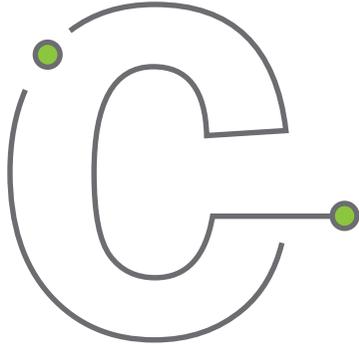




Catalysing Economic Growth

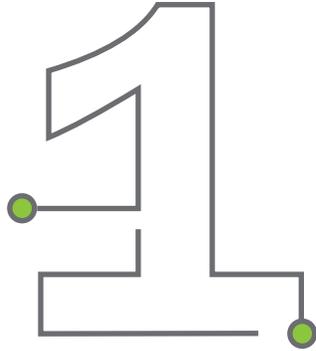
*Boosting Innovation
Expertise in the
Private Sector*



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EXECUTIVE SUMMARY

New Zealand is languishing at about 25th place in the Organisation for Economic Co-operation and Development (OECD) league table. We need policies that will bring about a continued growth rate in labour productivity of over four per cent per annum, to obtain parity with Australia within a generation. This is two to three times the rate we have experienced in the last decade.

New Zealand needs to identify economic opportunities and corresponding development policies that will make a real difference here, where we are small and geographically isolated but wanting first world living standards.

Some changes have been made or are being made to improve our productivity. These include improvements to the regulatory environment, public sector efficacy, the tax system and infrastructure.

However, these changes are insufficient. There are two issues that are poorly recognised and addressed in New Zealand. These are:

- the need to boost expertise in our private sector to develop, adapt and adopt new technologies (innovation expertise)
- the need to make the New Zealand economy more “sticky” to high technology companies so they remain here.

IPENZ has developed two proposals to address these issues.

- **Proposal 1:** Create an innovation expertise fund which is available for universities, Crown Research Institutes (CRIs) and potentially, institutes of technology and polytechnics (ITPs). This fund would require co-funding from a company or companies and would result in academics being strongly incentivised to go out into industry, build strategic partnerships with companies, and to transfer skilled people to the company at the end of the project. Clustering would be enhanced.
- **Proposal 2:** Provide direct co-funding for the early years of employment of workers in new research and development (R&D) positions in industry. This would incentivise small private businesses to take on R&D staff, thereby having R&D expertise in-house and encouraging R&D to become part of business as usual.

The two policy proposals will do better than other policies by:

- focusing on building innovation expertise and a skills pool to make New Zealand “sticky” to high technology manufacturing. (The companies build local skills networks and want to keep close to their university and CRI collaborators. The smart university academic or CRI is incentivised so they continue their relationship into the future.)
- incentivising research providers to shift their focus to developing innovation potential in industry
- incentivising companies to increase their investment and grow their potential to adopt, adapt and use new technology for commercial benefit
- making New Zealand a visibly smarter leading edge technology-based society.





NEW ZEALAND'S ISSUE

New Zealand is languishing at about 25th place in the OECD league table, well behind Australia.

New Zealand needs policies that will bring about a continued growth rate in labour productivity of over four per cent per annum, to obtain parity with Australia within a generation. This is two to three times the rate we have experienced in the last decade.

The labour productivity growth rate is unlikely to rise without a significant expansion of export value, primarily led by high productivity firms.

Glaxo, which started at Bunnythorpe but became a global United Kingdom-based pharmaceutical company, was possibly New Zealand's first high technology company. Since Glaxo's loss New Zealand has struggled to retain the fledgling high technology businesses that would make a difference. At critical stages these businesses leave to be nearer markets, to obtain the capital to grow, or to access new skills. As a consequence New Zealand has become over-reliant on industries that are retained in this country because their raw materials are grown or sourced here.

New Zealand needs to identify economic opportunities and corresponding development policies that will make a real difference to our small, geographically isolated country where the population wants first world living standards.

A brief summary of New Zealand's performance compared to other countries is provided in **Appendix 1**.





HOW ECONOMISTS VIEW THE NEW ZEALAND SITUATION

A wide variety of analyses of New Zealand's economic performance have been undertaken.

One completed relatively recently by the Treasury notes that “While many factors impact on productivity, evidence suggests that skills, innovation and investment are particularly important in determining productivity performance ... Ultimately, it is the entrepreneur who combines these factors of production, new ideas, skills and capital, in order to drive productivity growth”¹.

Consequently most studies highlight three key issues – capital markets, R&D investment and skills.

3.1 Capital Markets

New Zealand has relatively shallow capital markets. This is regarded as a major reason why the New Zealand economy is not “sticky” to fledgling high technology businesses. As noted by the Capital Market Development Taskforce², capital markets:

- allow New Zealand businesses to obtain the capital they require from savers at home and abroad
- make it easier for savers to achieve their financial goals and accumulate wealth
- help savers and businesses better manage the risks they face.

The Treasury notes that “Overall, a lack of development in certain parts of New Zealand's financial system is likely to be imposing a moderate constraint on the growth and performance of New Zealand firms”³.

Further, the Treasury suggests that entrepreneurship be encouraged and there be a greater use of innovation to improve investment opportunities⁴. Policies that promote savings and reduce the volatility of the exchange rate cycle can lower the cost of capital.

3.2 New Zealand has low R&D Investment

Innovation comes in many forms – from breakthrough or disruptive change to incremental improvement.

Breakthrough/disruptive change is more likely to come from basic research, and incremental improvement is often a development activity. Any country needs a portfolio approach whereby its government plays a greater role for longer term (often more basic) research and the private sector the greater role in development.

The OECD norm would be for a government to invest about 0.7 per cent of gross domestic product (GDP) and the private sector 1.5 per cent.

New Zealand has low R&D investment (see **Figure 1**). A large proportion of the investment that does occur is made by the Government (see **Figure 2**).

Despite the Government’s comparatively large contribution, its expenditure on R&D equates to only 0.5 per cent of GDP, which is below that of the OECD average.

The Treasury notes in its document *Putting Productivity First*⁵ that:

“New Zealand’s wider innovation framework is considered sound, such as policies affecting competition and firm dynamics, and the infrastructure for public research investment. New Zealand has a strong research base”.

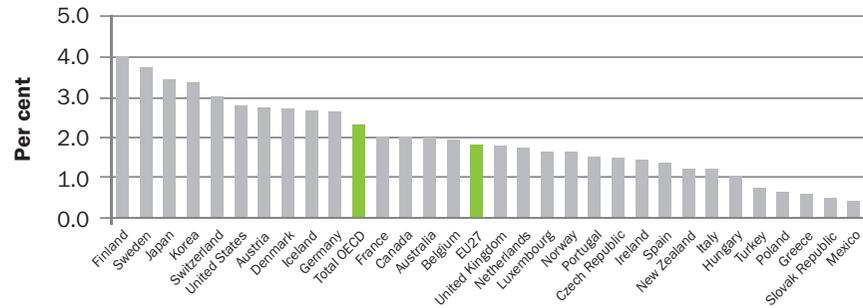


Figure 1 – Gross domestic expenditure on R&D as a percentage of GDP⁶

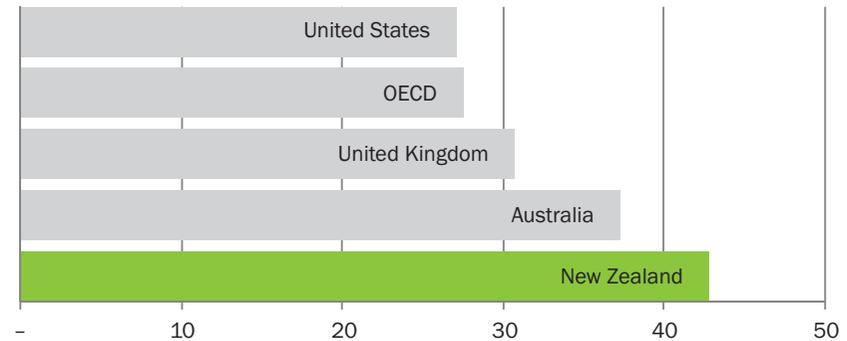


Figure 2 – Proportion of R&D funding provided by governments in New Zealand, Australia, the United Kingdom, the United States and the OECD overall⁷.

The Treasury goes on to say:

“Business R&D has been increasing rapidly; it grew at an annual rate of seven per cent from 1995 to 2004, much faster than Australia, the United Kingdom, the United States and the OECD average, and 52 per cent of firms report some form of innovation, comparable to other OECD countries”.

Despite this, at only 0.5 per cent of GDP, business involvement (funding) in R&D is still lower than other countries’ and the OECD average of 1.5 per cent of GDP⁹. (See **Figures 3 and 4**)

This suggests New Zealand needs deliberate change to make progress.

The Treasury notes in *Putting Productivity First*¹⁰ that:

“Innovation is more than just research and development though; investments in higher education enable innovative solutions to be implemented and investments in capital, such as information and communication technologies, enable the spread of new ideas. The OECD measures investment in knowledge as expenditure in R&D, higher education and software collectively. On this metric New Zealand performs better than a focus solely on R&D would suggest”.



Source OECD (2009), Main Science and Technology Indicators, Volume 2009 Issue 1.
¹The 2007/08 OECD figure noted is an estimate based on the 2006/07 OECD figure. No actual 2007/08 OECD figure is available to date.

Figure 3 – New Zealand’s government-financed gross expenditure on R&D compared with the OECD overall.⁸

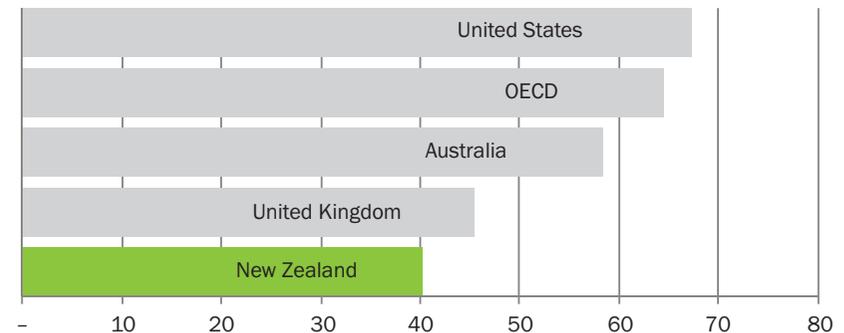


Figure 4 – Proportion of R&D funding provided by industry in New Zealand, Australia, the United Kingdom, the United States and the OECD overall¹¹.

3.3 Skills - Increasing Returns from Knowledge

The dairy industry is an example of where significant returns can be made from increased knowledge and skills (see the dairy industry case study).

The Treasury defines multi-factor productivity as “a measure of how much output is produced for given inputs of labour and capital”¹². Multi-factor productivity is subject to a range of influences, including the skills of the labour utilised and the amount of capital invested.

The Treasury notes that increasing returns from knowledge is “not only a key ingredient to explain the on-going rise in living standards over several centuries, but also has important implications for policies designed to foster growth”¹³.

New Zealand has low multi-factor productivity compared to other countries (see **Figure 5**). This low productivity may well indicate low skill levels in New Zealand, or that our skills supply is unbalanced.

3.4 Other Factors

A sound regulatory system with no undue burdens, fair taxation, effective and efficient government and good infrastructure are all seen as positive to productivity growth.

The innovation business is globally competitive. Many countries face diminishing returns from labour inputs. The OECD suggests future growth “must increasingly come from innovation-induced productivity growth”¹⁴. In this context there are a number of factors that attract businesses to move offshore. These include the access to capital, the cost of capital, and the proximity to markets. We need to consider the factors that enhance the “stickiness” of the New Zealand business environment to retain innovation businesses.

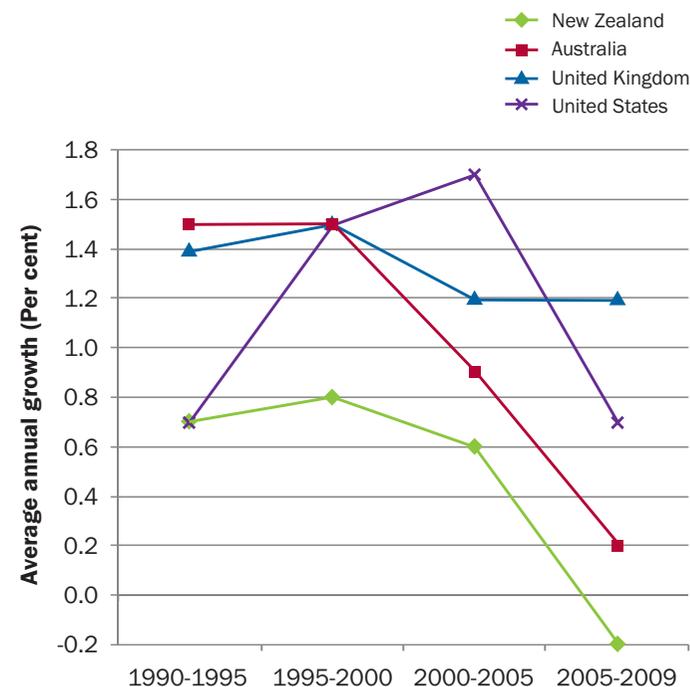


Figure 5 – Multi-factor productivity (measured as average annual growth) of New Zealand, Australia, the United Kingdom and the United States.¹⁵



Case Study: *the Dairy Industry*¹⁶

According to Statistics New Zealand, in 1975 when the umbilical cord to the United Kingdom was finally cut, dairy exports were \$289 million (about \$1,626 million in 2001 dollars), which trebled to \$4,728 million in 1999/2000. In contrast, meat industry exports increased from \$440 million (\$2,471 million) to only \$3,376 million, an increase of about one-third, and the wool industry actually fell – from \$263 million (\$1,475 million) to \$1,127 million. If they had grown comparably they would be earning \$7 billion more right now – enough to secure New Zealand a place in the top ten OECD countries.

In 1975 the dairy industry had no particular advantage other than a different attitude. Through its own endeavours it transformed itself from a commodity-based industry selling a narrow range of products to a limited market, into an internationally competitive industry supplying a wide variety of products (most with a high level of added value) around the globe.

Since the early 1980s the industry has invested in an excellent workforce, using an integrated technology transfer model based on ease of movement of people between the R&D, production and marketing sectors. It recruits first-class graduates in engineering, technology and science each year, and places them in a hot-box learning environment; they undertake study for a one-year Masters degree in both the R&D environment and a production company. R&D projects involve production company staff, researchers, and often technical staff from the marketing arm. Many long-term industry staff have worked in all three environments. The continuing movement of technically competent people between the sectors of the industry is widely acknowledged as crucial.



CONVENTIONAL WISDOM THAT MIGHT BE HOLDING US BACK

Despite detailed economic analyses New Zealand is not progressing. This suggests we may be tackling the wrong issues, or tackling the right issues in the wrong way. We should take nothing for granted. Some conventional wisdom might be masking the real issues and solutions.

4.1 Low R&D investment is okay in New Zealand because of the types of industry we have

This statement may misrepresent the issue and miss the point. The profit margins over the lifetime of a product can only justify so much R&D expenditure. Commodities in the market for 20 years can only justify one per cent expenditure per annum on R&D, whilst products in the market for two years might have 10 per cent per annum spent on this.

New Zealand needs new R&D. Our traditional industries will never make the quantum leap required unless morphed away from commodities. We need more than just “more of the same” R&D effort. “More of the same” will give us more of the same outputs we have had over the last two decades so we will continue to lag behind Australia.

New Zealand needs to set an ambitious target of three per cent total R&D – not just to creep up the OECD average. New Zealand is small and, as noted by other commentators¹⁷, this country has “large numbers of tiny firms”. Our nation needs this higher level of R&D investment to overcome the tyranny of distance and scale.

4.2 *The main problem in New Zealand is that we are not good at transferring R&D from our public sector to business*

It is true that we need to boost connections between our universities, CRIs and business. However, this is not all we need to do.

Elsewhere in the world the bulk of the really valuable R&D on which industries are built has never gone near a government laboratory (see **Figure 6**).

In these countries, whilst the transfer of R&D from the public sector is an important route to innovation, the dominant route is via industry-led and industry-performed R&D.

We thus need to increase the role of business in performing R&D of its own volition.

4.3 *The primary role of the CRIs is to do research for industry*

In many of the tiger economies (e.g. Taiwan, Singapore and Korea) the role of the equivalent body to the CRI concerned with manufacturing has been to build the expertise in the private sector to adopt, adapt or develop new technologies. Undertaking research is a tool they use to assist with the main objective of building expertise. Joint, co-funded programmes conducted at both the company and research provider's premises are vitally important. In each of our CRIs there will be an optimal balance in the spectrum from blue skies research, to research for industry to building expertise in industry.

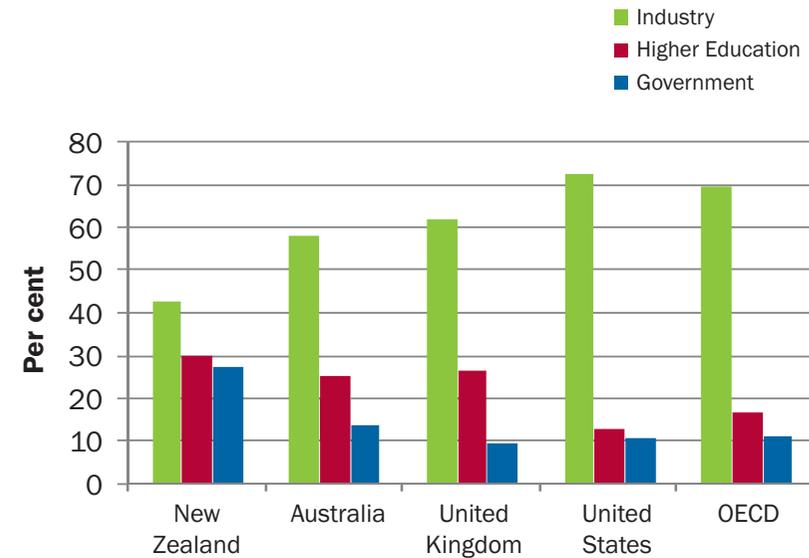


Figure 6 – Providers of R&D in New Zealand, Australia, the United Kingdom, the United States and the OECD overall¹⁸.

4.4 *The only thing New Zealand needs to do to lift its private sector performance is to educate more managers*

New Zealand produces a high proportion of business graduates and relatively few technical graduates (see **Table 1**). Of the business graduates, most study only general business skills. We lack international business expertise, technically-literate management expertise and commercially-literate technical expertise in our private sector. These shortcomings may reflect the isolated and somewhat insular society New Zealand has been.

The tiger economies have lifted their economic performance by flooding their economies with technical graduates, and then at their mid-career converting many of the more able of them to become managers of high technology businesses. A diverse management stock including a proportion whose origins were in technical roles, enriches companies.

The OECD recognises the importance of knowledge and skills in the application and use of innovation and new technologies^{20, 21}.

New Zealand’s production of engineering doctorates is low compared with other OECD countries (see **Figure 7**). The proportion is particularly low when compared with the OECD countries with the highest proportion of doctorates in engineering (Japan Korea, Denmark, the Czech Republic and Sweden). In these countries the proportion of doctorate completions in engineering ranges from 22.1 per cent to 25.9 per cent of all doctorates completed.

Improving management performance is a multi-faceted issue.

4.5 *Decisions are best made in Wellington on where the Government should co-invest*

When deciding what industrial R&D to do, decisions need to be made as close to the market and its customers as possible and with as short a delay as possible. This means empowering decision agents who are working in the field as service providers, and not relying as much on a centralised decision making process.

	Proportions (Per cent)			
	Management and commerce	Natural and physical sciences	IT	Engineering
Degrees and above	24	11	4	5
Doctorates	10	34	3	11

Table 1 – New Zealand’s production of all university graduates and doctorates (2009)¹⁹

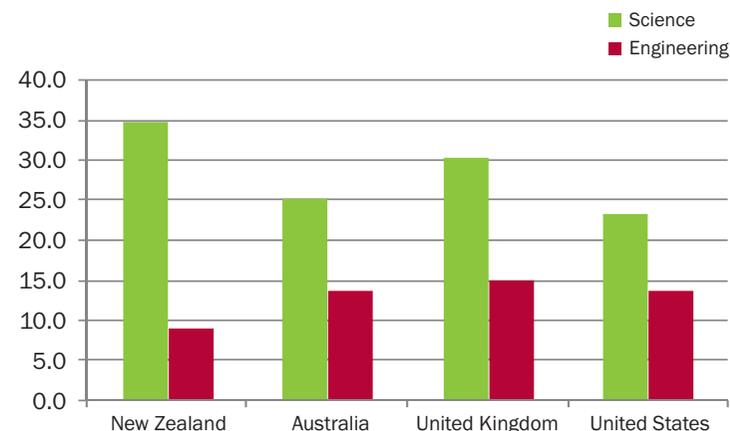


Figure 7 – Proportion of doctoral graduates in science and technology in New Zealand, Australia, the United Kingdom and the United States



CASE STUDY: *Taiwan's Industrial Technology Research Institute (ITRI)*²²

ITRI is Taiwan's national research organisation. It was established in 1973 to "strengthen the technological competitiveness of Taiwan".

ITRI's website notes that "in order to face a new economic era and serving as a nation's premiere technology research institute, ITRI must transform Taiwan's research capability from a 'follower' to a 'pioneer' in order to provide major advantage and opportunities for domestic industries".

ITRI's focus is to:

- expedite the development of new industrial technology
- aid in the process of upgrading industrial technology techniques
- establish future industrial technology.

Thus, ITRI is focussed not so much on research but development and the transformation of research capability to assist Taiwan's economic development.

ITRI's website also notes that "more than 60 per cent of the ITRI's 6,000 employees hold either a Master's degree or a Doctorate in their respective fields of study: Communication and Optoelectronics, Precision Machinery and MEMS, Materials and Chemical Engineering, Biomedical Technology, Sustainable Development, and Nanotechnology".

ITRI has a programme through which employees graduate and go on to be employed in the business community. According to ITRI's website, over 160,000 people have graduated from ITRI with the majority of these now being employed in the business community – some in mid to high level management positions.

Thus, ITRI is flooding the business economy with graduates who can apply their technical knowledge and in time move into management roles in businesses.

4.6 *The major skills issue in New Zealand is the low achievement of the bottom 20 per cent*

The low achievement of the bottom 20 per cent of the population is certainly an issue. However, there is another issue – where are our top brains deployed?

If the careers of the top 100 school leaving scholars each year were traced, we would probably find most of them in the spending economy (e.g. in health, business services such as law, accountancy and banking, infrastructural engineering, environmental science), and few in the earning economy.

By international standards we under-produce engineers, so most are absorbed in the important role of providing infrastructure. Few progress to postgraduate study and development roles in industry. The top scholars in science tend to follow the public R&D funds. Very little of that expenditure is aimed at developing new products or services to sell, so few scholars enter this area. In this country a top scholar is unlikely to work for a food company or a manufacturer. New Zealand needs more of our best brains to work in these areas to boost the economy.

It is highly likely that our earning industries (in effect the tradeable sector) are making do with too little of our top talent. The very people who would create more jobs, including higher skilled ones, and lift the employment opportunities for all are missing in action from the earning economy.





A START HAS BEEN MADE

Some changes to improve our situation are being made or have already been made to New Zealand's policies.

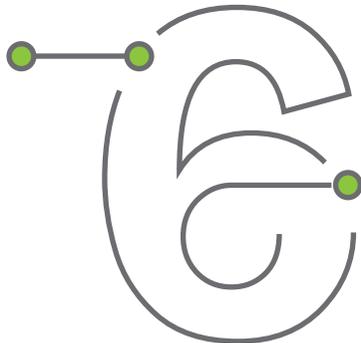
Improvements to the regulatory environment, public sector efficacy, tax system and infrastructure, for example, have been undertaken or are in progress. These will make New Zealand more attractive for businesses and investors, thereby improving the capital situation. The issue of New Zealand having shallow capital markets is also under investigation.

The Government is also looking to foster business R&D. New policy instruments like technology grants and vouchers, for example, have been introduced. These are primarily concerned with technology development.

There is a commonly held view that doing more R&D and shifting it to the private sector is the primary answer to lifting the contribution innovation makes to the economy. Some see moving the Government's investment to up to 0.7 per cent of GDP as a tipping point which will drive new behaviours into the private sector.

The important question is whether these actions are enough or the right ones. Are they sufficient to bring about the magnitude of shift required? IPENZ thinks they are not as they do not address two poorly recognised issues:

- success requires much more expertise to be deployed in the private sector.
- success requires that high technology companies “stick” in New Zealand.



THE MISSING POLICIES

IPENZ contends that there are missing elements in the policy framework to address the poorly recognised issues. These are policies that boost our private sector expertise to develop, adapt and adopt new technologies (innovation expertise), and develop industries that are less likely to migrate offshore and are thus more sticky.





WHAT WOULD SUCCESS FOR THIS POLICY LOOK LIKE?

7.1 *Increased commitment to private investment*

A New Zealand economy with 1.0 per cent of public and 2.0 per cent of private R&D expenditure would have additional R&D expenditure of approximately \$2 billion. This \$2 billion would be comprised of \$500 million of government investment and at least \$1.5 billion of private investment. This is a co-fund ratio of more than one to three.

7.2 *Increased opportunities for skilled New Zealanders*

It is highly likely the additional \$2 billion expenditure would support an additional 8,000 R&D jobs that are quite unlike many existing R&D jobs. These jobs would be focussed more on development than research, and be based largely in the private sector. They would be exciting roles, filled with enthusiasts getting a real buzz out of doing leading edge things that make money.

The private sector employers would be processing companies, manufacturers and knowledge-based businesses, and would be less likely to be in the traditional primary commodity industries sectors.

The majority of the new R&D workers would be tertiary educated to at least Level 8 (Bachelors with Honours) in engineering, information and communications' technologies (ICT) or other technologies as befitting their likely roles as developers. These are areas where New Zealand currently lags behind the OECD.

As a result of the increased R&D jobs, there would be a considerable replenishment need. IPENZ estimates that 500 to 800 research workers per year would be entering the private sector from universities and the CRIs.

To support the research workers, demand for technicians will also rise, correcting another imbalance in the New Zealand labour force.

The universities and CRIs would have responded with programmes to develop and move the research workers to the private sector. These researchers would see their career pathway enhanced by succeeding in adopting, adapting or developing useful new technologies in a confidential setting, rather than by publication alone.

The consequent impacts on all New Zealanders' general science and technology literacy may also be significant.

7.3 Increased expertise in businesses

The new R&D workers will be among the more intellectually able in the companies. As a result some will naturally seek to develop business skills and move up into management or marketing, making decisions on future R&D investment and market development.

Our business schools also need to lift their game. They need to produce specialist business graduates with expertise in going to the global market. For technical staff, the business education will probably be at postgraduate level.

As a result of the increased jobs and the focus on development, the private sector will have hundreds, if not thousands, of people with technical knowledge and international marketing skills looking for market opportunities – leading to further opportunities.

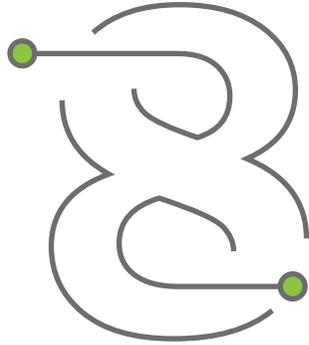
As a consequence of the R&D activity in companies, there will be considerably enhanced expertise in those companies to use new technologies, or adapt them for local needs.

With a greater diversity of business leaders at the helm, companies exploring offshore markets will be better equipped to invest wisely in R&D and market development. This will include building clusters with other visionary companies based in New Zealand.

7.4 Increased attractiveness for businesses to remain in New Zealand

Primary industries are immobile (“sticky”) to the New Zealand economy because their raw materials are grown here. Other companies tend to migrate close to their markets, or to where there is better access to suitable labour or capital. Those that do not migrate are held here due to compelling advantages such as access to critical intellectual property, clustering opportunities with other synergistic companies or a particularly well-skilled workforce. Clusters create hubs of excitement for young, motivated and highly skilled technology developers – they thrive on creative interaction.

As a consequence of the available pool of skills and their cluster linkages more high technology companies will see an incentive to remain in New Zealand. In this way our economy's stickiness will improve.



THE NEW PROPOSALS FOR POLICY TO BOOST INNOVATION EXPERTISE IN THE PRIVATE SECTOR AND INCREASE STICKINESS

New policy instruments like technology grants and vouchers are primarily concerned with technology development and only improve innovation expertise indirectly. They improve stickiness and will increase innovation expertise, but may not be the best value for money in boosting expertise.

In theory the Performance Based Research Fund (PBRF) allows for recognition of “fitness for purpose” of research as a quality measure and university promotion criteria for academics might take into account work with industry. However many academics, including those in fields such as engineering and technology, are convinced they should focus only on academic publication and do not need to also work with industry to progress their careers.

The overarching goal of any new policy must be to get parts of the university and CRI systems focussed on boosting innovation expertise, as well as creating scholarly output. This suggests a change of policy is needed.

Thus, the key question is: how would an extra \$500 million of government investment lead to a further \$1-2 billion of private investment, 5,000 to 8,000 R&D jobs in the private sector, and an annual demand for several hundred postgraduates by the private sector?

8.1 Proposal 1

- Take at least some of the extra investment the Government is prepared to make to create an innovation expertise fund, to be applied in two shares – one share for the universities, the other for CRIs.
- Universities
 - Given that the amount of new Government investment to the innovation expertise fund might be limited, explore re-allocating the existing investment. The best possibility might be to divert some of the PBRF, leaving the remaining part to continue to be allocated as currently.
 - The Institutes of Technology and Polytechnics (ITPs) could also be allowed to enter the innovation expertise fund by contributing funds – in fact this approach may be better altogether than them being in the PBRF.
 - Allow university departments to choose the extent to which their research activity is to be assessed under each of the innovation expertise fund and the PBRF.
 - In respect of the innovation expertise fund, the measure of the fitness for purpose quality of each participating department's research will be considered against three criteria. These are: evidence of economic impact of the research; the amount of private sector research investment attracted by the department; and the number of Level 8 or above graduates who have moved directly to New Zealand-based private sector employment.
 - Departments could be scored on a numerical scale, and their allocation of the university share of the innovation expertise fund (dollars/year for the period until next review) would be determined by combining the rating score and the measure of the extent of their activity.
 - The resultant dollars would not be transferred to the university as part of a lump sum allocation. Rather they would become available as potential co-funding tagged to the department. To pick up those dollars, the department would have to at least match them with new private sector co-investment for projects involving students studying at Level 8 or above with the company (i.e. 1:1 is a minimum co-investment ratio but the department could accept a higher company co-investment rate).
- Within this context, a high degree of flexibility could be allowed so that departments, universities, ITPs and CRIs can pool part or all of their tagged funds to meet private sector company needs. The total co-funding would be allocated back to departments on a pro-rata basis. Thus collaboration would not be inhibited and might even grow.
- On the next re-assessment of the department the overall co-investment ratio the department had achieved would be a key performance indicator towards determining the new score.
- The outcome of this approach is that academics would be strongly incentivised to go out into industry, build strategic R&D partnerships with companies, and to transfer skilled people to the company at the end of the project.
- The net change would be to rebalance the engineering schools, the ICT faculty and even some parts of science to be both scholarship and industry-focussed, rather than predominantly focussed on only scholarly outputs.
- CRIs
 - It is suggested that in the first instance Industrial Research Limited (IRL) be changed to an industrial development agency that is allocated a share of the innovation expertise fund. Part of IRL's core funding could also be recognised as a component of the innovation expertise fund. IRL would still deliver important R&D but become more focussed on innovation expertise development.
 - IRL's performance would be at the institution level i.e. its relevant key performance indicators would be the extent of industry co-investment, and the personnel transferred to the private sector.
 - Other CRIs with a significant role to develop private sector expertise could be partly converted to industrial development mode by recognising some of their core funding in a similar manner.

- Partitioning the innovation expertise fund between CRIs and the universities
 - To the extent that there needs to be contestability, a competitive test could be used from time to time for determining the optimum share of the innovation expertise fund allocated to CRIs on the one hand and to universities on the other. If overall, the summed performance of the universities exceeds that of CRIs the shares would change in favour of the universities and vice versa. However, this test should not disincentivise cooperation at an operational level.

8.2 Proposal 2

- A second proposal is to provide direct co-funding for the early years employment of R&D workers in new positions in industry. For example, if 50 per cent of salary (up to a maximum subsidy of \$50,000) for first year, and 25 per cent (maximum subsidy \$25,000) for the second year were allowed, then 500 new R&D workers per year would cost just \$30 million per annum.
- This would incentivise job creation and would reduce the offshore drift of our brightest graduates who are looking for jobs associated with a cutting edge technology development/innovation focus.
- It is important to set the cap high enough so the undersupply of R&D workers in disciplines that are highly in demand in other job roles would not occur
- There would need to be clear rules to ensure only new activities were co-funded.

8.3 Outcomes of these policy proposals

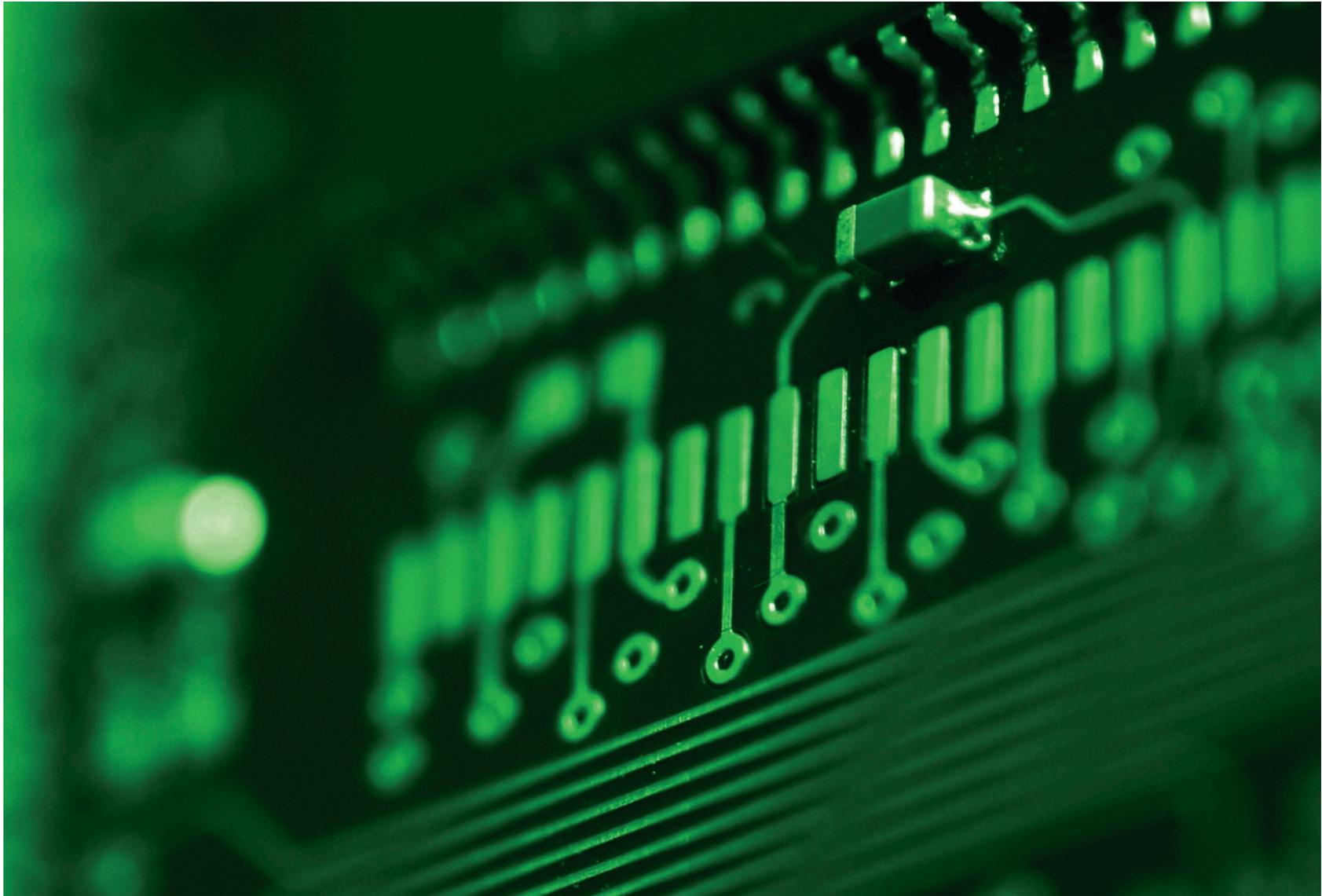
Proposal 1 would result in academics being strongly incentivised to go out into industry, build strategic partnerships with companies, and to transfer skilled people to the company at the end of the project. Clustering would be enhanced. The net change would rebalance the engineering schools, ICT faculties and even parts of science faculties to be industry-focussed, rather than predominantly focussed on academic outputs.

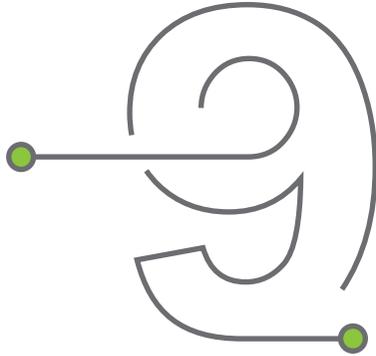
Proposal 2 incentivises small private businesses to take on R&D staff, thereby having R&D expertise in-house. It lowers the barrier of high initial cost to get a research worker established. This in turn encourages R&D to become part of a business as usual occurrence, thus leading to ongoing R&D and opportunities being developed for businesses.

Both the proposals would incentivise R&D job creation. This would reduce the offshore drift of our brightest graduates looking for jobs associated with a cutting edge technology development/innovation focus. If the salary were competitive then it would also attract New Zealand's brightest graduates into R&D, thereby creating fresh interest in the sector.

8.4 Fit of the policy proposals to other policy instruments for business R&D

How these proposals fit with vouchers and technology grants would need to be resolved. IPENZ suggests the best approach would be to give the company a choice of schemes best suited to their needs. Over time, the relative allocations of government investment between types of business-related R&D can be adjusted.





WHY WILL THESE NEW PROPOSALS ACHIEVE MORE THAN OTHERS?

Until very recently, the criteria for obtaining and retaining public research investment in the CRIs and universities has led to those bodies operating strong staff retention policies, and rewarding a track record of scholarly publications more than commercial outcomes.

The net result has been a reduction over the last decade in transferring R&D staff into the private sector, with a corresponding reduction in upskilling. The low absorptive capacity of the private sector to R&D (and indeed other new technologies) remains a major issue.

The two policy proposals presented will do better than other policies by:

- focusing on building innovation expertise, and building skill pools to make New Zealand “sticky” to high technology manufacturing. (The companies build local skills networks and want to keep close to their university and CRI collaborators. The smart university academics or CRIs are incentivised to keep close to their company and build clusters to retain the client for the future.)
- incentivising research providers to shift their focus to developing innovation potential in industry, not just to obtain investment from industry for work carried out at the research provider’s site
- providing expanded career paths based on science, mathematics, technology and engineering study. This will expand demand for relevant tertiary study and ultimately lead to rebalancing New Zealand’s tertiary education investment much closer to the OECD norm.
- shifting the decision point on what research to perform away from a centralised bureaucratic process to a distributed decision making close to market information
- incentivising companies to increase their investment and grow their potential to adopt, adapt and use new technology for commercial benefit
- reducing barriers for small businesses wanting to get R&D going in their own premises
- making New Zealand a visibly a smarter leading edge technology-based society.

APPENDICES

Appendix 1: How we compare

New Zealand is languishing at about 25th in the OECD league table, well behind Australia. On the basis of GDP per capita however, New Zealand's position is similar to that of Korea and the Czech Republic. New Zealand's position is well behind Australia, the United Kingdom and the United States, as shown in **Figure 8**²³.

Similarly, for productivity, New Zealand is languishing at about 23rd place when GDP per hour worked is compared, as shown in **Figure 9**²⁴. Again, this is well behind Australia. New Zealand's GDP per hour worked is similar to that of Greece and the Slovak Republic.

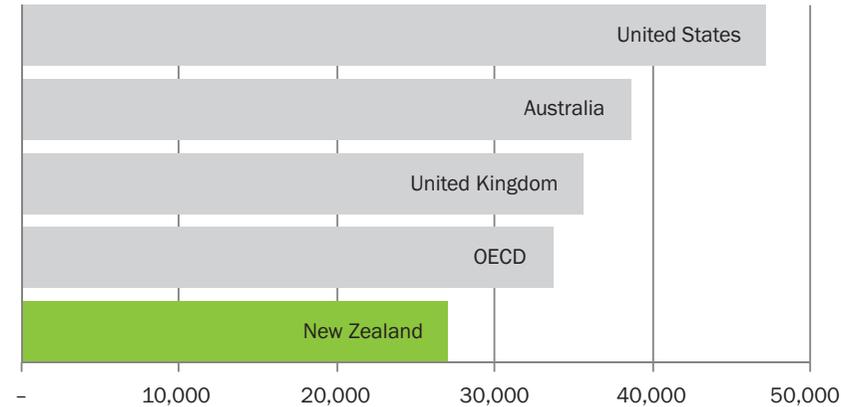


Figure 8 – New Zealand's GDP per capita compared with Australia, the United Kingdom, United States of America and the OECD overall.

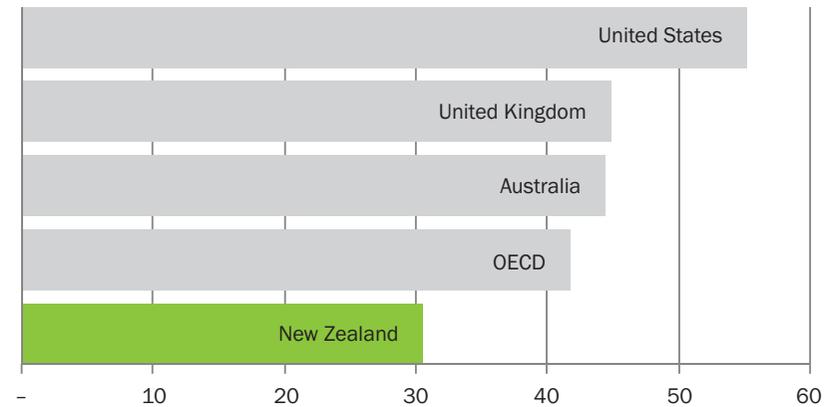


Figure 9 – New Zealand's GDP per hour worked compared with Australia, the United Kingdom, United States of America and the OECD overall.

The Treasury has noted that “on average, an hour worked in New Zealand produces approximately 30 per cent less output than an hour worked in Australia”²⁵. The gap in GDP per capita between New Zealand and Australia is not a new phenomenon and has grown over time, as shown in **Figure 10**.

New Zealand is also languishing when national income per capita is compared with OECD countries, as shown in **Figure 11**²⁶. New Zealand ranks 25th, with income of US\$24,997 per capita. Australia’s national income per capita is approximately US\$36,897. New Zealand’s national income per capita is similar to that of Slovenia and the Czech Republic.

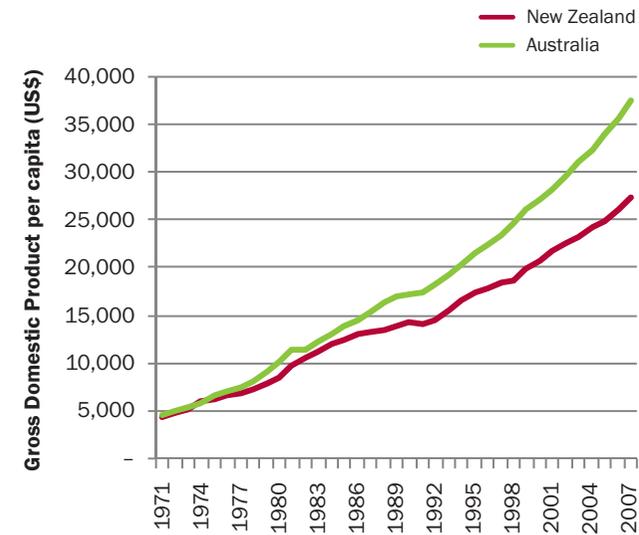


Figure 10 – Historical GDP of New Zealand and Australia.

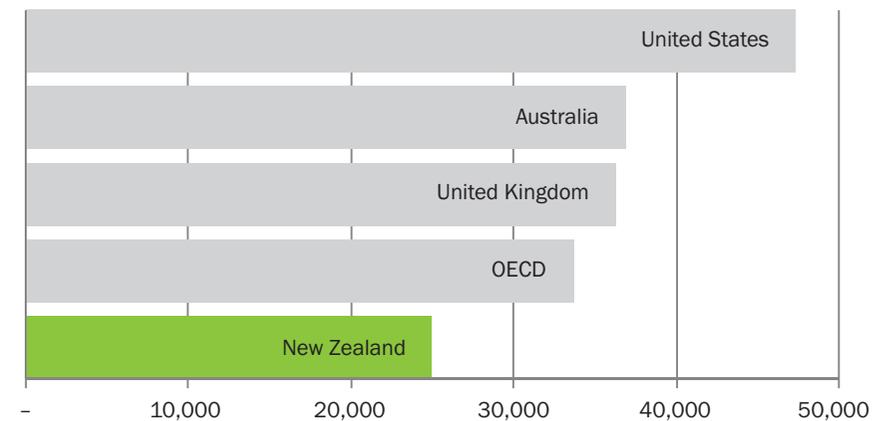


Figure 11 – New Zealand’s gross national income per capita compared with Australia, the United Kingdom, United States of America and the OECD overall.

New Zealand's export income is far too low – lower than Australia, the United Kingdom and the OECD overall as shown in **Figure 12**²⁷.

APPENDIX 2: Why is IPENZ involved in the innovation discussion?

As the professional body for New Zealand's engineers, IPENZ contributes to the public good by providing an engineering perspective on matters of national importance. Innovation is definitely of national importance.

Since 1999 IPENZ has developed policy documents relating to economic development and innovation. These documents include:

- Informatory notes, including:
 - Informatory Note 1 – *The Role of Engineers in Creating National Wealth* (December 2000)
 - Informatory Note 2 – *Policy and Leadership Framework for Wealth* (May 2001)
 - Informatory Note 3 – *The Role of Technology Education in NZ's Future Prosperity* (July 2001)
 - Informatory Note 5 – *Wealth Creation in NZ Improving Intellectual Property Realisation* (November 2001)
 - Informatory Note 7 – *The Drive for Innovators and Entrepreneurs – School Governance and Technology Education* (August 2002)
 - Informatory Note 8 – *Managing Innovation* (August 2002)
 - Informatory Note 11 – *Building Industrial R&D – The Missing Billion Dollars* (March 2003)
- *Growing Smartly: A Review of National Policies for Fostering Research, Development, Innovation and Entrepreneurship in New Zealand* (2004). This document outlined a plan to reshape New Zealand's R&D policies to encourage innovation.
- *Prosperity through Productivity: A Plan of Action* (2005). This document outlined a comprehensive plan for New Zealand's economic development. See **Appendix 3** for more detail.
- *Closing the Productivity Gap* (2009). This document set out new policies needed to increase New Zealand's labour productivity.

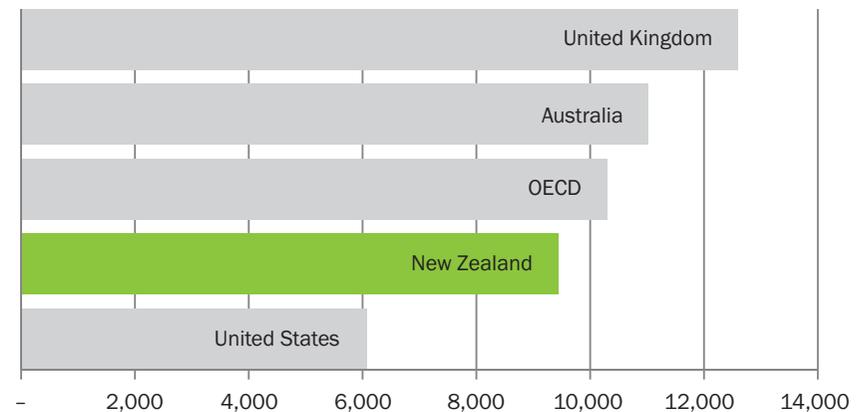


Figure 12 – Export earnings (goods and services) per capita of New Zealand compared with Australia, the United Kingdom, United States of America and the OECD overall.

APPENDIX 3: Previous proposals presented by IPENZ

In *Prosperity through Productivity* (2005) IPENZ presented an action plan to improve New Zealand's productivity. This action plan is reproduced below. Now, six years later, readers may wish to reflect on the continued relevance and benefit of foresight by the engineering profession's lead body.

Actions presented in Prosperity through Productivity

Action 1: National leadership and public support

The Government has a vital role to explain issues to the people of New Zealand and achieve their acceptance on a way forward. The issues people need to understand are the:

- nature of labour productivity and the value New Zealand will derive from increasing it – we need sufficient prosperity to be able to afford high quality social, educational, health and environmental services
- need to apply financial capital effectively to infrastructure, fast follower uptake of external intellectual property (IP) and innovation to lift labour productivity
- need to lift our national business capability to manage and grow IP-based business
- need to lift private sector investment in IP-based business development
- national need to develop leading edge technological literacy through strategically-focused tertiary education initiatives in engineering, technology, creative design and their nexus with business
- need to maintain a light-handed regulatory and compliance structure so the private sector can do what it does best – develop prosperity
- need to progressively increase the sustainability of our activities by implementing sophisticated technically-based strategies
- need to address environmental concerns does not mean discouraging investment in productive capacity – both objectives can be met through encouraging less resource-intensive service industries.

Action 2: Boosting private sector capital investment

The Government must incentivise the private sector investment through some or all of the following actions:

- lowering company taxation rates to encourage retained earnings for re-investment in business
- continuing modernisation of depreciation regimes to allow the more rapid recycling of capital in business
- consider taxation or other regulatory changes so the total benefit, ie risk ratio, including capital gains for real estate is not perceived to be higher than other investment opportunities
- investing a greater proportion of the New Zealand Superannuation Fund in productive New Zealand businesses and infrastructure to assist their capitalisation and expansion.

Action 3: Boosting private sector investment in intellectual capital value (ICV) creation

The Government must incentivise private sector investment by some or all of the following actions:

- redefining the role of CRIs in their activities under the so-called economic goal within Vote Research, Science and Technology so their primary measure of success is private sector co-investment, thereby driving up the pressure for CRIs to draw investment from the private sector
- both in the CRIs and elsewhere, moving away from picking winners by allocating public sector R&D investment in predetermined sectors towards co-investment with the private sector in any activity where there is reasonable evidence of follow-through capability to take new ICV to market
- reconsidering the grants/tax relief available to the private sector in general, and small to medium enterprises (SMEs) in particular, including considering subsidising initial employment of R&D workers in small companies.

Action 4: Directing public sector investment in ICV creation

In line with our previous recommendations in *Growing Smartly*, the Government must redirect public sector investment in R&D under the economic goal towards ICV creation by some or all of the following actions:

- measuring CRI performance on an outcomes basis for which the key performance indicators are private sector co-investment and transfer of research-capable personnel to industry
- recognising fitness for purpose as a measure of research quality, putting greater value on know-how and industry/research provider linkages, and developing a better understanding of the nature of basic research in engineering.

Action 5: Building the capability of our workforce to use physical capital

The Government must provide support for programmes that build participation in education within economically-critical disciplines to internationally acceptable standards:

- long-term assertive actions are required to address the key shortfall in engineering and technology at all levels from trades to doctorate level
- scholarships and bursaries provided for postgraduate study must reflect the market cost of engineering and technology graduates so they can be attracted to higher degrees.

Action 6: Building the capability of our workforce to create and use ICV

The Government must undertake the following actions:

- analyse the nature of tertiary education in the key sectors of engineering, technology and design, and their relationship with business education, to develop qualifications that better meet ICV-based industry needs
- use CRIs as capability transfer agencies to move R&D-capable people into the private sector
- create technical/business capability development programmes for SMEs.

Action 7: Maintaining suitable national infrastructure

The Government must undertake the following actions:

- continue increased public sector capital investment programmes in key infrastructure

- adopt policies that encourage further private sector investment in key public infrastructure projects
- review resource management legislation to lower the risks for attracting private capital to infrastructure projects
- develop high quality resource allocation systems, particularly for water.

Action 8: Maintaining economic efficiency

The Government must undertake the following actions:

- review resource management legislation to lower the risks for attracting private capital to innovation-based projects
- ensure that if employment law is further changed workers do not receive new entitlements unless it can be demonstrated that there are compensatory gains in labour productivity
- ensure that regulatory costs imposed on New Zealand businesses do not create undue penalties in comparison with international competitors.

Action 9: Being a role model in the Government's own activities

The Government should demonstrate its own commitment through activities such as:

- assertive actions to demonstrate that it uses public capital wisely using the best possible mix of engineering, technology, design and business skills
- demonstrating that State Owned Enterprises (SOEs) and other Crown entities conform to best practice governance and senior management standards and skills mixes
- ensuring directors on state sector boards are chosen for their knowledge and expertise of the particular business
- including a wider range of disciplines in public sector senior management development programmes
- moving high performing managers between the public and private sectors
- assertive action on sustainability.

REFERENCES

- ¹ New Zealand Treasury 2008, *Putting Productivity First: New Zealand Treasury Productivity Paper 08/01*, New Zealand Government, Wellington. Available at: <http://www.treasury.govt.nz/publications/research-policy/tprp/08-01>
- ² Capital Market Development Taskforce 2009, *Capital Markets Matter: Report of the Capital Market Development Taskforce*, Ministry of Economic Development, Wellington. Available at: http://www.med.govt.nz/upload/71047/MDV6220_CMD_TombStone_04c.pdf
- ³ New Zealand Treasury 2008, *Putting Productivity First: New Zealand Treasury Productivity Paper 08/01*, New Zealand Government, Wellington. Available at: <http://www.treasury.govt.nz/publications/research-policy/tprp/08-01>
- ⁴ New Zealand Treasury 2008, *Putting Productivity First: New Zealand Treasury Productivity Paper 08/01*, New Zealand Government, Wellington. Available at: <http://www.treasury.govt.nz/publications/research-policy/tprp/08-01>
- ⁵ New Zealand Treasury 2008, *Putting Productivity First: New Zealand Treasury Productivity Paper 08/01*, New Zealand Government, Wellington. Available at: <http://www.treasury.govt.nz/publications/research-policy/tprp/08-01>
- ⁶ Organisation for Economic Cooperation and Development 2010, *Key Figures*, OECD, France. Available at: <http://www.oecd.org/dataoecd/9/44/41850733.pdf>
- ⁷ Organisation for Economic Cooperation and Development 2010, *Key Figures*, OECD, France. Available at: <http://www.oecd.org/dataoecd/9/44/41850733.pdf>
- ⁸ Ministry of Research, Science and Technology 2009, *New Zealand RS&T Scorecard 2009*, New Zealand Government, Wellington.
- ⁹ New Zealand Treasury 2008, *Putting Productivity First: New Zealand Treasury Productivity Paper 08/01*, New Zealand Government, Wellington. Available at: <http://www.treasury.govt.nz/publications/research-policy/tprp/08-01>
- ¹⁰ New Zealand Treasury 2008, *Putting Productivity First: New Zealand Treasury Productivity Paper 08/01*, New Zealand Government, Wellington. Available at: <http://www.treasury.govt.nz/publications/research-policy/tprp/08-01>
- ¹¹ New Zealand Treasury 2008, *Putting Productivity First: New Zealand Treasury Productivity Paper 08/01*, New Zealand Government, Wellington. Available at: <http://www.treasury.govt.nz/publications/research-policy/tprp/08-01>
- ¹² New Zealand Treasury 2008, *Innovation and Productivity: Bright Ideas to Work Smarter*, New Zealand Government, Wellington. Available at: <http://www.treasury.govt.nz/publications/research-policy/tprp/08-05>
- ¹³ New Zealand Treasury 2008, *Innovation and Productivity: Bright Ideas to Work Smarter*, New Zealand Government, Wellington. Available at: <http://www.treasury.govt.nz/publications/research-policy/tprp/08-05>
- ¹⁴ Organisation for Economic Cooperation and Development 2010, *Ministerial Report on the OECD Innovation Strategy*, OECD, France. Available at: <http://www.oecd.org/dataoecd/51/28/45326349.pdf>
- ¹⁵ Organisation for Economic Cooperation and Development 2010, *Multi-factor Productivity*, OECD, France. Available at: <http://stats.oecd.org/Index.aspx?DatasetCode=MFP>

¹⁶ IPENZ 2001, *Informatory Note 5: Wealth Creation in New Zealand Improving Intellectual Property Realisation*, Wellington New Zealand.

¹⁷ Shangqin, H., McCann, P. and Ozley, L., 2009, *Innovation in New Zealand: Issues of Firm Size, Local Market Size and Economic Geography*, Department of Economics, College of Business and Economics, University of Canterbury, Christchurch. Available at: http://ir.canterbury.ac.nz/bitstream/10092/2601/1/12617422_Innovation.pdf

¹⁸ Organisation for Economic Cooperation and Development 2010, *Key Figures*, OECD, France. Available at: <http://www.oecd.org/dataoecd/9/44/41850733.pdf>

¹⁹ Organisation for Economic Cooperation and Development 2010, *Measuring Innovation: A New Perspective*, OECD, France. Available at: <http://dx.doi.org/10.1787/835355261387>

²⁰ Organisation for Economic Cooperation and Development 2010, *Ministerial Report on the OECD Innovation Strategy*, OECD, France. Available at: <http://www.oecd.org/dataoecd/51/28/45326349.pdf>

²¹ Organisation for Economic Cooperation and Development 2000, *Mobilising Human Resources for Innovation*, OECD, France.

²² Industrial Technology Research Institute website - <http://www.itri.org.tw/eng/about/article.asp?RootNodeId=010&NodeId=0101>

²³ Organisation for Economic Cooperation and Development 2010, *OECD Estimates of Labour Productivity Levels*, OECD, France. Available at: <http://stats.oecd.org/Index.aspx?DataSetCode=DECOMP>

²⁴ Organisation for Economic Cooperation and Development 2010, *Country Statistical Profiles 2010*, OECD, France. Available at: <http://stats.oecd.org/Index.aspx?DatasetCode=CSP2010>

²⁵ New Zealand Treasury 2008, *Putting Productivity First: New Zealand Treasury Productivity Paper 08/01*, New Zealand Government, Wellington. Available at: <http://www.treasury.govt.nz/publications/research-policy/tprp/08-01>

²⁶ Organisation for Economic Cooperation and Development 2010, *Country Statistical Profiles 2010*, OECD, France. Available at: <http://stats.oecd.org/Index.aspx?DatasetCode=CSP2010>

²⁷ Organisation for Economic Cooperation and Development 2010, *Country Statistical Profiles 2010*, OECD, France. Available at: <http://stats.oecd.org/Index.aspx?DatasetCode=CSP2010>



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