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OutLook

(February 2009)

Research & Development

Foreword

This series of papers has been developed to underpin the policy position advocated by the New Zealand Manufacturers and Exporters Association (MEA)[1].

"The Association supports a targeted taxation mechanism to enhance and accelerate innovative behaviours in New Zealand firms."

The Association advocates a targeted tax approach to enhance and accelerate innovative behaviour in New Zealand firms. We draw on the analysis and experience of our membership, and other research, to substantiate and present our perspective on how New Zealand can increase the growth rate of productive innovation and enjoy a first world future.

New Zealand needs a range of policy settings that support and encourage innovation. We see that this support is best delivered through the tax system, whereby those actually creating wealth are encouraged to re-invest in further wealth producing activity. Support for research and development (R&D) is helpful, yet our firms require further support for downstream R&D commercialisation; expensing plant, equipment and patent costs, early stage investment deductibility and tax credits for skills development. These or similar taxation measures would form the start of a coherent framework that would stimulate and encourage a diverse range of innovation across our entire economy, arrest our economic decline and begin our climb back up the ranks of rich nations.

The Value of Innovation

The commercial realisation of research and development forms the basis of growth in the tradeable (real) economy. Over time, that technology and its related products tend to fall in price in real terms, and although costs can be lowered, inevitably margins will be eroded. In the face of this trend, profitability can only be improved by selling to more markets, or selling new, and different products. This process is relentless. All competitors face the same pressure and must take a place on the 'innovation treadmill' to remain competitive.

Having the most advanced technology is not a lasting answer. Think of JVC and VHS videotape transport mechanisms. Patents and specialist manufacturing capability, license agreements, and market dominance count for little when superior DVD technology is created by the Chinese at lower prices. Higher productivity or lower costs of production are not, of themselves, lasting answers; there is always someone willing to work harder for less. Even quality fades in importance when every product is fit for purpose; ultimately only price matters.

New products (device and service innovations) are the weapons in the competitive advantage battle. Winning that battle will support economic growth.

"New products are the weapons in the competitive advantage battle."

With this view of growth, it follows that if New Zealand falls off, or chooses to step off the innovation treadmill, then we will fail to pass on the benefits of living in a developed economy to future generations.

Growth

Growth is one of the most important topics in macroeconomics with many growth models[2] having been proposed over the years. Technological progress is one of the most important drivers for long-term Gross Domestic Product (GDP) growth, which can be promoted by the development and exploitation of intellectual assets.

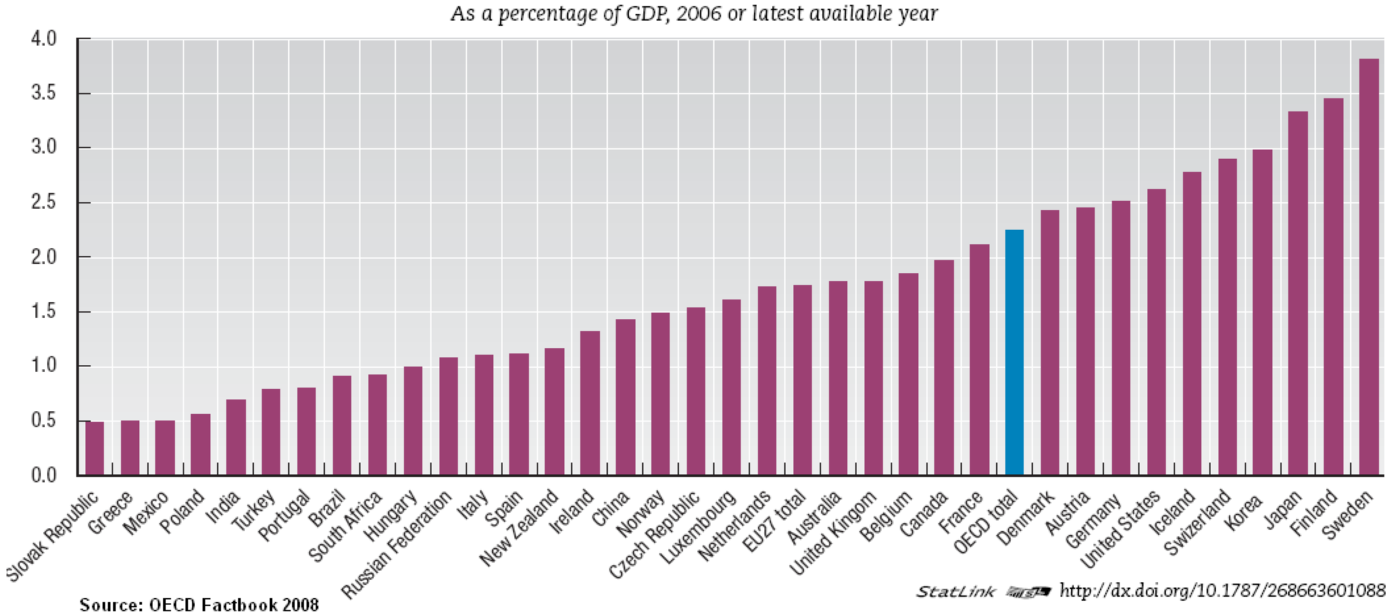
"Technological progress is one of the most important drivers for long run per capita GDP growth."

The principle elements are creation (R&D and staff training), protection (know how and patents), and operational (equipment, software and organisational change). The focus of this paper is on R&D, which is framed and driven by commercial requirements.

R&D Investment in New Zealand

In 2006 New Zealand spent approximately 1.17% of GDP on R&D, which was well below the Organisation for Economic Cooperation and Development (OECD) average of 2.25% (see Figure 1).

Figure 1 Gross domestic expenditure on R&D
As a percentage of GDP, 2006 or latest available year



In New Zealand R&D expenditure is reported from business, government and higher education (university) sectors; state-owned enterprises and private non-profit organisations are included in the business sector. Compared to the rest of the OECD, New Zealand's R&D investment has a very different sector profile (Figure 2). New Zealand's level of government and university R&D expenditure is similar to the OECD average. Business R&D has underperformed with expenditure at 0.49 percent of GDP, which is a third of the OECD average of 1.53 percent.

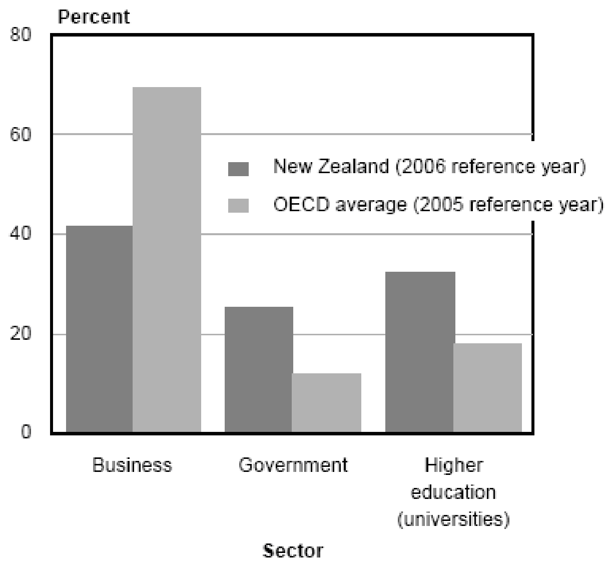
"Firms are more aware of market needs and are able to target research in those areas."

Firms are regarded as efficient in focusing R&D on customer needs as the forces of 'competitive selection' make product and service improvement crucial to their survival. Firms have the ability to carry out the development side of R&D, which is necessary to commercialise the innovation in order to claim the economic return. Firms are also more aware of market needs and are able to target research in those areas.

The highest levels of R&D spending come from those companies in the 'elaborately transformed[3]' (ETM) sector. As such, economy wide aggregate levels of R&D indicate the mix of industry types in a given economy demonstrating a proportionately low level of ETMs in New Zealand.

"The highest levels of R&D spending come from those companies in the elaborately transformed (ETM) sector."

Figure 2 Gross Expenditure on R&D by sector compared with OECD average *



* OECD data not available for the 2006 reference year.

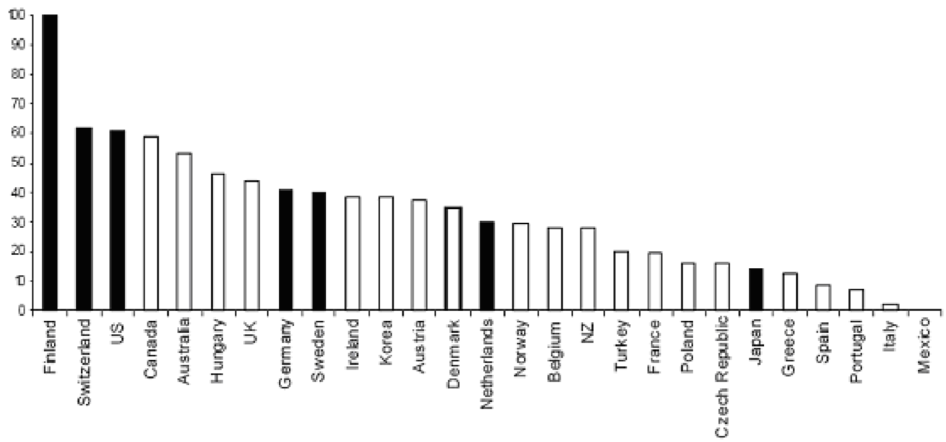
Source: Statistics NZ, R&D 2006

In New Zealand, a significant proportion of Government spending on R&D is made via Crown Research Institutes (CRIs). This spending is predominately focused on the primary sector, and in 2006, only 13% of Government expenditure on R&D was targeted at industrial development.

"Only 13% of government expenditure on R&D was targeted at industrial development."

Competitive pressures require spending by firms to be commercially effective, but Government R&D is not as 'commercial' as private investment. On that basis, New Zealand ranks below average among OECD countries in terms of commercialisation of research (see Figure 3).

Figure 3 Index for Commercialisation of Research



Source: OECD, Benchmarking Innovation Policy and Innovation Framework

If higher economic growth is to be expected from increased investment in R&D, then increased commercial R&D spending and better targeted (at ETM activity) R&D spending by Government is necessary.

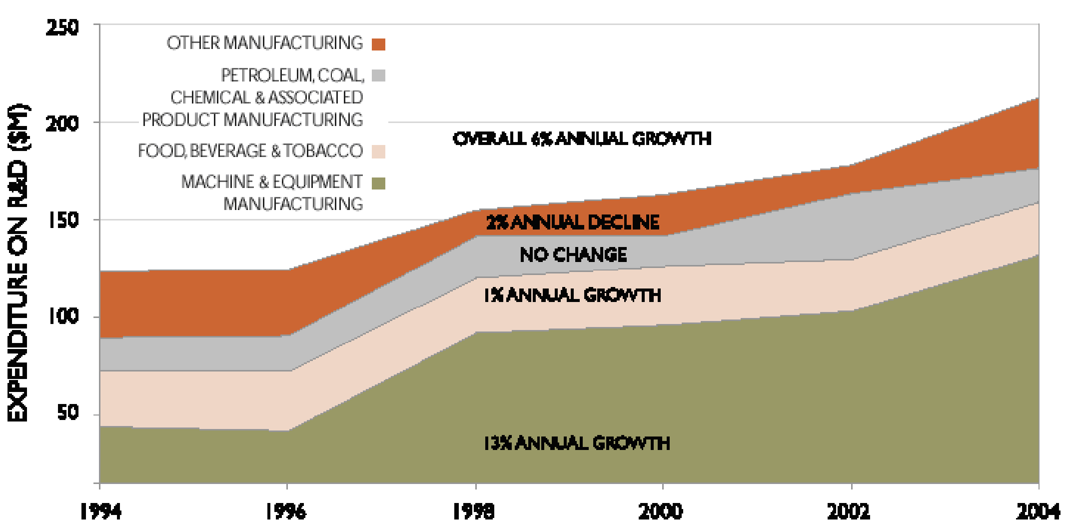
R&D activities can raise technological complexity, and when successfully commercialised, can improve business profitability and boost economic growth. Even a commercial failure can improve the skills of those involved. Furthermore, the spill-over benefits to the rest of the economy can be significant. Given the economic benefits of R&D successes, public policy support for R&D seems straightforward. However, some care needs to be applied when discussing what is the right level of R&D. For example, a boat builder might naturally invest less than others involved in high technology electronics.

The "right" level of aggregate commercial R&D is really a function of activity mix in the economy, and the level of R&D required in each set of competitive firms to stay in the game. What is critical is that New Zealand does not expect local elaborately transformed manufactures (ETM) activity to compete when other jurisdictions do more to support R&D. Taking ETM activity for granted or ignoring the sector will cause its demise. Traded products are the carriers of the R&D efforts; without these products there is little or no payoff from the R&D investment.

"Traded products are the carriers of R&D efforts; without these products there is little or no payoff from the R&D investment."

In the year to September 2006, manufacturing represented 14.7% of GDP and 30.39% of exports. The R&D 2006 Survey reports that 52% of Business Expenditure on R&D (BERD) carried out by manufacturers had fallen by 4% since the 2002 survey[4]. However, BERD in the primary and service sectors has increased by 0.5% and 3.0% respectively. Primary and agricultural production is volume limited due to resource constraints, and research tends to focus on land use and cost reduction. Compared with manufacturing, the development potential is limited.

Figure 4 Manufacturing Industry R&D Expenditure, by Industry sub-division 1994-2004



Sources: MORST, Research and Developement in New Zealand - A Decade in Review

From the R&D perspective all industry is not equal. Primary sector related processing spends little on R&D, and ETMs tend to spend much more. For example, the machinery and equipment manufacturing sub-division is responsible for the recent increase in manufacturing R&D. Expenditure has increased almost $100 million, from $37 million in 1994 to $131 million in 2004, and the annual growth rate is approximately 13% (see Figure 4).

"The ETM sector has huge potential for growth. More ETMs equal more R&D investment, equals higher growth."

The ETM sector has huge potential for growth. More ETMs mean more R&D investment, and more R&D means more ETMs and higher growth. Public policy needs to support the development of ETMs because when the R&D is successful in commercial terms we see growth in the economy, and even when a specific attempt fails the economy will see the spill over benefit in human capital and capability improvement.

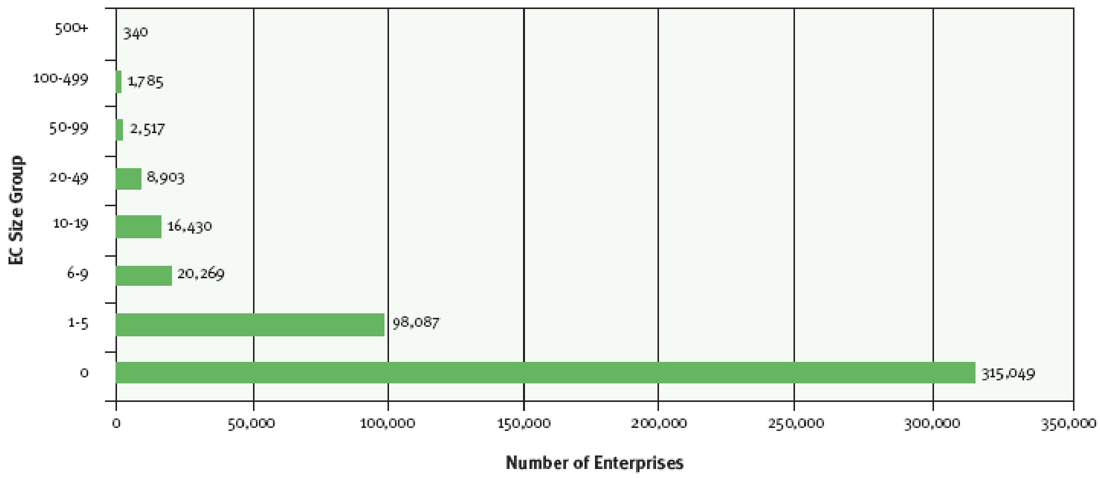
New Zealand’s Business Demography - Large Proportion of SMEs

A high level of R&D is essential for New Zealand’s economic development, an area that is currently under-performing by OECD standards. In order to develop a basis on which to promote R&D activities, it is necessary to understand New Zealand’s unique business demographics.

There are various criteria that can be used to measure the size of enterprises, such as number of employees, invested capital and turnover. The Ministry of Economic Development (MED) defines Small and Medium-Sized Enterprises (SMEs) as enterprises with 19 or fewer employees. As at February 2007 more than 97.1% of enterprises in New Zealand employ less than 20 people (see Figure 5)[5], and more than 90% of manufacturing enterprises employ 19 or less staff (see Figure 6).

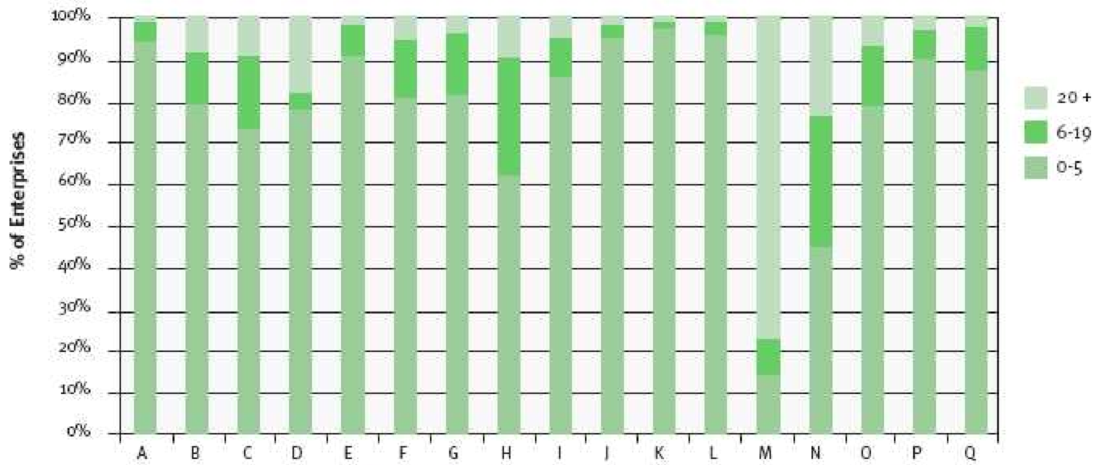
“90 % of manufacturing enterprises employ 19 or less staff.”

Figure 5 Number of Enterprises by Size, at February 2007



Source: MED, SMEs in New Zealand: Structure and Dynamics 2008

Figure 6 Percentage of Enterprises by EC Size Group and ANZSIC, at February 2007



ANZSIC Classifications

A	Agriculture, forestry and fishing
B	Mining
C	Manufacturing
D	Electricity, gas and water supply
E	Construction
F	Wholesale trade
G	Retail trade
H	Accommodation, cafes and restaurants
I	Transport and storage
J	Communication services
K	Finance and insurance
L	Property and business services
M	Government administration and defence
N	Education
O	Health and community services
P	Cultural and recreational services
Q	Personal and other services

Source: MED, SMEs in New Zealand: Structure and Dynamics 2008

Due to business growth and organisational changes, the number of employees in firms changes over time. The MED uses the notion of transition rates to measure this change. The transition rates of enterprises between size brackets[6] from 2002 to 2006 were reported in MED's annual publication, 'SME in New Zealand: Structure & Dynamics 2008'. It states that smaller firms are less likely to change in size over time.' Over 66% of firms with 1-5 employees remained the same size. Firms with 6-9 employees are the least likely to remain the same size, though, of the firms that moved out of the bracket 34.5% of firms downsized. Just over half of the firms with 10-19 employees remained the same size, where as those firms that moved were more likely to move into a smaller employment bracket. These figures show that the proportion of SMEs in New Zealand is likely to remain high.

"Smaller sized firms are able to be more flexible."

Being small is not necessarily a bad thing. Smaller sized firms are able to be more flexible when innovating and have a better understanding of consumer needs, allowing them to better anticipate market changes. Such companies often begin from just one idea or new product, with a large number started by technical people. As mentioned before, origin, or growth of ETMs, heavily depends on technical capability or other innovation.

"Many small enterprises are capable of generating innovative ideas and can even develop products."

Many small enterprises are capable of generating innovative ideas and can even develop products, yet there are other constraints and issues that make systematic R&D and the subsequent commercialisation much more difficult for SMEs. Usually initial funding and cash-flow are a challenge. Most of the funds for ETM start-ups come from savings, loans backed by personal guarantees, or R&D programmes funded by other cash flows in the firm.

The associated risks in many R&D projects are well outside the risk tolerance or understanding of major lenders. As is often said "beauty is in the eye of the beholder" and owners can often see what the potential lenders do not. Difficulties arise with risk management where the lender cannot adequately monitor risks as the project proceeds, and this forces reliance on limited funding options.

Even with a great R&D project in hand, the company may still find itself having a hard time obtaining finance due to the perception difference with lenders. Small manufacturers have limited headroom for error. The financial constraints, and the preoccupation with other management work, often preclude SMEs from investing in the deep improvement of technology, or risking the development of radical new products.

"Small manufacturers have little headroom for error."

As indicated by the low and negative size transition rates, which is often used as a proxy measure of business expansion, fundamental change is necessary to improve growth rates in New Zealand.

Government's Role in R&D

Government plays a very important role in R&D activities. In New Zealand R&D expenditure is measured across business, government and higher education (university) sectors. The government sector includes government departments, ministries, crown entities, crown-owned companies, government funding agencies, and the local government sector. In the 2006 reference year, 43% of all R&D expenditure was funded by the government, which spent a total of $784.7 million or 0.5% of GDP. The Government Expenditure on Research and Development (GOVERD)[7], which refers to R&D carried out in the government sector rather than R&D funded by the government sector, was estimated at $469.4 million which represented 0.3% of GDP. This is at the higher end of the OECD reference countries (see Table 1).

Table1 Government Expenditure on Research and Development as a Proportion of GDP

Compared with selected OECD countries and the OECD balance year, 2004[(1)]

Country	Percent
Australia	0.28
Denmark	0.17
Finland	0.33
Ireland	0.09
Norway	0.25
Sweden[(2)]	0.12
OECD average	**0.27**
New Zealand[(3)]	0.30

(1) Calculated from purchasing power parity values, OECD statistical databases, 2007.
(2) Federal and central government only.
(3) 2006 reference year.

"Government also plays an important role in encouraging the development of R&D."

The Government also plays an important role in encouraging the development of R&D. A supportive, competitive and stable tax policy can be an effective tool for encouraging an innovation-friendly business environment. Most OECD countries have specific tax incentives in place for R&D investments, and this policy instrument has become very popular for the reasons outlined in this paper; when R&D pays off, the firm grows. When it fails, spillover benefits accrue to the broader economy; almost a no lose bet for the taxpayer.

Between 1996 and 2006, the percentage of OECD countries with tax incentives for R&D has increased from 50% to 70%; that is 19 out of the 27 countries examined in 2006. There are two major forms of R&D tax incentives used: R&D tax credits and tax allowances.

"There are two major forms of tax incentives used: R&D tax credits and tax allowances."

Tax credits are a specified percentage of R&D expenditures that allows a deduction from tax liability. Tax allowances represent additional deductions from the gross income, which indirectly lower the taxable income. The value of a tax allowance depends on the company income tax rate, while a tax credit does not. R&D tax credits are more popular than allowances. As of 2006, 12 OECD countries offer R&D tax credits, and only seven countries offer R&D tax allowances. Provisions applying to R&D tax credits and allowances vary considerably from country to country, which includes deductible activity definitions, the rate that applies, the amount of any limits or caps, carry-over provisions, and so on.

Some tax incentives are based on the total level or volume of R&D expenditures, others are based on incremental increase in expenditure, and some combine both level and increment (see Table 2 for more detail).

Each calculation base has its own advantages or problems. One disadvantage of the level-based incentives is that they not only subsidise new R&D but also support the R&D a firm may well have done anyway, whereas incremental incentives can help address the problem of windfall gains.

However, it is often difficult to define a base period or base level of R&D to determine the increment or increase. Also, there is a tendency for countries to offer special treatment (i.e. give more generous tax relief) to particular targets in order to achieve other policy goals, such as encouraging public-private collaborative research or assisting small or start up activities.

Table 2 R&D tax Incentives, 2004-2005

	Level of R&D	Increment of R&D	Combination of level and Increment
Tax Credits	Canada; Italy; Japan; Korea; Mexico; Netherlands; Norway	Ireland; United States	France; Portugal; Spain
Tax Allowances	Belgium; Czech Republic; Denmark; Hungary; United Kingdom		Austria; Australia

Source: OECD

"The B-index measures the relative importance of R&D tax support across national jurisdictions."

In order to compare the relative importance of R&D tax support across national tax jurisdictions, a B-index[7] was created. The index measures how much of the present value before-tax income is required to cover the present value of a single dollar spent on R&D expenditure, and to pay the associated taxes. The relative generosity of the R&D tax provision can be calculated as one minus the B-Index, where the greater value indicates the larger the tax support associated with R&D. If there were no tax at all, the B-index should be equal to one. If there is corporate income tax and R&D expenditure is 100% deductible from revenue, the B-index will also be one. If not, all of the R&D costs are deductible, the B-index will be higher than 1, which means that more than one dollar of after-tax revenue is to cover one dollar of R&D expenditure, taking into account the tax impacts. In that case, one minus the B-index would be negative.

In 2002, Jacek Warda[8] calculated the relative generosity of R&D tax provision for large and small firms in the manufacturing sector of most OECD countries for the year 2001/2002 (see Figure 7 and 8). At that time New Zealand was on the bottom of the list for both large and small firms. These results do not come as a surprise for many people. In the rest of this paper, we will take a close look at New Zealand's R&D policy settings.

"New Zealand was on the bottom of the list for both large and small firms."

Figure 7 R&D Treatment of Large Firms, 2001/2002

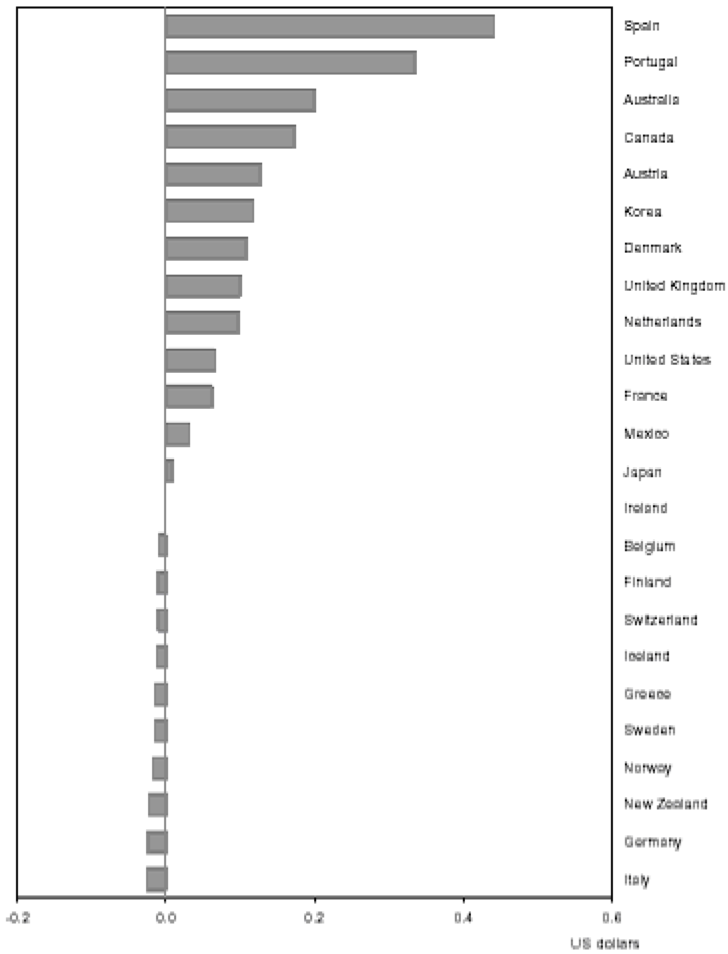
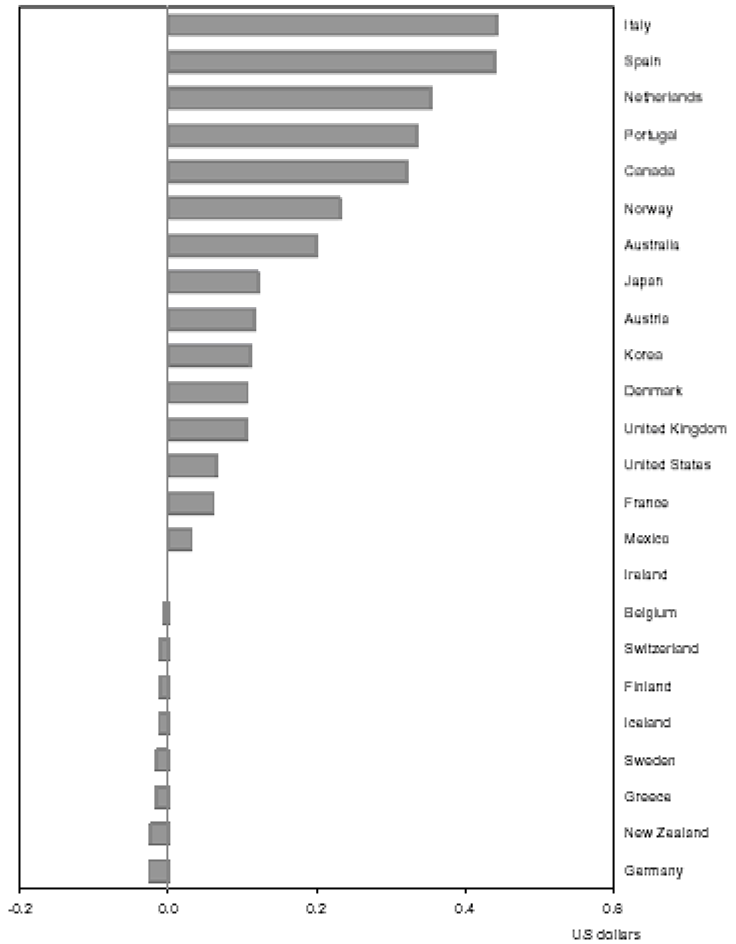


Figure 8 R&D Treatment of Small Firms, 2001/2002



Note: Comparative R&D tax incentives calculated as one minus the B-index.
Source: Warda (2002).

New Zealand's R&D Policy Landscape

The main policy instruments for stimulating business R&D were the grant funding programs delivered through the Foundation for Research Science and Technology (FRST). The three key instruments are:

- Public Good Science and Technology (PGS&T) – this funds Research for Industry (RFI), and the New Economy Research Fund (NERF). Both fund public good research that is not expected to generate immediate commercial returns, but is nevertheless intended to contribute towards increasing the future innovation and competitiveness of New Zealand industry. The difference between the two is that NERF supports 'science push' towards new industries, whereas RFI supports 'industry pull' research. However, the main recipients of funding are the CRIs and universities, with only a small fraction going directly to industry.

"However, the main recipients of funding are the CRIs and universities; only a small fraction goes directly to industry."

- Technology New Zealand (Tech NZ) – TechNZ is the Foundation for Research, Science and Technology's business investment program and is designed to support companies and people undertaking research and development projects that result in new products, processes or services. Recently the 12 support schemes within TechNZ have been simplified into one single programne, in order to provide a flexible and simple support system. Funding is provided in two areas; technology funding provides support for potential high growth companies to undertake research and development projects to develop new technology products, processes or services; capability funding is targeted both at early stage technology companies to give them the tools they need to succeed in research and development, and mature companies to help them exploit emerging areas of science and technology.

TechNZ partners were also established, which is a network of trusted regional advisors located throughout the country who help companies successfully develop and commercialise their new product.

- Co-funding for Research Consortia - the Research Consortia program is a relatively new initiative to stimulate early-user involvement and commitment to research. The scheme enables groups of New Zealand businesses, international businesses and public research institutions to undertake sustained research and technological developments in partnership with each other. This allows them to pool skills, knowledge, technologies and infrastructure.

In addition, there are a number of business support programs that provide assistance at the commercialisation end of the research spectrum. For example, New Zealand Trade and Enterprise's (NZTE) Growth Services Fund and the Market Development Assistance Scheme, and initiatives that promote access to early-stage risk capital, including the Venture Investment Fund and the Escalator Program.

"There are a number of business support programs that provide assistance at the commercialisation end of the research spectrum."

These mechanisms carried out by FRST and NZTE are 'discretionary schemes,' which stimulate business R&D, either by funding the private R&D directly or forming partnerships with the private sector.

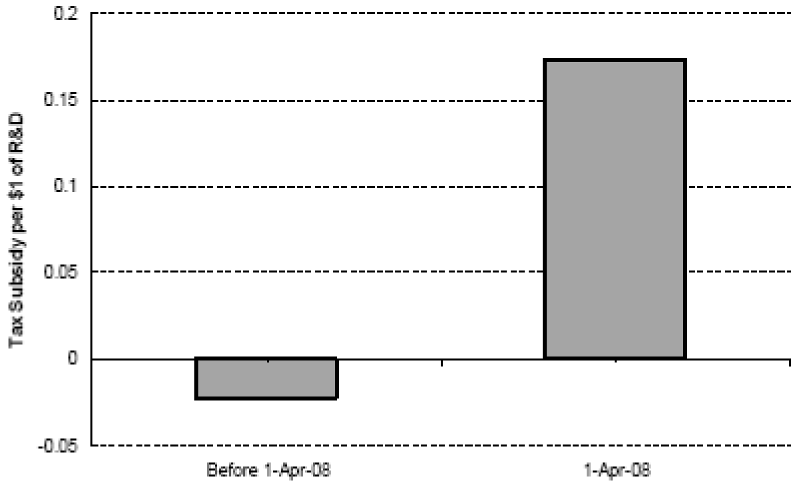
A discretionary scheme has the advantage of allowing Government to retain control over the nature of R&D conducted and the cost element is more certain. However, Government financing can displace private R&D investments, distort market competition, and encourage winner-picking behaviour. At the same time, it may create high administration and compliance costs for eligible businesses that can be highly inefficient.

Compared with the discretionary schemes, the non-discretionary schemes (i.e. tax incentives) are more market oriented. It raises the net present value of prospective research projects, and provides greater certainty about long-term assistance, thereby encouraging more sustained increases in R&D.

"New Zealand policy has been ambivalent towards R&D expenditures."

New Zealand policy has been ambivalent towards R&D expenditures early on, requiring R&D expenditures to be capitalised and latterly allowing deductibility as a business expense. In 2005 the absence of support for R&D resulted in a B-index for New Zealand of 1.023, which is worse than Norway (0.794), Australia (0.883), United States (0.934) and United Kingdom (0.904). In the 2007 Budget, the Government announced changes in the tax treatment for R&D investment to encourage innovation, which meant that R&D firms would have been eligible for a tax credit of 15% of allowable expenditure in the 2008/09 income year. The introduction of the R&D tax credit would not only have removed the tax burden on R&D, a tax subsidy of 0.173 was given for every dollar spent (i.e. B-index =0.827) (see Figure 9). In terms of country comparisons, it would have placed New Zealand on par with most OECD countries in terms of R&D policy (see Figure 10), and was expected to have wider benefits for the New Zealand economy in terms of increased productivity and international competitiveness.

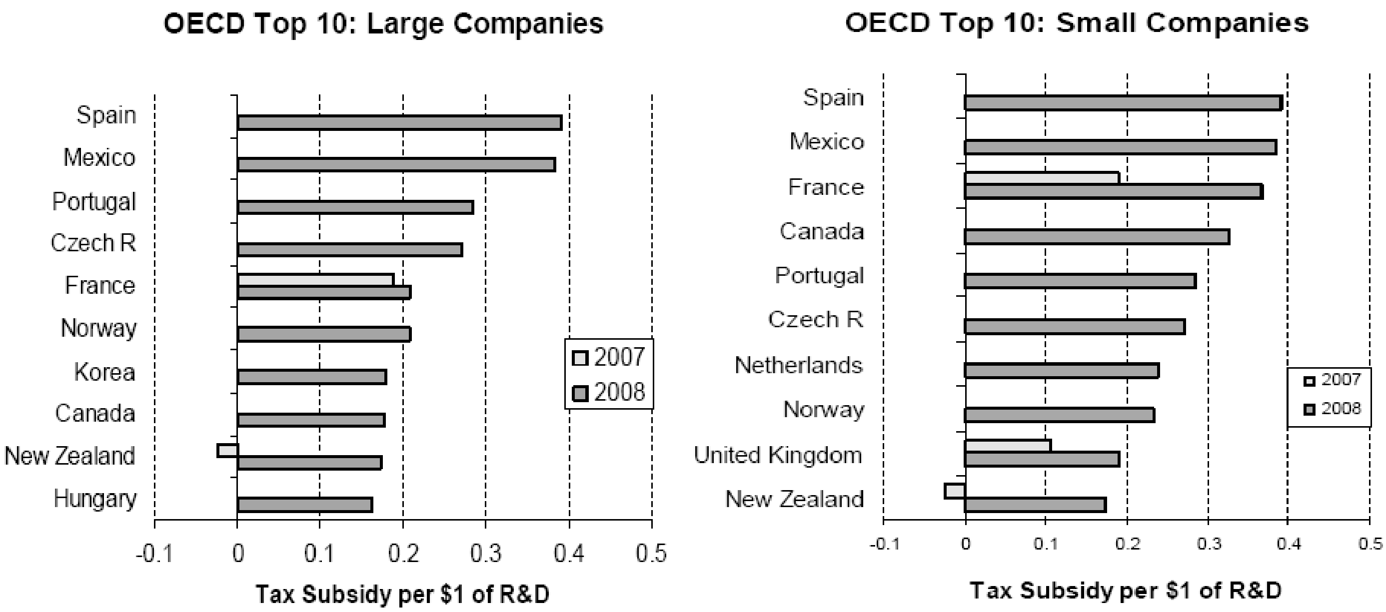
Figure 9 Tax subsidies for R&D: New Zealand



Note: 1- B-index = Tax subsidy (if positive)or Tax Burden (if negative)

"Companies that carry out R&D in New Zealand are considerably disadvantaged in comparison to other countries."

Figure 10 OECD Comparison



Unfortunately, the R&D tax credit was repealed soon after the 2008 election, and even with company tax reduced to 30 percent, companies that carry out R&D in New Zealand are considerably disadvantaged in comparison to other countries. Since the cancellation of the R&D tax credit the B-index is now at 1.02.

"Many innovative firms are likely to review their R&D activity."

Conclusion

In the long run R&D, and the capture of economic benefit by the ETM process is a key driver of productivity for any economy. The repeal of the R&D tax credit was a huge disappointment for those in the productive economy.

Prior to the introduction of the tax credit, the previous government devoted considerable amounts of effort in policy design and fine-tuning, and firms have invested large amounts of effort to maximise the advantage and implement systems to support the tax credit claims. Since the tax credit will not apply for the 2009/2010 income year, all these efforts have been wasted, and many innovative firms are likely to review their R&D activity.

Innovation is inherently risky, but the more innovation an economy produces, the greater the pay off. How to improve the environment to effectively encourage and support innovation is perhaps the greatest policy challenge faced by governments today. Only those economies that succeed in the innovation race will have a place in the world of rich nations. Our new Government has failed to recognise the need to match favourable R&D conditions offshore, instead choosing to leave our innovative firms at a comparative disadvantage.

"Innovation is inherently risky, but the more innovation an economy produces, the greater the pay off."

To boost producer confidence, the policy position of the New Zealand Manufacturers and Exporters Association is that it is best to create an environment for innovation in ETM firms by:

Encouraging more investment in productive activity:

- A balanced taxation regime across income, profits and realised capital gains[9].
- Inflation control mechanisms that do not overvalue the exchange rate.
- Extended deductibility on early stage investment R&D based firms.

Creating more R&D based commercial outturns in ETM firms:

- A tax credit for R&D.
- Expense all productive equipment and patents (see our Tax and Depreciation paper).
- A tax credit for training and skills development, targeted at new products and processes.

A range of policy settings that support innovation are necessary. Support for R&D should be considered as part of a package including expensing plant, equipment and patent costs, early stage investment deductibility and tax credits for skills development. This would form a coherent framework that would encourage a diverse range of innovation across our entire economy.

Members of the New Zealand Manufacturers and Exporters Association make nearly $2.0 billion in sales and have an export value of around $1.0 billion. Our organisation can trace its existence back to the early history of New Zealand. As a legacy of the hard work and careful financial management of the past, we have a significant asset base that enables our independence and extends our activity. Subscriptions fund only a very small part of our current operating costs.

Membership is open to all manufacturers and exporters and others at the discretion of our Council. Enquiries should be directed to mea@mea.org.nz

"A range of policy settings that support innovation are necessary."

[1] Formed by the Canterbury Manufacturers' Association (CMA) and the New Zealand Engineers Federation (NZEF) in August 2007.
[2] From Robert Solow's neoclassical growth model to Paul Romer's new growth theory.
[3] Elaborately transformed manufactures (ETM) are finished or near-finished goods with high added value.
[4] Statistics New Zealand (2007) Research and Development in New Zealand: 2006.
[5] Due to the method used to apportion the employee count to geographic units and subsequent rounding applied to derive the employee size group, the 0 employee size group for geographic units can include a count of employees greater than zero.
[6] There are eight Employee Count (EC) size brackets: 0; 1-5; 6-9; 10-19; 20-49; 50-99; 100-499 and 500+.
[7] Algebraically, the *B-index* is equal to the after-tax cost of an expenditure of one USD on R&D divided by one minus the company income tax rate.
[8] Warda J. (2002), "A 2001-2002 Update of R&D Tax Treatment in OECD Countries", report prepared for the OECD Directorate for Science, Technology and Industry.
[9] The family home should be exempt from capital tax.