps and opportunities for improvement, and overlaps that might be eliminated.

The report notes that multi-year funding and long-term contracts for science research have been introduced recently. Multi-year funding provides research institutions with financial certainty for the business planning, investment planning, and staffing stability. Negotiated funding initially applies to three funds – Research for Industry, Environmental Research, and the New Economy Research Fund. Up to 30% of funding for particular projects is available from across these funds. Researchers with a proven track record can negotiate longer-term contracts. To qualify, projects are assessed for relevance, potential to deliver national benefits, and potential for technology transfer.

The Foundation for Research, Science and Technology will evaluate the performance of the projects after a year. In the second year the ministry and the foundation will conduct an evaluation and report to the government.

–Bob Edlin

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