New Zealand Institute of Agricultural and Horticultural Science Forum 2009

New initiatives to improve the New Zealand science system

On 30 June 2009, the New Zealand Institute of Agricultural and Horticultural Science conducted their annual Science Forum at which their membership and other delegates had the opportunity to be addressed by a representative of the Government, senior officials, and science-sector stakeholders. The theme of the Forum was:

New Initiatives to Improve the New Zealand Science System.

Dr Ken Aldous, a NZAS member and former Association council member attended the Forum and has kindly prepared the following report on the day's proceedings.

Editor

The NZ Institute of Agricultural and Horticultural Science Forum 2009 at Lincoln University aimed to discuss the state of New Zealand's system for the funding and undertaking of scientific research, and to explore ways in which the system might be improved (see http://www.agscience.org.nz/about_NZIAHS.html). About 150 attended to hear MP for Hunua Paul Hutchison, Foundation for Research Science and Technology CEO Murray Bain, Industrial Research Ltd CEO Shaun Coffey, Royal Society of New Zealand National Science Panel Chairman Jim Watson, and Treasury Assistant Secretary Struan Little present their views on the issues and propose remedies for the shortcomings they perceived. Following the addresses, the five speakers answered questions from the floor.

In the following, most of the salient points made by each of the speakers are given. Comments, *in italics,* interleaved with the principal material, offer opinion and occasional clarification. The author apologises if any of the points speakers made have been omitted or misinterpreted.

The following were the principal issues discussed:

1. The science system is too cumbersome – transaction costs are too high and waste too much of scientists' time.
2. The bureaucratic processes that businesses must undertake to access funding for research and innovation are inhibiting and discouraging.
3. A statement of national priorities for research, development and innovation should be prepared.
4. Productivity in New Zealand is low: it is lagging behind our trading partners, particularly Australia.
5. Scientific research and development cannot always produce goods and services to order. Its benefits often accrue some time after the scientific work has been done. *To this one might add that it is also impossible to predict whether any particular research programme will deliver economically advantageous results, and innovation may or may not generate new saleable products, still less products with an enduring market penetration. This implies that failure, or apparent failure, will occur along with success. This may be tacitly recognised by the science system, although cases in which, for example, CRIs admit to having failed, are hard to come by.*
6. New Zealand's scientific efforts are generally very good, but the development of economically useful products and processes is slower and less successful.
7. Generating new knowledge through scientific endeavour is a quite different process from innovation and from technology transfer. These activities occur on different time scales – sometimes the science may take less time than its application, sometimes not – and they require different skills. Mixing them together can lead to muddle and failure.
8. An organisation for commercialisation of new developments, jointly – and collaboratively – run by the CRIs would offer a surer path for innovation and product development. *It seemed, from a comment he made, that this idea was not supported by Murray Bain.*

Paul Hutchison MP, Chairman of the Health Select Committee, emphasised the importance of agricultural products to New Zealand's economy and gave as an example Zespri Gold kiwifruit, which is worth $1B per year.

He said that New Zealand needs to be more ambitious in its scientific endeavours and pointed out that Singapore, Taiwan, and Finland each spend 3% of their GDP. He also pointed out that research and development are particularly important during economic downturns.

The Government has signalled additional support for science through the allocation of up to $70M p.a. ($190M over 4 years) to the Primary Growth Partnership scheme (PGP) for matched government and industry funding for primary, food and forestry industries, including pertinent work on climate change and emissions. The scheme will encompass the entire range from inception of research to technology transfer.

This is an interesting and relevant point regarding the mixture of research and technology transfer. FRST has required most technical programmes to include technology transfer, but, as was later pointed out, properly conducted, technology transfer often takes longer than the research, and obviously cannot be conducted in parallel.

Also of particular interest to the Government is basic research supported through the Marsden Fund and CRI capability funds.

Priority issues to be addressed include reducing transaction cost of access to government funding; encouraging R&D to boost business growth by, inter alia, removing barriers to universities undertaking commercial research; and improving clarity of government outcomes from science. *The last point would itself be clarified by some instructive examples of how the government's required outcomes for science may be clarified.*

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RSNZ President Garth Carnaby introduced FRST CEO **Murray Bain** by remarking that the science funding system has evolved since 1992 in ways that sometimes irritate scientists, and that there is a perception that the system makes original work difficult.

Bain mentioned four issues the Foundation was addressing: economic growth, improving the RS&T system, RS&T roadblocks and the reviewing the Foundation's directions.

He pointed out that RS&T systems are complex. An examination of systems used around the world revealed that a perfect system is elusive: there is no best form for allocating funding or measuring performance, and more money is always needed by all public sectors.

The New Zealand economy has fallen behind Australia by around $30B p.a., which is the excess growth New Zealand needs to achieve parity. Some means of addressing this under consideration include fostering high-value exports, improving current exports and diversification.

To improve the RS&T system it should be recognised that research is a process to convert money into new knowledge and 'competencies' (*nuspeak for 'skills'*), while innovation converts knowledge and skills into money. There are some useful lessons to be learned from how the world-leading small countries promote innovation by cultivating relations among what is termed the 'triple helix' of government, industry and research organizations. *Further information on triple helix can be seen at http://users.fmg.uva.nl/ lleydesdorff/th2.*

FRST's goals include the alignment of objectives between government, industry and science, and improving science collaboration, the funding system and relationships with users.

RS&T roadblocks that need to be addressed include uncertainty, trust, complexity, collaboration and the commercialisation culture. Uncertainty is useful, but only in small quantities. The establishment of long-term funded 'strategic research platforms' for core pieces of research, beginning with Natural Hazards, was cited as an example where high trust will be required between the multiple parties (triple helix) involved.

Complexity will be addressed through process simplification, which will reduce reporting and increase dialogue. Collaboration and commercialisation imply better communication between the business world and scientists. *One cannot necessarily infer from this that FRST intends to mediate this process*.

One impression that Bain's address left was that government funded science is viewed largely as a means of generating more or less immediate wealth, in particular, wealth from new or significantly improved productive activities. There are two things wrong with this: it ignores the technical problem solving that DSIR and other organizations once provided to small businesses and which no doubt provided a significant, if perhaps uneven, benefit to productivity at a very low cost; and it assumes that only research that has a quantifiable and foreseeable economic benefit is worth conducting.

A reminder of the continuing importance of the first point is the fact that as recently as 2005 firms with technical problems were phoning what they fondly imagined to be DSIR seeking more or less informal assistance, only to be told that services of that kind were no longer available. Jim Watson raised the second point in saying that some research generates knowledge and skills that lie dormant, perhaps for several decades, before its economic value is recognized. Examples are legion: the long wait for the application of (and the taxes levied upon) Michael Faraday's electromagnetics, the 25-year delay between Planck and the Lilienfeld transistor and the further 25 years until its rediscovery and deployment in the 1950s, and the long 35-year delay from Crick, Watson and Franklin's elucidation of DNA in 1953 and the emergence of molecular genetics as a technology in 1988 with the happy discovery of the PCR.

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Shaun Coffey quoted John Ziman on changes to the research system: 'The real question is … how to reshape the research system to fit a new environment without losing the features that have made it so productive in the past.'

Coffey posed three questions raised by the reshaping of research to better serve a changing society: What is the role of S&T in the community? How can it be harnessed to help the community? What form should its organisation take?

Clearly, one of the first matters to be addressed is simplifying and accelerating funding and administrative processes. National priorities should be determined, taking account of the strengths and weaknesses of research capabilities. An analysis of the types of research shows that it is hard to achieve a comprehensive list of priorities. Research may be generic or specific; generic research includes, among others, industrial development, and productivity improvement; and specific research can be split into overlapping categories such as those relating to specific problems and specific sectors.

New Zealand industry under-invests in R&D, but Coffey asserted that there is a major unmet demand as shown by the response to a competition being run by IRL with $1M worth of scientific and technical services from IRL as the prize. The 'What's your problem, New Zealand?' competition attracted more than 100 entries.

The role of technology development is not well understood. *Here there was a digression, in which market fractals – the not-very-surprising idea that economic trends and in particular those of the financial markets are self-similar at different time scales – was mentioned in relation to a joint commercialisation venture between IRL and AgResearch and the need to avoid industry capture. It was not clear what point was being made.*

If R&D is restricted to service requirements, first-in-class products are not likely to be developed. Such products require

a technological development life-cycle from embryonic to mature to be both understood and followed. To this end, technical literacy of New Zealand industry needs to be improved.

Coffey said that a national innovation policy is needed, in which CRIs and universities perform different roles, both of which are needed. For these roles to be properly played, Coffey asserted that funding specifically for collaboration is needed. *How the roles differ was not explained, but one question that raises itself is whether the CRIs should participate in the publication and citation battleground where matters of individual and institutional academic rivalry are determined. This issue was mentioned by the next speaker, although in a slightly different context.*

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Jim Watson said that a long-term strategic planning process for science is needed. DSIR was established to support industrial and economic development, but science is much more than an economy.

The National Science Panel was established to 'address the declining state of the science system'. There is an impression that the scientific bureaucracy is far too concerned with micro-managing scientific effort, implying, perhaps, that the bureaucracy needs to take a longer view. Watson said that the appointment of a Chief Science Adviser to the Prime Minister is to be applauded.

There is a conflict between scientific success, which comprises the publication of new knowledge, the value of which is measured by subsequent citations, and Treasury's view of science as the generation of new knowledge that can be shown to improve the economy. From the measures available Treasury would conclude that science is not paying its way given in terms of the investment made in it.

This raises the question why invest in science? Watson pointed out that the returns from scientific research may occur at quite unpredictable times, often long after the science has been done, while governments have over the past few years regarded investment in science as a means of generating swift, short-term profits.

What, then, is wrong with science? The system is allowed to meander according to the demands of funding: young scientists are trained according to Pavlovian principles and learn to salivate when funding is turned on. School children view science to be under-valued in New Zealand, and scientists do not encourage children to make a career of science.

There is no equivalent in the CRIs to the publication stimulus available to university scientists. *This is not quite true – publishing is certainly seen as career-enhancing, although perhaps not as the existential imperative that it is in the universities.*

Contestability should be removed from science funding. CRIs have a pseudo-commercial (or corporate) focus, something that is not specified in the CRI act. They have become too much like corporations, and CCMAU has no non-commercial indicators for evaluating scientific research.

The role of CRIs has to be clarified. *This question was raised earlier by Shaun Coffey with the assertion that the CRIs and universities have different roles*.

A good model for the commercialisation of new scientific knowledge and skills is Auckland UniServices Limited at Auckland University. A joint, collaborative commercialisation organization servicing CRIs, similar in function to UniServices could be very effective. *It would also be a fertile seedbed for yet another vigorous but unproductive bureaucracy. A careful evaluation of the costs and benefits of UniServices would be necessary before considering this proposal.*

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Struan Little quite accurately pointed out that productivity improvements are essential for New Zealand's economy to prosper. There are several aspects to this, including enterprise, skills, investment, natural resources and innovation. The last, which is necessary if New Zealand is to compete, is the process of putting new ideas into practice. Little said that although our research track record is generally good, development processes, as shown by the relatively few number of registered patents, are slower and less successful. Primary Growth Partnerships may, however, prove transformational and build off our strengths in the primary sectors supplying a global demand for food.

The following actions are required for improving innovation.

1. Prepare a statement of priorities for innovation. *Murray Bain said that this is being done.*
2. Sort out the current muddle (*this was not the word used, but it conveys the meaning*) of business assistance programmes so that access to them is straightforward and clear.
3. Canvass input from industry to determine the nature of research-for-industry programmes that industry would find beneficial.
4. Encourage firms to undertake research, for example, through seeking assistance from and perhaps collaboration with CRIs. 'Innovation vouchers' are one possibility, although tax credits do not seem to be a good form of encouragement.

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Questions and comments taken from the floor were addressed by the panel of speakers. A selection of these follows.

1. The payment of a 9% dividend by CRIs to the consolidated fund is perverse. What is the sense in this?

   The dividend was defended by Stuart Little as appropriate, but other panellists suggested return of the dividend to CRIs for reinvestment was more logical.

2. There is a conflict between doing excellent science and merely enough to fulfill contracts to the letter and no more.

   This important point generated little response.

3. Is MoRST still needed?

   Jim Watson said: Yes, since we need a strategy to develop policy. Murray Bain said: Yes, because MoRST and FRST have different roles.

   Determining the nature of the 'strategy' and how the roles of MoRST and of FRST differ were left as exercises for attendees.

4. Is PGP just a levelling exercise?

   This was unanswered. It is uncertain what the questioner meant by 'levelling'.

5. Jim Salinger asked: Why do we need a science bureaucracy?

   Jim Watson said that, in the US, science policy comes from science inputs (by which he presumably meant that policy is formed by trained scientists who take time away from their research activities to determine what should be done next.) One panellist then went on to say that science is actually a business, but the bureaucracy cannot always measure the output.

   Measurement implies defined units in which the values of observations are expressed. What unit is used to determine the value of scientific output is something to which only initiates of the bureaucratic mysterium are privy.

6. The Marsden Fund is working well, and has done for a long time.

   Jim Watson attributed this in part to the enthusiasm and energy of scientists. Improved dialogue between MoRST, FRST and the CRIs over the past 2–3 years has contributed to this.

7. The problem (with R&D) does not lie with the science but rather with development.

   Shaun Coffey said that the model consists of doing research and commercialising that research. The New Zealand model is weak in technology transfer. Both New Zealand and Australia have disbanded agricultural and industrial extension.

   As noted above, no-one has told industry that the non-existent DSIR no longer offers on-demand assistance.

   Murray Bain said that extension, technology transfer and commercialisation should be a function of research organisations, not of a separate agency.

   No justification was offered for this. It implies that each research organisation must have staff skilled in these activities, and must shoulder the burden of yet another attendant bureaucracy.

8. Technology transfer has a different time scale from research, which means that there is a mis-match in the funding system.

   Shaun Coffey said that lack of core funding means that CRIs are unable to address (technology transfer) issues with the most productive firms – they are constrained to deal with those firms with whom relationships already exist.

   It is interesting to speculate what the large business development teams maintained by the CRIs do if they are not forging relationships with the 'most productive firms'.

   A number of other panellists made comments tangentially related to the question: 'long-term funding is needed for end-to-end R&D'; and 'there is a need to address new industries rather than the large dinosaurs'.

9. Why not have a single New Zealand science organisation with a high profile?

   This question did not appear to elicit any answer. How, after all, do you explain why there is an elephant in the living room?

10. Why is funding in long term (up to 12 years) not inflation adjusted?

    Murray Bain pointed out that FRST's budget extends only for one year, so that accurate funding can be allocated only for that time. Inflation adjustment is not specified, but neither is it specifically denied.

    From this, it is inferred that it is not unreasonable to expect funding to be inflation adjusted, although this is not guaranteed. This, of course may be a very significant issue if and when the US economy picks up and the US economy has to make good the multi-trillion dollar hole in its accounts, which it may only be able to do if a massive devaluation of largely off-shore savings occurs through inflation.