OFFICE OF THE PRIME MINISTER'S SCIENCE ADVISORY COMMITTEE

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'Globalisation of science: New Zealand's R&D direction'

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Introduction

New Zealand's economy requires significant transformation if it is to achieve sustainable long-term growth. The Government has identified science and innovation as one of six key strategies needed to attain this. This was an overdue commitment. If one looks at other small advanced economies such as Singapore, Israel, Denmark, Norway and Finland, all have seen science and innovation as central to their viability and growth and these countries took this approach at least 1-2 decades ago. All are now reaping dividends as a result.

In taking some first steps, pursuing a science and innovation strategy with greater intensity is essential to continuing transformation away from commodity-based trading. Scientific transformation will permit our country's well-educated population and increasing technological capacity (for example as a result of improved broadband capacity) to partake far more in the increasingly weightless global economy.

At the same time though, we must have the capability and capacity to build areas such as advanced foods, high-technology products and the service sector. Furthermore, the nature of innovation is such that a truly vibrant innovation-based culture will inevitably create unexpected value in other domains as well.

In thinking about the other small advanced countries, essentially all have succeeded in transforming their economies via government-led basic and strategic investment in research and development. The exceptions have been Ireland, which focused on tax breaks to attract multinationals, and New Zealand, which while continuously refining its macroeconomic settings has faced only diminishing returns.

New Zealand has lagged because it has, for some decades, failed to invest sufficiently in strategic and holistic scientific research in a manner sufficient to create a fully-functional innovative ecosystem. Rather, in relation to comparator economies, it has maintained one of the lowest investments in R&D and sought repeatedly to achieve improved performance by

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partially addressing only single component of it, usually by repeated restructuring, zero-sum diversion of existing funds into new areas, and minor and erratic increments in investment. Experience demonstrates that a minimal incremental approach can never succeed. Prior to the Canterbury earthquakes creating a pause, *Igniting Potential* indicated the intent to move to a more holistic approach. A key understanding of those countries which have thrived, Ireland excepted, is that their systems only work if there is sufficient idea flow for entrepreneurs and businesses to develop and that in turn can only come through investment in basic science. There is no other way. This, in turn, requires attention to create suitable performance incentives and drivers in the universities and research institutes (the latter has been partially addressed by the CRI reforms and early indications have been positive).

In Israel it is accepted that only 1 in 100 ideas leaving a university or institute will make it to the first phase of commercialisation and of those 50% if well managed and governed will succeed. In a country not that much bigger than ours they are reviewing more than 10,000 ideas per annum, of which more than 50% come from the university sector. We are nowhere near that – and not just because of our low investment in research but also, I think, because of deeper cultural issues.

I have just returned from Denmark: they invest 1% of GDP in publicly funded research and 2.5% of GDP in privately funded R&D. Further, they have over 2000 people employed solely in technology transfer, recognising that the universities themselves have incentives that focus on internal return rather than national return. This university-driver has been a major challenge for them and they have had to confront the universities in dealing with it. Overall, such action has paid off well for them and their GDP and productivity is much better than ours. However, they are now worried regarding a tail-off in productivity – they relate that to two major factors. The first is a brain drain of their best entrepreneurial scientists to the rest of the EU. The second is even more fundamental: there is a general lack of risk-taking in Danish society. This their officials related to being a low-risk society with deeply embedded culture of egalitarianism and social democratization, and this in turn is thought to have led to a failure to be entrepreneurial. The cultural issue starts at school and is seen as being at the root of the limit in gains possible. compared to more frontier societies.

This is a unique time in New Zealand's economic history, when transformation is not only needed but indeed, is possible. Realisation of potential will require investment by the public sector, which in no way is a question of market failure because the nature of R&D means that much of it must be a public good. Indeed, the OECD has pointed out the reasons why it would expect New Zealand to invest on the high rather than low side of the range of typical national science and innovation investments. The evidence is absolutely clear – public investment in science leads and drives greater private sector investment.

Beyond arguments based on comparator economies, events over the last year have shown to the New Zealand public the importance of rebuilding and maintaining a strong public science system. All have seen the importance of science in dealing with earthquakes, in the

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Psa incursion in kiwifruit, in the shifting understanding of climate change, in the emergence of green-tech industry and the application to social science. Public support for science and scientists has become apparent in the perhaps surprising recent but very unscientific *Reader's Digest* poll.

Science as global business

Every advanced nation needs science-based innovation as it is central to ongoing growth. Many countries have set targets – generally in the region of 1% public investment and 2% private sector spend. Some have set higher targets – especially the Asian economies. The reason for doing so is not just one of national pride – it is the recognition than in an increasingly weightless economy, it is ideas that generate money. The product can be produced anywhere, but in the end it is the source of the ideas that generates the return. These ideas can be in the form of many kinds of new knowledge, from fundamental new ideas discovery leading to new drugs or gadgets to the integration of new service models such as cloud computing and social networking to the role of smart design. We need to understand that ideas generation is where it starts. There are then a series of steps that transform that into real dollars – at the end it is about scale and marketing.

New Zealand must develop clear ideas of where its contributions can fit into the value chain. In general we can do well in ideas generation –we are well educated, we can be inventive. This means a greater investment in discovery research, not less. But we will not necessarily do well in going to scale and dealing with marketing to the world. After all, the bulk of our marketing experience is in commodity foods which are easy to sell and in tourism which is also easy to sell. There are of course exceptions, we could readily develop a high value added food industry if we consider the future of food was in Asia and are prepared to invest in it. The potential for foods that really do advance health to be developed is real. The success of Weta workshop and some of our gamers shows that we can do well in the weightless economy, but Weta is arguably a capricious win built on an individual with an association with New Zealand who was prepared to build an ecosystem here.

I think we have to think hard and innovatively about how we go to scale. One of the problems that is clear is that taking knowledge-based industries to scale and marketing them is in many ways a very different skill set to that that comes from tradition corporate training. We have had the tradition of thinking that we must own the whole value chain from New Zealand, then try and sell it to the world. In a country with a low capital base and a small number of technologically savvy managers, to try and do it on our own can only have a high failure rate. Too often we will end up with clever ideas, undercapitalised, slow to be developed and likely to fail in the market. But there are solutions – we must be innovative and grab them.

Israel is the most successful small economy in the knowledge based sector. Their first rule is to make sure they have enough ideas flow so that good ideas can be identified and filtered and effort is not wasted.

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They insist on international expertise on their boards, on proper scientific advisory boards, and high-quality skilled management with experience in knowledge based industries. For them the ownership of the idea is often more important than the site of manufacture.

For New Zealand the problem of geography and isolation is particularly apparent . But there are solutions – for example we could develop strategic partnerships at every level in the knowledge value chain, both pre-commercial and commercial, generally with small advanced economies where there is an equity of interest. We need partners who can do what we cannot do, be it access to markets, going to scale and/or expertise. We are better to own a fraction of something large than stay small. Examples are starting to emerge of such approaches.

Our future is in Asia. Asia values our capacities to generate knowledge. Asia has scale, capital and markets. Our businesses and academia have to look for new models that will allow the added value of science to be exported and the returns find their way back to the New Zealand economy. I suspect this will lead to New Zealand science not just building domestic multidisciplinary teams, but becoming part of international teams.

New Zealand has another challenge – one of ensuring it relevance in a world where we are small, distant and not part of many key forums such as G20. Science has a very important role in ensuring our relevancy, and indeed internationally there is a growing nexus between science and diplomacy. This is in no small reason because science is key to many issues of global concern, such as climate change and food security, but is also because, as I have already implied, science will be at the heart of the global 21st century economy.
The interaction between science and diplomacy can be considered to have at least four dimensions.

Diplomacy plays its role in science - look at how many international agreements now have science within them. Diplomacy has allowed New Zealand science to get access to EU funds, other bilateral initiatives have been developed with Japan, Germany, China, Singapore to name but a few. The science community has benefited. At its extreme, diplomacy and science come together in very large science projects such as in Andrill, the ice drilling research we are part of in the Antarctic, or hopefully the Square Kilometre Array radio telescope.

Secondly, science assists diplomacy. Science is to a large extent politically neutral and opens doors – it is perhaps the modern equivalent of ping-pong diplomacy. And that science leads to trust and innovation and that innovation leads to economic opportunities through trade and investment.

Thirdly science operates within diplomacy – the most obvious examples are in arms control verification but science is playing an enormous role in the diplomacy of climate change – not just in creating measurement approaches and identifying the problem but in helping the community towards solutions.

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New Zealand can be truly proud of its role in leading the work on the global research alliance to reduce agricultural emissions – one that meets several diplomatic objectives.

And lastly science is the glue that holds the real and virtual ungoverned spaces together for the global community – it is science that essentially governs the Antarctic, the internet, space and the ocean deeps.

The recognition of science as a key part of diplomacy is new, but New Zealand has not been slow in filling this space. The Prime Minister has established a coordination committee, the International Science and Innovation Coordination Committee, to ensure that there is multiagency alignment on how best to use our science in international agreements.

Over the next decade the shape of science in New Zealand must change dramatically. There will be a far greater role for science in protecting New Zealand's position in the world. New Zealand will not thrive unless its science system is vibrant and outward looking. We need to move beyond 20 years of chronic underinvestment and demonstrate the key role that science will play in our future – be it in social development, environmental protection, economic development and in ensuring our relevance as a nation in a world in which new knowledge is accumulating at an accelerating rate. Such an outlook brings both challenge and opportunity.

Thank you.

ENDS.

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