The Royal Society of New Zealand

A Manifesto for Science, Technology and Innovation

How Research, Science and Technology can contribute to New Zealand – the Urgent Agenda

1. INTRODUCTION

New Zealand has introduced a range of new policies and instruments to assist innovation along a broad front from encouragement of research at the fundamental, underpinning level to assistance to businesses to build new technology into their operations and growth plans. The Royal Society strongly supports Government's broader innovation goals.

This paper aims to make a pragmatic, realistic contribution from the RS&T community to these goals. It focuses on the wealth-generating sciences and technologies. Our immediate aim is to identify how New Zealand can use R&D to turn around its economic base and to increase its economic ranking in the OECD. We recognise that analogous problems are faced in the research areas that provide an evidence-base for policy, and thus we comment specifically on these domains in Section 6.3.3.

2. THE ROYAL SOCIETY AND ITS MANDATE

The Royal Society represents science and technology in New Zealand and internationally. We promote, invest in, and celebrate excellence in people and ideas in S&T and put them to work as an example and inspiration to New Zealanders. We are the independent and authoritative voice for New Zealand's research, science and technology community. We share the view that all partners in New Zealand's knowledge society must work together**.**

The Society's Act of 1997 requires us to invest our efforts to:

Contribute to New Zealand Society by:

- Promoting public awareness, knowledge, and understanding of S&T
- Advancing S&T education
- Providing expert advice on important public issues to the Government and the community:
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Support New Zealand's S&T community by:

- Encouraging, promoting, and recognising excellence in S&T
- Providing an infrastructure and other support for the professional needs and development of scientists and technologists:
- Establishing and administering for members a code of professional standards and ethics in S&T.

3 WHY THIS MANIFESTO?

This paper fulfils our responsibility to provide expert advice on important public issues to the Government and the community. It embodies conclusions drawn from a series of four Royal Society conferences held between 1996 and 2000. The 2000 meeting reviewed ways in which urgent changes in the RS&T sectors could help to kick-start our knowledge society.

3.1 WE MUST ACT NOW

Over the past 50 years New Zealand has fallen from third to 25th in the OECD ranking of GDP per capita. Many of the countries that have overtaken New Zealand were in poverty in 1950 and faced crises situations ranging from economic desperation to national survival. They achieved their current standing through applying technology, underpinned by the provision of appropriate financial and human resource, a sound understanding of relevant areas of science, effective mechanisms for technology transfer and having a focus on a benefit to society, ie wealth generation. While there was no common path to prosperity some common philosophies can be summarised:

Vision	These successful countries embraced technology as the key to wealth
Focus	Governments took decisions and selected areas of science and technology that would meet their needs.
Commitment	Decision makers recognised that considerable time would be required to see the benefit of their actions
Investment	Governments recognised that significant selective and government-led funding would be required.

3.2 WE MUST IMPROVE OUR RESEARCH MIX

Over the past 20 years New Zealand has tackled economic crises via market-driven restructuring. While these solved some problems New Zealand still relies heavily on a commodity-driven economy in a world where commodities fall in value by 1-2% per year. As a result we have a chronic balance of payment deficit and a rapidly depreciating currency. There are no signs that the slide down the OECD ranking can be arrested or reversed. New Zealand will inevitably find it increasingly difficult to afford the benefits of the knowledge generated and applied elsewhere.

Recent increases in government RS&T funding, are encouraging, but, the level has only now re-attained the levels of the early 80s, and current funding per capita, at US$75 per person ranks us 16^{th} in the OECD; less than half that of Australia and about 30% that of the USA. Increasing the per capita expenditure to US$100 (by increasing our government expenditure to 0.8 % of GDP) would only improve our ranking from 16^{th} to 15^{th}.

As important as the total amount in the science “envelope” is the distribution of government funding. Of all the OECD countries, New Zealand allocates the highest proportions of its public sector R&D funding to Environment, Resources, Agriculture, Forestry and Fishing. Consequently we allocate the lowest proportion of our investment to industrial R&D. Our current profile reflects the natural advantage conferred by our climate, and the importance of tourism and primary industries to New Zealand’s economy. Likewise, support must continue for environmental research specific to New Zealand. Disinvestment in related research areas in the Public Good Science and Technology envelope exposes us to the risk that (a) core competencies required to examine the new biotechnologies may be irreversibly lost and (b) we will erode our competitive advantage in primary production. New funding however leads to the possibility of improving our “research mix”.

For the long-term benefit of New Zealand, a significant proportion of any new funding should be directed to underpinning high growth sectors in the NZ and global economy. While investment in Agriculture, Forestry and Fisheries underpins the development of a biotechnology sector, there is little support given to other high-growth areas such as pharmaceuticals, electronics, communications, software, etc.

3.3 PUBLIC AND PRIVATE INVESTMENT MUST WORK TOGETHER

Public investment does not drive out private sector funding. This has clearly been shown in New Zealand where a *reduction* of Government funding has been accompanied by a *loss* of private sector funding. A 1996 survey showed that, of the 300,000 or so business entities in New Zealand, only 700 possessed any R&D capability of their own. New evidence is coming to light that public investment in RS&T attracts private sector funding. For example 70% of all biotechnology patents in the US cite papers originating in public institutions that carried out the science underpinning the patent. Silicon Valley owes much of its existence to defence R&D and procurement programmes and many of the Route 60 companies are based on RS&T emerging from MIT, the Radiation and other government laboratories. One factor that would reinforce New Zealand’s science community more than any other, would be the presence of an entrepreneurially-spirited, technologically-literate, private sector.

4. NEW ZEALAND'S GOALS FOR RESEARCH

The Government has set out four goals for RS&T which aim to develop human capital, and to enhance our knowledge of the economic, environmental, social and health determinants of our well-being. **We also believe there are four "behavioural" goals for research:**

- **Excellent and Effective Research for New Zealand's Benefit** - encouraging focus and producing excellent research outputs for New Zealand, and particularly intellectual property capable of generating significant export earnings.
- **Excellent and Effective Researchers –** developing, and retaining excellent researchers / innovation workers for the national needs, and using them effectively across the full spectrum of activity from basic to applied research, from wealth generation to policy application.
- **Effective Critical Masses and Concentrations of Researchers** - developing and maintaining an excellent research capability / infrastructure based upon networks, collaboration and co-operation across the public and private sectors.
- **Effective Use of Research to underpin Public Policy and Private Sector Innovation** – developing a cadre of New Zealanders who are S&T-literate, and are intelligently able to commission needed research, interpret its results, and embody their findings in public policy and the private sector.

5. CURRENT PROGRAMMES AND GAPS

The Table below places relevant government programmes into an "innovation spectrum" running from *near to application* to research which is *underpinning.* An "innovation system" is that mix of creators and exploiters of ideas which, when joined in effective partnerships, can combine knowledge from a wide array of disciplines into a new product, service or application.

New Zealand urgently needs a system where innovators are connected to each other in a web so that new avenues of opportunity can be created. While individual elements of an innovation system exist, New Zealand offers little encouragement for them to work together. In fact much of what we do has the side effect of discouraging effective partnerships.

We have to build:

- ***Research linkages which stimulate partnerships in delivering public and private goods and services.***
- ***A private sector which values and performs research because it sees the commercial advantage in delivering value added in the economic, social and environmental spheres.***
- ***A private sector which matches or outperforms its counterparts in the OECD in exploiting research and technology***

Table 5.1 New Zealand's Innovation Programmes

Place on the Spectrum	Government Goals for RS&T[1] .			*Gaps/Opportunities*
	Economic Goals	**Capacity Building**	**Social, Health, Environmental, Govt Depts' research**	
Near to Application	Trade New Zealand			***Encourage Foreign Direct Investment***
	Industry New Zealand BizInfo etc.			***Tax incentives***
⇓	Venture Capital Seed Capital Incubators			***Help SMEs***
	Grants for Private Sector R&D $12M	Enterprise Scholarships – eventual $20M		***IP use and protection***
⇓	Technology New Zealand $25M	Maori Scholarships - $0.4M Post Doctoral Fellowships -$5M,	Research in Government Departments - $95M	***Public/Private partnerships***
⇓	Research for Industry- $170M	Doctoral Scholarships - eventual $10M		***Target value-added research***
			HRC – Health research - $48M	***Long-term policy commitment***
⇓	NERF- $51M	NERF	FRST Social ($4.3M), Maori ($2.7M), Health ($1M) Environmental ($84M) research	***Specialise in tertiary sector research***
⇓		Science and Innovation Advisory Council		***Review EFTS, loans and Equipment funding***
⇓	EFTS-funded research in Universities - $144M[2]			***Conserve Human Capital. Rationalise teaching***
Under-pinning	Public-Good-orientated Non-Specific Output Funding (NSOF) - $27M Marsden Fund - $26M			***Develop New Zealand's capacity to absorb overseas research***

[1] The bulk of funds that are allocated by Government for "public good" science are distributed through the Foundation for Research, Science and Technology (FRST), the Health Research Council (HRC) and the Royal Society of New Zealand (RSNZ). Of these, FRST administers the largest budget which includes research to stimulate economic growth, innovation and new industries. These include Technology New Zealand, Research for Industry (RFI), the New Economy Research Fund (NERF), environmental, social and Maori research and funds for doctoral and post-doctoral fellowships (including the Education fund for academically elite doctoral and post-doctoral candidates). The HRC targets the health and biomedical research sectors and the RSNZ invests the Marsden Fund in basic research. These agencies distribute funds across public (Crown Research Institutes, Universities, Polytechnics, health agencies) and private sectors. A separate component of Government's research budget is distributed through the Ministry of Education to tertiary education providers and some funding for policy and operational research is allocated directly to Government Departments. A range of agencies (eg. Lottery Health, the Cancer Society, charitable research foundations) make a significant contribution to research in specialised areas, particularly in the health sector.

[2] Estimate.

6 THE MANIFESTO – ENHANCING RS&T's CONTRIBUTION TO NEW ZEALAND

6.1 LEADERSHIP IN INNOVATION

Two key factors emerge from countries that have succeeded in making a major shift to a knowledge-based economy, for example Taiwan, Singapore, Ireland and Finland. The first is leadership at the highest political levels, expressed through a coherent strategy for change. The second is a shift in societal values, based on an awareness of the need for change. If New Zealand is similarly to shift its direction, we will require political leadership plus significant public education and awareness. The science and technology community has an important role to play in the latter. We are far more likely to succeed if we are able to work within the framework of a nation-wide strategy for change.

At the heart of this strategy are four major elements:

Vision
New Zealand needs significant political leadership from the highest level, in which a vision for change is clearly expressed. This vision should encompass an emphasis on innovation and wealth generation through knowledge.

Focus
New Zealand must identify and target winning areas of innovation. These might include new bio-technologies, health or well-being promoting food products, software development, electronics and communications technologies, development of new materials, or the development visual arts and design based on our unique physical and cultural environment. Prioritisation is essential as NZ has limited resources to carry out R&D at a globally competitive level. A key factor in selecting these targeted areas should be the capacity to generate new wealth.

Commitment
A knowledge society is built on human capital and a willingness to provide the long term support necessary to establish careers and infrastructure needs. In order to acquire and then harness that capital our strategy must encompass the time-scales associated with higher education and professional employment. ***Our approach must be long-term and bi-partisan, minimising upheavals in policy.*** We must send appropriate signals to young people about their career choices and to the institutes regarding their management policies.

Investment
New Zealand has suffered from significant market failure in innovation, as we have not captured or appropriated innovative developments from research. Private investment patterns tend to favour real estate over new technology. We have a shortage of venture capital and our private sector under-invests in R&D. Government-funded human capital investments have often been misdirected. The proportion of students enrolling in science, technology and engineering programmes is in severe decline. In key areas of physical and biological sciences and in software engineering, only small numbers of students are enrolling. ***Government must target investment in order to meet the needs of the country.***

6.2 ISSUES REQUIRING URGENT CHANGE

6.2.1 Human Capital – the issues:

Human capital issues are arguably the most severe constraints prohibiting achievement of a knowledge society. The broad parameters to be addressed in any human capital strategy include:

1. Education and training – not just in terms of volume but also matching supply with demand for a skilled workforce of scientists, technologists, technicians and support staffs.
2. Attracting sufficient students and apprentices into developing areas of science and technology.
3. Recruiting a skilled workforce from those recently trained in New Zealand and by migration.
4. Retaining a skilled workforce both New Zealand-trained and immigrant. We must recognise that
    - New Zealand is a small player in a world system of highly skilled and mobile workers that includes the USA, Japan and the EU, and the smaller but critical player, Australia. For a wide range of demographic and economic reasons we will have (a) difficulty recruiting highly skilled migrants, (b) retaining the New Zealand-resident (NZ-trained and migrant) skilled workforce, and (c) attracting back to New Zealand trained highly skilled workers from jobs overseas. Recently the net losses have gone beyond younger scientists into older age groups, and thus we may be losing both the newly trained and those who hold the tacit skills.
5. Negative factors affecting training, recruitment, retention and attraction back to New Zealand include:
    - Short duration of contracts for people starting careers in relation to the normally long duration before research outputs are achieved
    - Personal debt resulting from the student loan scheme
    - The lack of early career support systems
    - Low pay. Many scientists start on salaries below those of other NZ professionals, and at a later stage in their lives (eg 10-12 years after starting university, as against 5-6 years common for other professionals). As a result, it is not financially worthwhile to carry out postgraduate study.

An urgent challenge is to re-stabilise the RS&T work force by favouring longer, rather than shorter research contracts. The loss of a research grant can lead suddenly to the loss of valued researchers While some solutions will bear fruit over the longer term, several human resource issues can be addressed immediately:

Responses

1. ***The student loan scheme must be rethought. This manifesto advocates a review of:***
    - ***rates of interest;***
    - ***mode of repayment (through the tax system);***
    - ***earning level at which repayment starts;***
    - ***effects arising from the differential costs associated with various courses;***
    - ***the system favours those studying shorter courses which take them into service industries and disadvantages those doing masters or PhD courses that are necessary for the training of scientists.***
2. ***Shift from short-term contracts (1-3 years) for beginning scientists (eg. after a post-doctorate) to a longer tenure (say 5-10 years as is the custom overseas).***
3. ***Restructure some of the instruments intended to capture young scientists (eg Bright Future).***
4. ***Address the problem of career instability, with a fund created to make employment continuity and retraining possible for high performing scientists, in those areas where funding is being reduced.***
5. ***Establish a data base relating to supply and demand – to document New Zealand scientists, technologists and technicians overseas (ie NZ-trained, and those who have been skilled migrant workers in New Zealand in the past).***

6.2.2 Public/Private Collaboration – the Issues

Sixty cities around the world have populations greater than New Zealand, and 40 of the Fortune 500 companies have revenues greater than the New Zealand GDP. New Zealand is such a small player in the global scene that all of the benefits of internal collaboration have to be sought if the country is to have a competitive position in the global community and survive and prosper in the 21st century.

The science reforms have to a large extent made CRIs and universities competitors for funding and this has had the effect of driving a wedge between them. New Zealand must find a research funding process that does not have this effect.

To achieve the highest possible returns on investment the various parts of the New Zealand innovation system must be closely integrated. Strengthening horizontal links between CRIs and universities would strengthen the national research network. The providers of knowledge, skills, human resources and capabilities must work closely together, and with those who benefit from them. The recent moves to reduce the level of destructive competition for the small and (until recently) shrinking, pool of R&D funding is to be welcomed. Likewise the Government encouragement and support of closer links with industry and other users of R&D are to be applauded.

Responses

1. ***Encourage closer links between CRIs, Industry and universities through joint R&D, and TT projects to increase the effective pool of researchers available to work on a selected topic.***
2. ***Encourage the development of new companies exploiting high-tech products that might be spin-offs from universities or CRIs through appropriate fiscal policies and support that will minimise the risks of start-up and growth. These might include:***
   - ***Targeted tax relief***
   - ***Direct grants***
   - ***Business assistance through serviced incubators***
   - ***Service provision***
   - ***Assistance with intellectual property protection***
3. ***Establish "return-provisions" to allow university or CRI staff time to establish a spin-off company at minimal risk to their future (the French CNRS allow scientists up to 6 years to establish a business, when they can return to a similar position to the one they left).***
4. ***Improve secondment provisions for scientists between CRIs, universities and industry to reduce the barriers to effective collaboration and exploitation of their findings.***
5. ***Remove tax disincentives to R&D activities.***
6. ***Consider further grant and tax subsidies which focus on start-up businesses and encourage industrial R&D, that match those available to businesses elsewhere.***
7. ***Alter tax provisions to encourage gifting and endowments.***

6.2.3 Infrastructure and Equipment – the issues

The physical infrastructure of New Zealand Science and Technology includes buildings and capital equipment. In the full-cost-recovery funding system used for the Government's RS&T investment through the FRST, RSNZ and HRC, the provision of capital items is left to the provider but with the opportunity for full depreciation. In principle, and if properly managed, this approach should provide for all capital requirements except very large items (eg. research vessels or very high field NMR spectrometers), where the capital cost is too high for any one institution to manage. It is in the area of very expensive items (greater than $1Million) that NZ has fallen behind the rest of the world and increasingly equipment intensive science can no longer be carried out in NZ The provision of especially large items may need the formation of special inter-institutional consortia. Within the framework of an increasing national investment in RS&T, a case can be made for the formation of a large equipment seeding fund.

By and large, the Crown Research Institutes have maintained and even enhanced their capital equipment except for the very expensive items.

However, universities have identified a number of problems in providing and maintaining capital equipment. Our university investments in capital equipment have slipped behind equivalent institutions in Australia, Europe and the US. Much university research is carried out as part of their advanced teaching functions and their provision of human capital critical to our national innovation strategy. The present EFTS model of funding model provides strong disincentives for universities to invest in capital infrastructure critical for research in science, technology and engineering. This issue is addressed in Section 6.2.4 below.

EFTS funding system has encouraged universities to build up student numbers, and it would also appear that some universities have preferred to invest in new buildings rather than in capital items for research. It can be argued that in part this has been due to management failure in the use of depreciation funds under Vote RS&T grants. Individual project leaders have sometimes been reluctant to amortise their research equipment fully, while some institutions have failed to appreciate their leadership role as investors in large capital items. The changes in funding mechanisms have also affected the provision of identified funding for the maintenance of research libraries and national databases.

The end result is that university investments in capital equipment have slipped behind equivalent institutions in Australia, Europe and the US. Much university research is carried out as part of their advanced teaching functions and their provision of human capital critical to our national innovation strategy. The present EFTS model of funding model provides strong disincentives for universities to invest in capital infrastructure critical for research in science, technology and engineering. This issue is addressed in Section 6.2.4 below.

Many researchers have called for the establishment of a competitive equipment research fund. Such a fund would not necessarily conflict with EFTS-based research activity. The establishment of such a central fund may need to be accompanied by efficiency gains achieved by rationalising teaching and research provision in expensive science areas.

Responses

- ***Rationalise tertiary teaching and research in expensive subject areas of critical importance to our innovation strategies, providing incentives for collaboration by means of new funding for infrastructure.***
- ***Establish a competitive fund for the purchase of very large items of equipment.***
- ***Establish a mechanism of funding identified key regional research libraries and national research databases.***

6.2.4 The Education-Research Interface – the issues

Universities have a research-led teaching function required under the Education Act. Universities benchmark their standards internationally by ensuring that their staff carry out internationally peer-reviewed research work. This activity is vital to New Zealand's status as a first world nation, and to the maintenance of the highest levels of education in the provision of our future human capital needs. All funding for this type of research is presently via the EFTS device, which encourages tertiary providers to compete for EFTS numbers irrespective of subject area, and irrespective of research productivity. This funding system favours quantity over excellence.

The current EFTS system contains a structural bias against Science, Technology and Engineering subjects. The greatest profits are made in subjects which are the cheapest to teach. Science, Technology and Engineering subjects are more expensive to teach than is allowed for within the EFTS categories. Universities can only compound their financial difficulties if they invest in these expensive subjects, and they weaken their market position vis-a-vis other tertiary providers who are under no obligation to teach expensive subjects, let alone support New Zealand's science and technology goals.

Previously these subject relativity distortions has been compensated for by internal reallocating of funding, but as university finances have been squeezed this is no longer occurring. At the same time as the demand for R,S and T graduates is increasing, universities are cutting back on the resources that can meet the need.

Response
Reform EFTS funding to meet more clearly the cost of Science and Engineering education.

6.3 THE LONGER TERM

6.3.1 Government Goals

We believe it is essential to restore expenditure on public good research and technology to 0.8% of GDP by 2010[3] The 10-year timetable must be regarded as a maximum and 0.8% as a minimum. Nevertheless, many of the gaps highlighted in this document can be filled by inexpensive or even fiscally neutral programmes. Some gaps can be filled immediately by re-prioritising resources already in the system, and many can be filled by targeting new money as it becomes available.

The OECD average government expenditure on R&D is about 0.7% of GDP, falling from a high of almost 1% in 1986. However, this reduction in the proportion of GDP spent on government funded R&D is due to the GDP in many OECD countries rising faster than the expenditure on R&D. In contrast the reduction in government funded R&D in NZ is due to a reduction in the expenditure on R&D. Another factor that needs to be taken into account in making these comparisons is that the simple OECD statistics do not reflect the degree of government assistance to industry through government grants to industry, research contracts, tax subsidies and selective procurement policies. In many OECD countries this type of government support has the effects of significantly increasing BERD over the level spent by the business only. The 0.7% OECD average is therefore a misleading indicator of the total government R&D support.

To increase the per capita level of investment to match that of Australia, New Zealand would need to increase Government R&D to some 1.3% of GDP. Any additional investment should be directed to wealth generation, both short and long-term, with the aim of encouraging new knowledge-based exports.

6.3.2 Planning Horizons In R,S&T

Because of the long tertiary training and postgraduate periods for science and engineering, in order for an individual to make a genuine contribution to knowledge; and because of the generally extended time required to go from a new discovery through to a marketable product, planning horizons in research, science and technology have to be measured in decades.

The number of scientists today is related to the choices of secondary school pupils a decade ago. A new compound with possible pharmaceutical applications will require 15 years before the drug is commonly available. This is not the case in all areas, a new software concept can be commercialised within months, a new electronic product within a year or so, however, these are the exception not the norm.

This is the reality that drives the need for long-term planning and support if the benefits of any investment in research, science and technology are to be realised.

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[3] During the 1980s, the size of the total public good science envelope decreased from 0.8% of GDP in 1981, to 0.5-0.6% and has remained more-or-less static to the present day. Recently, Governments have restated the target of 0.8% of GDP by 2010, and the Government has confirmed its commitment to meeting this target. New investment in the Marsden Fund, Medical research, NERF and education scholarships, has been made, but the total remains at some 0.6% of GDP, which implies that funding of the other output classes has not kept up with inflation or growth in GDP.

New Zealand science has shifted from a period of no apparent change for decades to one of continual change as a new funding and provider structures attempt to meet conflicting requirements. This is not likely to return the maximum possible benefits to New Zealand. A higher level of stability of funding to allow individuals and institutions to plan their careers and management programs is required, together with a higher level of accountability to ensure that the confidence of the investor is maintained.

A further need for a long-term planning horizon is that the limited resources available to New Zealand must be invested wisely in order to maximise the return to society. Even the USA now admits to being unable to fund all areas of science! There has been little willingness to change New Zealand's historical pattern of relatively heavily funded R&D in the commodity, environmental and resources areas, and as a result the high growth areas of electronics, computing, software development and biotechnology now need a significant portion of new funding. New Zealand has not benefited from the last decade's global boom in these areas to the degree that it might have done, partly because of government under-funding of public sector R&D in these areas. Unquestionably Government support is needed for new research programmes which can help grow the contribution they can make to future economic development. But the publicly funded RS&T sector alone cannot achieve the development that is required.

The Foresight process gave some indications of future needs and opportunities but in attempting to solve all of society's needs lost its focus on the science and technology planning requirements. New Zealand needs a rolling 10-year programme identifying the areas of RS&T which will deliver wealth a decade away. The plan must identify what investment will be needed in the tertiary sector, the CRIs and in the form of industry support over a 10-year planning horizon. It must have enough stability for career and infrastructure planning, and enough flexibility to accommodate the inevitable opportunities that will arise from time to time.

6.3.3 An Evidence-Base For Policy

All areas of public policy require adequate evidence-bases before they are formulated, and as benchmarks for monitoring and evaluation. Much of the basic and applied research in the health, social, economic and environmental domains will be of this form.

Normally this evidence-base will be derived from research, and frequently this research will not be wealth generating. Thus funding and support for it will have to come from Government or from the co-operative sector; it is unlikely that a great deal of support will be derived directly from the private sector. The present under-funding of the research-based social sciences means that New Zealand is missing out on the opportunity to ensure that Government policy is soundly based.

Such research support will not constitute a net fiscal burden on Government if it forms a baseline for effective policy with a positive impact on society, population, economy or environment. Effective policy will be more cost efficient and allow Government to avoid policies that are likely to have negative impacts. Finally, there is the potential for the generation of intellectual property that has commercial value.

7 CONCLUSION

We return to our key point. New Zealand is facing a watershed at present. It can either address this by some immediate measures and by formulating a longer-term vision, or it can accept that we will continue to slide economically by comparison with other OECD countries.

This manifesto has suggested some immediate steps that could arrest this decline. It strongly urges government to build on these and on the recent scoping exercises (eg. Foresight) to build a national consensus and a vision for the future.

Thus the Society, and the Academy Council that hosted the meeting from which this manifesto has been generated, and that prepared this manifesto, issues it in the hope that it will

- stimulate discussion;
- provide cost-efficient immediate palliatives;
- encourage government to forge a new vision around what might be the parameters of a knowledge society;
- help government, the private sector and the society in general to develop a focussed approach to achieving this vision.

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