OFFICE OF THE PRIME MINISTER'S SCIENCE ADVISORY COMMITTEE

Professor Sir Peter Gluckman, KNZM FRSNZ FMedSci FRS
Chief Science Advisor

Speech at MAF Conference Wellington – Tuesday 4 May 2010

PD Gluckman, Chief Science Advisor

I have no doubt that all of you will have seen the KPMG report of a couple of weeks ago which highlighted the fact that New Zealand has done well off its past investment in agricultural R&D. But it goes on to say that momentum has been lost and will have to be regained if our agricultural sector is to be maintained in a healthy state into the future. I largely agree with that assessment. What I would like is to understand why we've come to that situation, look at the scientific issues that might be worth addressing and need focus - and then look at the challenges of how we might do it. New Zealand has a large accumulated deficit in investment in R&D. We spend in total about 1.2% of GDP on R&D, about 0.5% of that comes from Government and about 0.5% from industry.

Across countries that we would compare ourselves to, like Australia, Denmark, Finland, Norway and Singapore, governments spend on average about twice what we do, in the order of about 1% of GDP on R&D, and the private sector spends between 2 and 3 times what we spend. So most OECD countries are spending between 2.5 and 3% of GDP on research, science and development and it would be weighted towards its dominant sector. This is a long-standing issue, it is about 30 years since we were last on a par in this regard with countries that we would like to compare ourselves to, and it reflects a fundamental cultural issue in New Zealand in its attitudes to knowledge.

It is made more complicated by the fact that there is at least a 7 year lag time for a return on R&D investments in the biological sciences. That's not a reason to delay, it's actually a reason to accelerate development. There is also a reason why one needs to be aware of and supportive of, but not be solely focused on, industry-identified needs which are often led by rather short-term objectives. One of the side effects of a chronic underinvestment in research is that it is difficult for people to collaborate. We have seen this extensively within the university and CRI sector, where public providers of science particularly have come to compete rather than to collaborate with each other and a large part of the CRI reforms is in essence an attempt to alleviate some of that competition.

Centres of Research Excellence including the Riddet Centre and the Bio-security Centre in Lincoln are further into efforts in the same direction. But it might also be that in the private sector we are seeing less cooperation between potential users of research than is seen in many countries. A widely held view is that in this situation all one needs to do is to invest late in the value chain. That is not the international experience which suggests that if one is to have a knowledge-based economy one must invest first and appropriately in training and infrastructure, and in basic or not yet applied research before the opportunities emerge which are most exploitable through technology transfer arrangements of a variety of types.

Mail: PO Box 108-117, Symonds Street, Auckland 1150, New Zealand Physical: 2-6 Park Avenue, Grafton, Auckland 1023, New Zealand
Telephone: +64 9 923 1788 Facsimile: +64 9 373 7497 Website: www.pmcsa.org.nz Email: csa@pmcsa.org.nz

Secondly, it is critical to ensure, particularly in farming, open transfer of knowledge and know-how held in universities and CRIs to farmers and growers.This may be important in considering initiatives like the PGP. Certainly in the public good science fund for a number of years we have forgotten that we need to have an appropriate balance of investment in both applied and exploitable research and not yet applied research and the latter must be adjudicated on quality rather than nominal business plans. I think that until the climate in the "not-yet applied area" is improved we will fail to address the capability gaps which exist in animal and food science. New Zealand exports are about two thirds dependent on either agriculture or agriculturally derived products, and given the billions of dollars involved, the percentage of that volume of exports that is committed to R&D is manifestly inadequate.

If one looks at the food industry then we have gone through a period where we have had a 20 year effort where we have added value to food largely by increasing efficiencies in production, storage and shipping and in shifting from a commodity basis to value added foods on the basis of consumer perceptions of taste and social cache, driven by marketing. We see that in value of high value lamb cuts, high value beef cuts, green-lipped mussels and so forth. But while commodity and such added value exports will always remain a significant part of our agricultural economy, the issue of whether we will be able to sustain value from those commodity exports against the background of changing consumer perceptions, of carbon and water footprints, of competition against lower labour markets and higher volume producers such as Brazil and the other South American countries is something that we should not take for granted. Again this is a point made by the KPMG report.

In my judgement, there is an opportunity for New Zealand to become known as an exporter of foods which are not just safe, not just of quality in terms of taste and other related production values, but with added value because of science proven impacts on the quality of life. My experience in Asia suggests that as the middle class emerges, there is a large opportunity for foods for which there is regulator approved claims for maintaining quality of life or actually providing a food benefit. I concur fully with that conclusion, I believe that given the low volume of foods that we export - in reality enough perhaps to feed only 20 million people, the only way we can really add value which will be sustained against competition will be to focus on the one area of food purchase where there is no doubt that the market will always bear considerable premiums - that is in the area of foods which have proven benefit in terms of quality of life and/or proven health benefits.

The health benefits would largely be – if we think of Asia as our market – in the areas of maintaining brain function or of using the risks of metabolic disease. All said and done there will be at least 250 million diabetics in Asia by the year 2030. We need to understand that with the growing market in Asia, issues of sensory perception of foods will be different, if what appeals to the Asian market is different to what appeals to the European or North American market. In most areas of science we will not be able to go it alone. It is very difficult in most areas of science to take that science to scale without stable international partnerships. One of the challenges for New Zealand in the agricultural sector will be to what extent should be exporting ideas rather than food itself? That is, exporting our expertise in agricultural and food systems to countries like China, the Latin American countries and so forth. To a certain extent we are already doing this and we are starting to market our knowledge in food safety and food security in those markets as well as agricultural systems.

The dilemma which will need to be worked out is how to do that and yet maintain value for the New Zealand farmer. It could be placed at risk if we do not develop market niches for New Zealand products themselves. This is going to require some very coordinated strategies. What strikes me about the New

Mail: PO Box 108-117, Symonds Street, Auckland 1150, New Zealand Physical: 2-6 Park Avenue, Grafton, Auckland 1023, New Zealand
Telephone: +64 9 923 1788 Facsimile: +64 9 373 7497 Website: www.pmcsa.org.nz Email: csa@pmcsa.org.nz

Zealand science system in agriculture is that the level of communication between the players is largely at the operational level and not at the strategic level. Universities, AgResearch, the producer organisations, the large food producers, and the Government funding agencies tend to interact at an operational level rather than working at a 'New Zealand Inc' level and working out how to combine expertise in agricultural production, post farm gate processing, value added products and marketing either on our own or in partnership with third parties, maximising profit. The exception might be the dairy industry.

This is New Zealand's problem - we are very good as a small country at competing amongst ourselves, we need to get better at working together as a team. I believe that MAF needs to consider how they could assist in a greater cohesiveness than we have to date. We should not underestimate the issues, look at what's happened in the wool sector. AgResearch has had recent problems in part because it assumed that the sheep farmers would continue to provide a levy to support research in the sector. That didn't happen and the consequences are obvious. I don't have the expertise to understand why it is that that wool farmers pulled away from the investment, but in reality, this is a very serious issue if we lose our residual capacity in fibre science and once lost that capacity will be hard to rebuild.

There a number of scientific issues that need to be addressed. Clearly one we have started to work on is how does the world increase its volume of food against the background of issues around carbon, nitrogen and water? We are already facing the problem of intensification with regards to water quality and we face the problem that increasingly large volume producers at low price are emerging in South America. We are going to have to work through complex science of these bio-physical systems, to understand how and where we can intensify and to what extent we can intensify without getting into situations where the environment is compromised beyond our capacity to cope, and at the same time I believe that over the next decade we will start to see the implications of the warming climate, and a change in climate cycles, influencing what and how we grow things and again farmers will face the challenge of how to address this. Again, we need to get better and improve the quality of interchange in science and the farming community to help them through these issues.

The need to improve knowledge transfer in both directions is obvious. What kind of high-volume farming will be acceptable to the New Zealand population? We have seen issues relating to the Mackenzie basin, and dairy intensification in Canterbury. We have also seen models where high intensity and high products and farming have been very successful, for instance some operations in the Hawkes Bay. These issues require the integration of farm system science, economic science, environmental science and we need to get far better at integrating these – both at the level of the public and private sectors and across the two if we are to make the right choices. We have been remarkably lucky in the biosecurity space but there are very many challenges facing the capacity of our agricultural system to remain relatively secure, it is almost inevitable that at some time in the future we will face some form of outbreak which will be threatening to our industry, do we have the scientific systems in place? Do we have the scientific infrastructure in place to address these issues?

If one looks to Britain, there was a big difference in the response to the BSE crisis and to that of the foot and mouth crisis. Everybody believes that the foot and mouth crisis was handled well in contrast to the disaster that surrounded the BSE outbreak. What was the difference between the two – in response to the BSE disaster, Britain strengthened its science advisory network and its science advisory system to the policy maker such as that by the time of the foot and mouth epidemic there was a solid, non-politically manipulated science advisory system in place such that DEFRA and the Government were able to make the appropriate responses. I believe that MAF in particular needs to give a great deal of thought to improving the quality and the establishment of a science advisory process. It becomes even more

Mail: PO Box 108-117, Symonds Street, Auckland 1150, New Zealand Physical: 2-6 Park Avenue, Grafton, Auckland 1023, New Zealand
Telephone: +64 9 923 1788 Facsimile: +64 9 373 7497 Website: www.pmcsa.org.nz Email: csa@pmcsa.org.nz

important now that food safety is now again part of your ambit. At the heart of agriculture is biology. Our livelihood depends on the biology of nitrogen fixation, the biology of forages and of animals and are not just the animal alone but their gut microbiome as well. We have fallen badly behind in our capacity to undertake modern biological research, such as our abilities in genomics and epigenomics.

Our abilities in animal physiology are now deficient compared to those of our competitors and if we wish to return to the cutting edge we need to address these issues. I will not talk at length on food science, except to say that food science is changing and requires a close integration with sensory sciences and human physiological sciences on one hand, and with agricultural sciences on the other hand. Do we have the level of integration that is required? As agricultural science progresses further, the issues of the public engagement with the scientific process will become even more important. At the moment New Zealand has taken a very clear position on the use of genetically modified organisms outside the laboratory. That is a valid position to take because no science can operate in a society without the full engagement and understanding of the society.

The challenge moving ahead is whether this is an economically sustainable position, in a world where we are seeing a lot more genetically modified crops, and we will undoubtedly see the use of genetically modified organisms in a variety of domains ranging from dealing with methane production, to genetically modified vaccines and so forth and genetically modified forages.

On the other hand it may be that being GM free is a better economic position. As food security becomes a more global issue, and given the safety of genetically modified foods, we will see many countries adopt a different attitude to genetically modified organisms than they have at the present time. New Zealand's situation is different because we market on the basis of our clean and green image and the extent that genetic modification is seen to undermine that image. Clearly at the moment we would refrain from the introduction of genetically modified crops or genetically modified organisms say into our soil to improve nitrogen fixation. Whether the situation in New Zealand will change in the long term or never is clearly and appropriately a political decision but the science surrounding these issues are matters that New Zealand needs to be competent to adjudicate on.

These are issues that transcend party political politics in my judgment, and it comes down to some very careful strategic decisions that New Zealand will have to keep a watching brief on over a long time. The biggest problem in biological research is the time frame from discovery to exploitation, which can take anywhere between 5 and 25 years. The difficulty in that circumstance is to what extent should research be industry-led and to what extent should it be scientifically pushed? Clearly the short term gains will always be industry led. Farmers and producers are the ones in the best position to judge, but I do wonder whether we sometimes forget that industry in New Zealand does not work on the time horizons that are necessary to protect the interests of our farming community over the next 2 to3 generations.

My most immediate concern is the state of the New Zealand science system. Because of the 30 years of under-investment we have a large number of unacceptable infrastructural gaps. Part of that infrastructure is human infrastructure, we have gross gaps in expertise in some areas such as soil science and informatics, that is not to say we do not have one or two outstanding individuals, it's just that we don't have enough of them and we don't have critical masses built around the few we have, and we have even greater gaps in the infrastructure of modern science technology which is needed for modern biological science. Modern biology with bioinformatics, genomics and epigenomics requires infrastructure on a scale and with both people and infrastructure that requires much greater investments than we have within New Zealand. We need this because at the end of day understanding the soil bacteria,

Mail: PO Box 108-117, Symonds Street, Auckland 1150, New Zealand Physical: 2-6 Park Avenue, Grafton, Auckland 1023, New Zealand
Telephone: +64 9 923 1788 Facsimile: +64 9 373 7497 Website: www.pmcsa.org.nz Email: csa@pmcsa.org.nz

understanding forage biology, understanding animals, understanding how animals digest their food, all require access to these modern biological technologies. When it comes to optimising farm production on an individual farm, over the next 10 years we will be looking to match soil biology, forage biology, animal biology, together with farm management and nutritional systems, optimal for that particular farm, that particular environment.

If we want transformational technologies for the farming sector it's this kind of new technology that we will need. If I am right, and food for health becomes a dominant part of our market in 20 years time, then we need to integrate our food science and human science much better than we have to date. We have a number of latent advantages for why we could do this, we have a good health care system, we have good clinical research, we have some capacity in human nutrition which could be built off, and we need to think seriously about a far greater effort in the food-for-health space.

This speech has been a bit of a pot-pourri. I've done so intentionally because I wanted to point out that our economy will depend on a greater use of knowledge to protect and sustain our agricultural and food sectors. Farmers themselves are important direct users of knowledge, they need to be rapid technology adopters, and our CRIs and universities need to give greater focus to direct knowledge transfer.

We need a better integration of effort between all the parties involved, whether public or private sector, and the multiple players within the public sector. The CRI reforms assist this process. New Zealand is a very small country, out current paradigm for undertaking research doesn't encourage the level of co-ordination that needs to be there but we are trying to change that. The challenge for MAF is to take leadership in encouraging a greater integration of effort.

Thank you very much.

Mail: PO Box 108-117, Symonds Street, Auckland 1150, New Zealand Physical: 2-6 Park Avenue, Grafton, Auckland 1023, New Zealand
Telephone: +64 9 923 1788 Facsimile: +64 9 373 7497 Website: www.pmcsa.org.nz Email: csa@pmcsa.org.nz