



OFFICE OF THE PRIME MINISTER'S SCIENCE ADVISORY COMMITTEE

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There is now a more intense focus on the role of science in New Zealand's development than there has been for two decades. There is a shift in thinking and in particular a growing realisation in government that science expenditure must be seen as an investment in our country's future rather than viewed as a cost. But, like any investment, there needs to be clarity over its purpose. Science has pervasive role in our society be it in developing our economy, protecting our environment and responding to the challenges ahead, of climate change or understanding our society and developing our quality of life.

On comparators such as the OECD ratings we have declined – our relative productivity is poor, we are ranked surprisingly low on scales of innovation. The world is changing at an exponential rate, knowledge and technology is a major part of that change and whether New Zealand remains of relevance to the rest of the world or not will depend on transformational strategies than in turn will depend much on how we develop and use knowledge. Science is the only way we have of developing new knowledge. A knowledge-based society will be more ambitious, more prepared to face the challenges ahead, more able and willing to address issues of social development and environmental protection, and certainly more productive.

Studies by the OECD show a remarkable relationship between a nation's investment in science and innovation and productivity: nations that invest more in knowledge generation and exploitation are the most productive. While in the past it has been argued by some that this relationship reflects the fact that more productive countries can afford to undertake more RS&T, the strong international consensus amongst economists is that the causal relationship is in the other direction, namely that investment in RS&T is a strong driver innovation and productivity.

That is why despite tough economic times many nations including the UK, USA, Denmark, France , Germany, Australia, Japan, Korea, Singapore and China have in the last 12 months announced marked increases in their public investment in research, science and technology. As a whole, New Zealand spends only 1.2% of GDP on research, about half of that from the public sector, and half of that from the private sector whereas comparator nations spend somewhere between 2 and 3 times that amount.

And what has happened, at least in part because of that investment gap, Denmark's labour productivity more than doubled while ours has risen by only 40%, Denmark's GDP has remained well above the OECD average while ours fell from 120% of average to only 75% of average.

We need to consider why we have such a low investment both from the public and private sectors. Of particular concern to me is the dismally low expenditure from the private sector. We need a frank and urgent national discussion on addressing this problem. At the heart of it we have a very deep cultural

issue. Have we have been seduced by our national mythology – myths like the number 8 fencing wire, punching above our weight, we think New Zealand is highly innovative when the report of the OECD and the recent report from the New Zealand Institute show that we are not as good as we presume to be.

Has our strong egalitarianism led us as a country to deprecate intellectual activity which has been projected as elitist? Is it that over time we have built up a pattern of spending such that shifting expenditure towards productive areas with long delays before return such as R&D is difficult, especially when electoral cycles are short and we have a very adversarial political system? We also need to ask why is it that our private sector spend on RS&T is so low?

Is it just part of the same cultural milieu or more? Could it stem from the chronically low public sector investment dis-incentivising the private sector from seeing RS&T as exploitable because there has just been insufficient ideas flow? Has it been that the incentives in the public research sector drove an excessive focus on late stage application rather than knowledge generation/transfer and this either displaced private sector investment or competed directly with the private sector? Could it be that the New Zealand private sector is too focused on short term returns through commodity cycles and property rather than long-term growth?

Given the quality of science and engineering education in New Zealand, we clearly have a large, unexploited potential for knowledge based industry growth but there is an issue of the availability of investment capital and the commitment of the New Zealand shareholder to more speculative investments or those with a longer term return. Perhaps some of the heralded changes in the tax system might assist a necessary shift in mindset.

There are many more issues – one of particular importance to this audience is that of the interaction between the public and private sector. Universities and CRIs have been so competitive and been so driven by their own bottom line considerations that they have confused their core role of being ideas generators with drivers that have led them to hold onto ideas and try and exploit them inside their organisations. Excessive completion has hurt rather than helped. We have very few people skilled in knowledge transfer, we tend to work as lots of small individual operations rather than going to scale by combining expertise. Our skill base in managing and developing the knowledge based sector and in learning how to take it to scale internationally needs enhancement. This issue is occupying much of my time.

Incentives operating on our public research providers have led them to focus on institutional survival rather than seeking synergies through inter-institutional activity. That is why the Government has embarked on a program of change starting with the CRIs. There is a need to develop a more “New Zealand Inc” approach and give priority to exploiting the latent synergies that exist across institutions. This is a fundamental shift in thinking beyond the very competitive models that have driven our research system for the past 20 years. It is not generally appreciated that our system is much more competitive and less strategic than that of other countries.

While competition and peer review are essential, a highly competitive but under-funded system of research drives conservative rather than innovative research. Cutting edge research is based on two core capabilities; infrastructural and human. Sadly too many of our best scientists and technologists have judged the environment for research and innovation based careers in New Zealand as unattractive and we therefore have much work to do to reverse this trend.

This has more than simply catching up as the global competition for scientific talent continues to get more aggressive. We have deficient capacity and capability in many areas. We do not have a clear approach to publically funded infrastructure and what principles it should operate under. How should it link to the private sector, can we achieve better national and in some cases international coordination? Work is underway to address these questions.

Seeing where such needed productivity growth will be is complex, for we face the peculiar challenges of distance, size, and lack of internal markets. We have to become clever about using our resources – our well educated people, our ability to grow grass and ruminants, clean water, our minerals, our closeness to Australia, our strengthening umbilical cord to Asia. We have to work out where will our capacity to export will really grow.

Will the food industry in 20 years be focused more on food for health? What can we do with our mineral resources? How should we respond to global warming, How can we export services better? What will be the role of advanced ICT? We need to become clearer about that science we can do well on our own and that where taking it to scale will require partnerships from an early stage. Will we do better trying to grow a hi-tech industry on our own or, in an age of parallel discovery; will we do better by partnering from the discovery stage?

The mix of skills at the board table is a concern: few scientists, academics or technologists are appointed to Boards, be it of public or private companies. The type of analytical and lateral thinking that they bring can be of immense value and their appreciation of the innovation process can be essential. The few scientists and academics on boards in New Zealand tend to be found only in companies directly related to their technical expertise whereas in many other economies such individuals make important contributions well outside their narrow disciplinary expertise. In particular, they can play a major role in bridging the cultural divide.

I will focus my remaining remarks on some issues that are likely to be of particular interest to you. There is a general concern regarding the quality of technology transfer from the public sector organisations to exploitation within the private sector. The issues are multiple, and include aspects such as those of scale and expertise, the ability of academic organisations to identify what is exploitable, the willingness of the private sector to get beyond a narrow focus, a naivety over the best ways to manage deal-flow. Also capital availability is limiting and is constrained in the nature and direction of how it is used.

There have been a number of discussions over the last 12 months regarding the best ways to assist better commercialisation efforts from the public sector. Some of those are encapsulated in a report that I released after a round-table discussion on the subject late last year. The CRAG has also made essential contributions. Government is now actively considering the best ways to assist in promoting this effort. Other nations have recognised that the need to aggregate skills in the field of technology transfer in all its domains is critical and that technology transfer separated from access to pre-seed funding is not as efficient.

We have very few professional exponents across the domains of technology transfer in New Zealand and those that we have are scattered and not well connected. That being the case, imaginative solutions will require tools that allow aggregation and development of expertise in some way so that we can accelerate exploitation and innovation.

One of the particular concerns I have is whether or not, as a small isolated country, traditional assumptions around the route to exploitation are always the best. The orthodox view has been one of research, development, commercialisation and attempts to export a finished product to the world from New Zealand. In many cases, the New Zealand product may well be world class – indeed, it may be the best - but in a world of parallel discovery, when developments and inventions are made around the same time in multiple jurisdictions, New Zealand’s limitations around access to adequate funding, expertise, not being in the large market zones and difficulties in taking things to scale, all crimp our capacity to project to the world. The end result is that we end up celebrating success based on relatively small export volumes, when really what this country desperately needs is large export volumes.

We have a highly educated population, we are small and can therefore undertake multi-disciplinary research well, we are expert in a number of scientific disciplines – in fact a surprisingly broad range given our size. If we can get into a more innovative and empowering mindset we will be good at generating new ideas, new proofs of concept. What we are less likely to be good at is taking it to scale and marketing it to the world, except in the areas such as food, perhaps ICT and services. Could it be that what we should be doing is negotiating to be part of global discovery efforts at the pre-commercialisation stage, with stable partners that have the capacity to help accelerate the rate of development (that is often too slow) thereby rapidly going to scale and moving from prototype to definitive concept, and hence to market?

The point I am making here is that we need to get clever, we need to get imaginative, we need to look at new ways in which we can make ourselves more relevant to the world through our ideas and discoveries. All said and done, it is ideas that have largely protected our economy to date, because it has been the research and development invested into the farming sector that has made such a large difference to the economy of New Zealand over recent generations. In that regard I think the release yesterday of the KPMG agri-business report is cogent. It points out that without a greater investment in R&D in that sector, our ability to remain competitive will diminish.

The second point I want to raise but equally speculatively, is the issue of open and closed innovation. There has been a tendency to think innovation always has to be closed for maximal exploitation. And in many areas that is indeed the case. However we must be careful not to throw the baby out with the bathwater. For example, was it logical to lock up knowledge about sheep genomics prematurely? A commercial structure was created which in retrospect locked up research in sheep molecular biology on one hand and yet was unlikely to be broadly exploitable in its own right. The effect was that it stifled advanced sheep research – collaborations were broken and inhibited.

Some commercialisable information was obtained but others opportunities were lost and in the meantime the rest of the world moved on. Even now we have sadly not acquired the information on the sheep genome that would have advanced our meat and wool industries to the extent that with hindsight could have been achieved.

Parenthetically this type of approach drove a wedge between CRIs and industry. Collaboration suffered when CRIS become dominated by the need to capture IP at all costs. This should now change. Recently, wearing an academic hat – I was involved in discussions with one of the world’s major pharmaceutical companies about a drug target discovery project they want to undertake. I assumed that in writing the contract they would want all the standard clauses about locking up the data, delaying publication etc.

I was surprised when they wanted the exact opposite: a contract which required that all the data be made available on a publicly accessible database as soon as it was collected. Indeed the company said they did

not have any interest in actually trying to patent the targets, that is the gene sequences that emerged from this research.

What they said follows: Firstly we don't believe that natural system patenting is particularly valuable. Secondly we actually want other academics and indeed other drug companies to be working on these biological systems. The more they find out the more we know at the same time, the more we can focus our effort. We will rely on our cleverness, our ability to develop drugs against the target, our ability to develop our screening efforts, and our ability to build patents that surround the drugs and the manufacturing of those drugs to protect our position. If one looks at the move to open access software, one sees again a very different approach emerging in terms of concept in terms of open and closed innovation.

One of the discussions that occurred in the global research alliance meeting on pastoral greenhouse gas emissions, and agricultural greenhouse gas emissions in Wellington two weeks ago – was the IP framework that might surround this international collaboration. The initial discussions were highly successful, there was high-level of agreement on the general structure and intent of the consortium and over the next 12 months we will see the emergence of a formal research effort and collaboration across these countries.

One of the issues that we will have to work through in the next year, is how we will manage intellectual property across such a consortium in which in some places there will be sharing of work in a pre-publication, pre-commercialisation phase and how we ensure that knowledge transferred without impediment to others, particularly those in the developing world, while at the same time recognising that there will be private sector exploitable opportunities. All of this will require a careful consideration of where the boundaries between open and closed innovation lie.

I raise these examples not because I have firm convictions but rather to point out that there is a considerable rethink going on about when and where closed innovation as opposed to open innovation is most effective and in the national interest, be it social and environmental, or economic. As a small country relatively naive in the area of technology transfer and technology exploitation, we must find a case by case approach that is most advantageous. This is a very different mindset to that we've had over the last decade.

There is another aspect of open innovation versus closed innovation and that is the ownership and exploitation of data funded from the public purse. The Government has got an initiative underway to make more of its databases and data sets accessible. This to be applauded. Data mining for whatever purpose can often lead to new knowledge when looked at through different lenses, and certainly making more information available, will enable many people within the private sector and in the NGO Sector to make better decisions in terms of their own businesses and interest.

But let me turn to research. If this was the United Kingdom or Singapore where research – particularly in the medical area is funded by the State – the information that comes from that is open to other researchers, and the samples that are collected are made available to other researchers, subject to the obvious constraints of ethical limitations and the limitations that allow the original investigators to exploit the information first.

We do not have consistent rules in New Zealand and I have seen a number of examples where effectively the same data set has been collected twice because one investigator who has state funded data available will not make it available to another potential investigator.

The situation I suspect is worse in New Zealand than in most countries because our small underfunded system over many years has led our researchers to be far more competitive against each other than is the norm in many countries, indeed many investigators in New Zealand find it easier to collaborate with people off-shore than within their own county.

One of the things I am doing at the moment is reflecting on this situation and whether we need more coherent guidelines for the access to, ownership of and use of, data and samples collected under State-funded competitive research. It's a complex area, there are different perspectives. I would hope that in the next few months I will produce a discussion paper on this topic.

I hope these comments which are indeed somewhat speculative challenge you to think outside the square. As a country we have to do better. The government has rightly put science at the centre of its economic strategy. Your profession is a key part of the path ahead.

But we must think outside the square – thinking inside it has not got us far enough.

Thank you.