Chapter 5: NETTING ECONOMIC RETURNS – how we deliver across the value chain
HEALTH SPENDING IS A KEY DRIVER OF WESTERN ECONOMIES, WITH THE OECD PREDICTING THAT RISING HEALTHCARE COSTS POSE THE BIGGEST THREAT TO THE LONG-TERM SUSTAINABILITY OF NEW ZEALAND'S ECONOMY. HRC PROVIDES THE ANSWERS TO OUR MOST PRESSING HEALTH QUESTIONS WITH RESEARCH THAT IMPROVES THE NATION’S HEALTH, RAISES THE EFFICIENCY AND EFFECTIVENESS OF SERVICES AND TRANSLATES TRANSFORMATIVE IDEAS INTO INNOVATIONS THAT IMPROVE LIVES AND BOOST GDP

Why is health research such a vital part of New Zealand’s economic growth solution?

Because NZ’s biggest economic challenge is health spending

Healthcare spending is a critical part of our long-term fiscal challenge because it is both large and growing - health spending has been increasing faster than our national income for most of the last fifty years. Long-term fiscal projections show health spending continuing to increase as a proportion of national income, from 6.9 per cent of GDP in 2011 to 11.1 per cent of GDP by 2060 - which would account for approximately 40 per cent of core government spending.

Health research is a significant weapon in the Government’s armory – we have a vital role to play in ‘bending the curve’ in health expenditure through:

- improving health, which drives participation and productivity;
- containing healthcare costs by increasing efficiency, efficacy and cost-effectiveness of delivery, and
- generating new and transformative ideas, products, tools, interventions and services that have commercial value.

The payback

"New Zealand has an imperative to strengthen the use of health research to deliver better, more timely and convenient healthcare."

The Treasury

Investing in health research generates considerable economic gain, in and of itself. Health research returns an overall economic value to society that exceeds the cost of investment.

The direct economic returns from cancer research in the UK between 1970 and 2009 translated to a rate of return on investment of 10 per cent, compared with the 9 per cent previously estimated for cardiovascular disease research. The wider ‘spill-over’ benefits produced a 30 per cent rate of return.

A comprehensive review of all phase III clinical trials in the United States found that, estimated conservatively, the economic benefit exceeded $15 billion over the course of 10 years, and that new discoveries from the trials were responsible for an estimated additional

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17 Temple: Capital Investment Specialists ‘New Zealand’s addiction to healthcare: Diagnostic, trends and initiatives to manage cost growth’ August 2009.
470,000 healthy years of life. The 10-year return on the investment in clinical trials research funding was estimated to be 4600 per cent.

**The economic value of a healthy and productive population**

HRC-funded research reduces demand for health services by keeping people well, and by supporting innovative research that enables patients to better monitor and manage their own health outside of high-cost healthcare settings. Advances in screening, detection and diagnosis, prevention and intervention, as well as the identification of new and better treatments and services has led to substantive improvements in our health.

When New Zealanders live longer and healthier lives, this has the knock-on effect of enabling greater participation in the workforce and higher productivity, which enables economic growth. So in helping the population to be healthier, health research has a strong impact on the economy. **Between 2000 and 2011, about 24 per cent of the growth in income in low- and middle-income countries resulted from health improvements.**

Health research has led to reductions in risk-taking behaviours, prevention of injury and illness, increased awareness of healthy behaviours, and also tackled key environmental factors that affect our health. HRC-funded research in healthy housing, immunisation and urban design are just a few of the areas that net health gains can be attributed to. Health inequality has also been identified by economists as an important factor in slowing economic growth, due to both the high social and service costs involved, and the political instability health and social inequality creates. Significant improvement in Māori health can be seen even within the last decade where Māori life expectancy has increased by 3.8 years for both males and females, up from 66.6

**Impact of advances in screening detection & diagnosis**

- The disability rate among over-65s has decreased by 13 percent
- NZ’s infant mortality rate has declined by 30 percent
- Life expectancy has increased by 6 years for males and 3 years for females since the 1990s
- Survival rates from cancer have doubled since the 1970s

“**When we invest in medical research, we win twice over: we make discoveries that lead to better health, while also generating wealth. The health research ecosystem is one of the most important contributors to the economy. A long-term, stable commitment to research is needed to ensure advances in the nation’s future health, and its economic prosperity.**”

Dr Jeremy Farrar, Director of the Wellcome Trust
Antimicrobial Resistance – the biggest global economic threat

Just as improved health produces a significant boost to our economy, significant deterioration in population health can severely threaten the economic stability of not just New Zealand, but the entire world. The discovery of antibiotics has had a major impact on health outcomes since penicillin came into common usage in the 1940’s. However, we must now face some concerning facts:

- no new antibiotics have come to the market for more than 25 years, and
- current projections indicate that, due to increasing antimicrobial resistance, the world population will be between 11 million and 444 million lower by 2050

This rate of mortality and morbidity would impact on world GDP, reducing it by between 0.06 per cent and 3.1 per cent, a cumulative loss of between $2.1 trillion and $124.5 trillion (this cost only includes disruption to the labour supply and not direct healthcare costs, or wider indirect social costs).

The economic value of an efficient and cost-effective health system

Health research delivers value for money in healthcare and improves the quality, efficiency, and sustainability of our healthcare system – results that are growing increasingly important in light of our ageing population and the escalation of chronic conditions such as diabetes, obesity, cardiovascular disease and cancer. HRC-funded research ensures that we get maximum health gains from every dollar spent, through greater understanding of the efficacy, efficiency and cost-effectiveness of treatments and services. Some key economic benefits to the health system from this knowledge over the last 25 years include:

- a 56 per cent reduction in hospital stays and related costs between 1980 and 2000;
- an up to 76 per cent reduction in diabetes related complications, such as blindness, related to technology to control blood glucose levels, and
- time in hospital reduced by a minimally invasive treatment for aneurysms compared with more invasive medical interventions (4.5 vs. 7.5 days).

Advances in identifying the right and most cost-effective treatment saves the New Zealand tax payer considerably. HRC-funded research identified that prescribing calcium supplements to prevent osteoporosis increased the rate of cardiovascular events in older women. This finding both improved the safety of clinical practice but also had a significant economic impact. The subsequent 66 per cent reduction in calcium supplements prescribed translated into $3.9M in savings over 5 years, with the annual savings likely to accrue into the foreseeable future (Gray, 2014). This does not include savings that result from not having to treat the cardiovascular events that might have resulted had the supplements been prescribed.

Technologies have reduced the costs of surgical procedures, such as laparoscopic techniques and balloon angioplasty. Other technologies have allowed cost-reductions by enabling a shift in treatments from an in-patient to out-patient setting, or to remote monitoring.

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**The economic value generated from IP and Innovation**

The medical devices and health technology sector is one of the most commercially successful in New Zealand, contributing more than a quarter (27 per cent) of export earnings to our high-tech manufacturing sector and injecting an estimated $1.4 billion into the economy.

The Institute of Economic Research states that New Zealand should prioritise areas of science where it is capable of playing a leading role and where there is the potential to deliver advanced technology products. As a country, we have an acknowledged comparative advantage in this field - thanks in part to our strength in health research. However, we have also achieved excellent engagement of the people who utilise the technology in the research endeavour – clinicians and health professionals.

**Where do the ideas and evidence for the creation of medical devices and technologies come from?**

**Health research and health researchers**

HRC-funding has led to a number of innovative companies being launched and intellectual property licensed to commercialise discoveries (see Appendix 1). These spin-off companies have received significant HRC support for underpinning research, and they have produced a wide array of commercial products that include therapeutics, software, imaging and diagnostic tools. In some instances, HRC can lay sole claim to the health and economic benefits accrued from the development of lifesaving tools, having supported the research from conception through to product development, such as in the

with two of case studies follow, PREDICT an the Cooling Cap - each illustrating that the road to discovery is usually a long one.

Investment that moves research from patent to patient does not necessarily take a direct route as the research progresses. Innovative research is complex and new questions and barriers arise constantly along the way – as the story of the development of New Zealand’s first cancer vaccine demonstrates.

Even when the pieces of the story slot nicely into place, as with the development of the Cooling Cap, we expect a ‘travel time’ of twenty years from the first lab-based discovery to the trial of a clinical solution. For this reason, the HRC’s twenty-fifth anniversary is an exciting time for the organisation, as now the long-term programmes of research we have invested in for two decades are delivering on their promise with medical advances that will be life-altering for many New Zealanders, and others around the world.

More of the examples that we have given relate to biomedical research, because we want to illustrate the typical innovation process. However, public health research also generates commercialisable products. The premise that spin-off companies in the health sector are typically underpinned by decades of sustained investment in biomedical research, and often take years to see return on investment, has recently been challenged by successful companies built on HRC research funding. **PREDICT software**, an electronic decision-support tool for the prediction of cardiovascular risk, which was developed by Enigma Publishing and now used in primary care throughout New Zealand, was underpinned by HRC-funded epidemiological – rather than biomedical research conducted by Professor Rod Jackson and colleagues at the University of Auckland.
PREDICT allows clinicians and hospitals to target limited resources to the right patients, preventing 30 per cent of cardiac events occurring compared to standard practice. This leads to a significant reduction in healthcare costs including hospital and post-hospital care. Auckland District Health Board estimate cost savings of between $10M and $20M a year – extrapolated across all the DHBs adopting PREDICT, this could save our health system $300M a year. PREDICT has been sold to Australia, Singapore and Canada.

Keeping a cool head improves outcomes for newborns

Even with advances in obstetric care over recent decades, up to three babies in every thousand births will have abnormal brain function due restricted oxygen during labour - from a twisted cord, inadequate placenta or contractions that are too strong. Cerebral palsy is one of the most devastating consequences of oxygen deprivation or infection before or during this critical time.

The HRC first started funding research on trying to improve outcomes for these babies in 1994. The key steps on the pathway to discovery neatly illustrate how breakthroughs often come from a clinical observation, and the value of having those at the front-line of treatment trained to undertake the vital research to find answers.

• Professor Alistair Gunn notices that babies deprived of oxygen at birth improve initially but then decline - often with seizures.

• He undertakes a PhD with Professor Peter Gluckman to try to understand what is happening to these babies. His initial studies are in rats. He notices that when he gives them drugs designed to protect the brain from injury, they become cold. When he tries to keep them warm, the protective effects of the drugs are lost.

• HRC funding supports him and his team to show that cooling is a side-effect of the drugs and is protective in itself.

• Continued HRC funding leads to further breakthroughs:
  - brain damage develops progressively over time, following the initial injury;
  - damage is caused by a progressive biochemical cascade that results in the delayed death of brain cells - the reason babies improve, and then decline;
  - cooling the brain interrupts this cascade (Professor Tania Gunn - also a paediatrician - joins the
From patent to patient: The road to an innovative cancer vaccine

HRC contracts awarded to the Malaghan Institute of Medical Research

Spin-off research:
on improving cancer detection,
controlling aggressive brain tumours & a parallel programme on developing immunotherapy for asthma & allergic disease, all HRC funded

- 2006 Clinical trial of enhanced vaccine in melanoma patients (HRC 06/139)
- 2004 – Boosting response
  The immune response in patients is variable & work continues, focused on extending the lifespan of the anti-tumour immune cells in the body by eliminating barriers to their survival (HRC 04/249)
- 2005 – Recruiting natural killers
  Finding immune modulators that will amplify the body’s response to the vaccine, particularly that of ‘natural-killer T cells’ (HRC 05/459; 05/031)
- 2014 onwards
  Clinical trial of enhanced vaccine in melanoma patients & work begins on a new vaccine (HRC 10/667; 14/500; 14/502)
- 2008-09 New approaches
  Work continues on ‘fine tuning’ the activity of the natural killer T cells & focus moves to isolating specific T cells from patients’ blood or tumour & comparing them to those ‘primed’ in the lab to try to understand differences in efficacy (HRC 08/427; 09/105E, 09/105D)
- 2006 -Increasing the potency
  In addition to testing compounds that activate natural killer T cells, the team looks at adding others that resemble those the body encounters in infections, to provoke an even bigger response from the immune system. An additional factor is added that will help the dendritic cells to interact with immune cells & transfer the tumour peptides to resident cells in the patient. The new vaccine is tested in an animal model of melanoma. The trials of the original dendritic-cell based vaccine continues in lymphoma patients. (HRC 06/316, 06/207)

Code breaker:
Peptides – like proteins, but smaller, simpler molecules
Antigen - antibody generator; Dendritic cell - immune cell that ‘presents’ antigens to the immune system, T-cell – white cell, part of the immune system

Distance (yrs):
Breakthrough 5
Progress 10
Impact 20

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2014 onwards
Clinical trial of enhanced vaccine in melanoma patients & work begins on a new vaccine (HRC 10/667; 14/500; 14/502)

1998 – On the road to a vaccine
Identifying peptides on the surface of cancer cells that can be used to create antibodies to tumours (HRC 98/090)

1999 – The first vaccine
The tumour peptides are loaded onto dendritic (immune) cells from cancer patients and re-injected as a vaccine to prime the immune system to recognise & attack the tumour. (HRC 99/188, HRC 99/188)

1999 – The first vaccine
The tumour peptides are loaded onto dendritic (immune) cells from cancer patients and re-injected as a vaccine to prime the immune system to recognise & attack the tumour. (HRC 99/188, HRC 99/188)
research effort, and the mother and son team develop the prototype 'CoolCap');

- cooling is only effective if started early in the process and there is a narrow time window in which it is effective;
- they develop a system for measuring brain activity to identify accurately the precise point when cooling should be applied, and
- they discover that the baby's brain has to be cooled continuously for several days whilst the inflammation settles.

The first international trial was launched in 2005 - the CoolCap Trial. Many trials have followed, including one by researchers at Oxford University’s Health Economics Research Centre who have done a meta-analysis of trials and shown that the treatment is cost-effective, especially when those costs are viewed in relation to disability-free life years gained to 18 years of age.

The treatment is very cheap, all that is needed is cooling blankets and a capital investment of two cooling machines at a central neonatal intensive care unit. There are no additional costs beyond standard care. The return is paid over decades in the contribution these children subsequently make to society and the savings on life-long disability support services.

Economic Impact Study:

Pacific Edge Limited

Pacific Edge Ltd is a NZX-listed spin-off company based on commercialising intellectual property generated by the Cancer Genetic Laboratory at the University of Otago, which received HRC Programme support for over a decade (over $9 million) to research the genetics and epigenetics of cancer.

This laboratory, led by Professors Tony Reeve and Parry Guilford, has a guiding philosophy that their research should ultimately translate to the cancer clinic. Their findings on diagnosis of Wilm’s tumour and stomach cancer have benefited many families worldwide, saved lives and gained international recognition. But it has been the group’s continued
Chapter 5: Netting economic returns – how we deliver across the value chain

emphasis on protecting intellectual property that has made it possible for Pacific Edge to achieve ongoing success in delivering commercial cancer tests for early diagnosis and better treatment.

Pacific Edge’s flagstone product is CxBladder; a diagnostic test for bladder cancer that was first introduced to the NZ market in 2011, and is now also available in Singapore and the USA. Bladder cancer is only the ninth most common cancer overall, but has a high risk of recurrence and requires life-long surveillance, making it the most expensive cancer to manage from diagnosis to death. It is typically diagnosed by cystoscopy (endoscopic evaluation, which is highly invasive and expensive). CxBladder Detect is a non-invasive laboratory test, conducted on urine samples, with better sensitivity than competing products.

A second product, CxBladder Triage, was launched in New Zealand in 2014 to complement CxBladder Detect, and brings the company closer to their goal of creating a ‘one-stop shop’ for urological cancer detection and management products.

The company’s growth plan is to expand into the USA, the world’s largest biomedical market, with up to 2 million potential CxBladder test opportunities every year. To this end they are pursuing initiatives that include expansion of the US Sales and Marketing team, the continuing rollout of ‘User Programmes’, negotiation of agreements with funders in the US healthcare system, and advancing commercial relationships with private insurance companies.

Pacific Edge also have a promising pipeline of other cancer detection tests in late-stage development (see: www.pacificedge.co.nz), including CxColorectal, for diagnosis of colorectal cancer, which has completed clinical trials and is being prepared for commercial launch. The company’s patent portfolio continues to grow and expand into different countries, reflecting the high-quality innovative science underpinning their products.

Pacific Edge now has extensive experience in intellectual property protection of health technologies, is well connected to the pharmaceutical industry and has experience in the identification of the international partners who are likely to be required to co-fund clinical trials and enable rapid market entry. In recognition of its contribution to industry, Pacific Edge was awarded the 2013 Supreme Winner of the New Zealand Innovators Award, and named NZBIO’s top bioscience company for 2014.

The company’s annual report for the 2014 financial year shows trading revenue of $523,000, up 187 per cent; total revenue $838,000, up 63 per cent; 33 global employees, and considerable growth in the share price, culminating in Pacific Edge entering the NZX50.

Since 2011, Pacific Edge has received approximately $0.5M in grants from MBIE, and in 2014 was awarded a Growth Grant from Callaghan Innovation ($4.5M over three years, with additional funding for a further two years available on review). This support builds on the company’s track record of turning scientific discovery into products that bring real benefits for clinicians and patients, and will provide additional resources to accelerate the
development of a range of cancer detection tests.

Where HRC made the difference
The HRC funded the early research that formed the basis of Pacific Edge’s success, and continues to fund pioneering research conducted by researchers at the University of Otago’s Cancer Genetic Laboratory. This includes:

- investment of over $2 million in research on the next generation of urological tests based on single cell RNA profiling, with potential for unprecedented accuracy, and
- a promising new approach to target and treat tumours, based on exploiting the observation that the tumour-suppressing protein E-cadherin is frequently inactivated in many common cancers.

Economic Impact Study:

Telemetry Research
Professor Simon Malpas’s research career began in cardiovascular physiology but has evolved to see him leading a start-up R&D company, Telemetry Research, and using innovative wireless technology to develop medical devices for the worldwide market. The impetus for the start-up came from a 1998 HRC grant that he received to study hypertension, when he found that he was unable to buy the instrumentation needed for physiological measurements of animals in a free-roaming, rather than anaesthetised, state. He teamed up with Dr David Budgett from the Bioengineering Institute, and they set about building a device that could make the required measurements.

They received funding from FRST to develop the core technologies of miniature sensors, wireless communication, and wireless power, and founded Telemetry Research.

Research in 2005 to capitalise on the intellectual property generated from this work. Telemetry partnered with, and was eventually bought by Millar Inc (Houston). The resultant product portfolio, which is focused on developing and marketing tools for use in biomedical research (animal studies), continues to do extremely well. Products are now sold in over 30 countries.

Professor Malpas’s research team have their sights firmly set on developing their technology for clinical use in implantable medical devices – representing a big step up into a R&D environment that is extremely challenging and dynamic, with the most stringent requirements for demonstrating safety.

The wireless technology company, Telemetry Research, which was established by HRC-funded Professor Simon Malpas from the University of Auckland, experienced a rapid rise in fortune, becoming profitable within two years and receiving an assortment of honours including Finalist in NZ International Business Awards 2010 for best use of intellectual property.

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The device developed to monitor animals in free-roaming conditions and below, the size of the tip in relation to a paper clip.
They recognised a huge market opportunity in being able to deliver wireless power and communication to implantable medical devices, obviating the risk of infection and inconvenience inherent to the alternative technology – a ‘driveline’ cable passing through the skin.

Malpas’s approach has been not to develop the devices, but to bring his group’s technology to a point where they can partner with international device companies, and seek private investment for the expensive phase of development: full medical device development, regulatory approval and human trials.

He sees local funding as critical, as it ensures that the University research team can keep control of the direction of the research, secure the intellectual property, and build a critical mass of expertise in New Zealand to support the growth and development of a high-value export sector - centred on implantable medical devices.

The research to date has built on a substantial array of funding over the past 6 years. The University of Auckland has made a $12 million investment into core wireless power technologies that have resulted in more than 60 patents for industry. In terms of applying that technology to medical devices, the research team have received project grants from both FRST/MBIE and HRC.

FRST/MBIE funding has included a 2008 NERF grant followed by Smart Ideas grants in 2012 and 2014. These grants have been awarded to bioengineers to develop the platform technology known as TET (transcutaneous energy transfer), and to develop wireless power technology in a small battery-less implantable device, with potentially broad clinical application.

Where HRC made the difference:

The HRC grants in 2010 and 2014 were awarded to accelerate development of devices for the first clinical applications: management of a) heart failure and b) hydrocephalus. The HRC-funded teams have been multidisciplinary, consisting not only of engineers and physiologists but also expert clinicians in the areas of cardiac medicine and neurosurgery, respectively for each project.

The scope of the HRC grants has been to validate technical requirements, including the conduct of studies in large animals to ensure compatibility with humans. This funding is intended to provide proof of principle and bring the technology to a point where it is attractive to private investors.

In terms of private investment, the heart pump research findings are currently under evaluation by international companies, for the powering of their ventricular assist devices.

How HRC’s sustained investment in the best people and ideas underpins the success stories of MBIE and the Callaghan Institute

HRC funding not only plays a critical role as a ‘cog in the innovation machinery’ - the ideas and the people we support produce the evidence and clinical platforms (the commercial-potential pool) from which MBIE and Callaghan Innovation can draw to generate commercial products with economic value for New Zealand.

In 2014, the HRC commenced long-term Independent Research Organisation (IRO) Capability Funding for the Malaghan Institute, which is at the international forefront of research in cancer vaccine technology (see From
The Malaghan Institute has an impressive track record of gaining competitive funding from the HRC, including Programme funding in 2010 for pre-clinical and early stage clinical studies of a new melanoma vaccine. Building on this, and supported by IRO funding, the Malaghan is now undertaking a clinical trial of the vaccine, in collaboration with Capital & Coast District Health Board, Callaghan Innovation, The University of Auckland and Cancer Trials New Zealand. Leading this work is Associate Professor Ian Hermans, the Malaghan Institute’s Deputy Director of Research, and former recipient of the HRC’s prestigious Hercus Fellowship.

**Ideas in the pipeline**

Of MBIE’s health-focused contracts, close to 50 percent build on HRC-supported research. This includes diagnostic biomarkers for cancer and diabetic complications, bioengineering for implantable devices, virtual clinical trials, technologies for use in breast and lung cancer, magnetic nanoparticles for bio-applications, and gels for enhanced skeletal repair.

The HRC’s strong investment in basic biomedical research, and our training and engagement of clinicians in research, continues to provide a well-spring of new opportunities.

Exciting and promising research with commercial potential that we currently have in the pipeline is highlighted in 'Ideas in the HRC Pipeline' (right). **Twenty-one per cent of our investment in 2014 focuses on new opportunities in developing and testing novel health**
technologies and devices, and identifying new drugs and biologics.

HRC-funded research will continue to be a particularly important source of commercial potential for Callaghan Innovation, given their move away from conducting basic research and their new primary focus on industry demand-driven development projects.

The value of patents - where ideas become exploitable

For ideas at the technology frontier, the single most useful measure of innovation is ‘international’ patenting. Patents reflect the realisation of national innovative performance because they are a marker of potential economic value, and because the patenting process ensures a standard of technological excellence that is at or near the global technological frontier (Porter and Stern, 2001).

In the last 6 years, HRC-funded research has resulted in 31 unique patent grants being awarded. In 2014 our researchers were awarded or have patents pending for:

- diagnostic/prognostic biomarkers for pneumonia or atherosclerotic conditions;
- novel devices relating to wireless power technology, and
- molecules with anti-cancer activity.

HRC’s role in fuelling the innovation value chain

How we add value

The commercialisation of research ideas to realise economic potential often requires investment over a long period of time. HRC has an impressive track record of providing vital support for innovative, revenue-generating health research in New Zealand, and is a key player in supporting New Zealand’s health technology pipeline.

We recognise that sustained investment in the best people and ideas is essential to underpin innovation and provides the platform of discoveries on which companies will build. Ensuring that the nation’s top teams are funded for the long-term is critical because some of the most innovative and productive research programmes span a decade or more.

HRC identifies scientifically valid commercial opportunities

HRC strategically makes significant investment in biomedical research to ensure that there is a continuous flow of new discoveries in the pipeline to commercialisation and that the skills and the talent required to power the innovation system are maintained in New Zealand.

Over the past 5 years, an average of 42 per cent of our funds have gone to support biomedical research.

There is a strong relationship \((R^2 = 0.80)\) between the ability to create wealth from innovation and the number of scientists and engineers in the workforce. Basic research is the key driver of long-term innovation and makes contributions which are extremely important in areas in which New Zealand is unique, including biodiversity, health and Māori studies.

Ministry of Economic Development 2003

Understanding customer needs

The success of the medical technologies and devices industry depends on being able to understand customer needs and demands – especially the clinicians and health professionals who utilise the technology. HRC’s success in engaging clinicians and end-users on our research
teams and contracts, along with the research training opportunities we have provided for health professionals over the past 25 years, means New Zealand is ideally placed to drive a customer or consumer-led medical technologies enterprise. Our research-savvy clinicians are ready to explore new and better ways of using technology in health care practice. They can develop medical devices, equipment, processes and technology based upon a core understanding of what is needed, and how it will work in the healthcare environment.

**HRC & the Innovation Value Chain**

*We play a vital role from finding the first piece of the puzzle to ensuring the safety & efficacy of the final product*

- We support long-term underpinning research which leads to development of models & software, creation of patents & identification of potential therapeutics, devices & products

- Testing the potential clinical application of cutting-edge devices & technologies in patients

- Providing clinical validation of innovations & undertaking efficacy & cost-benefit analysis of interventions

**Our unique contribution**

**HRC is the only funder supporting clinical trials of novel drugs and biologics in patients**

In 2012, an analysis of HRC, Marsden and MSI’s investment in health technology was undertaken. Health technology research accounted for 34 per cent of HRC funding, 17 per cent of the Marsden Fund’s health-related funding and 70 per cent of MSI’s health-related funding. Marsden funding primarily supported early-stage identification and development of drug candidates, and biological therapies. MSI funding was focused on the manufacture of drugs and biologics, preclinical development of drugs, and development of a range of medical devices. HRC funding spanned all categories. However, we were the only agency to fund clinical trials of novel drugs and biologics in patients – this, therefore, is our specialist niche and unique contribution to the innovation value chain.

While MBIE and Callaghan could be described as having a top-down (product or industry-led approach), HRC has a bottom-up (ideas-led) approach. These approaches are complementary, mutually reinforcing, and are both required to support a productive innovation chain.

**Barriers**

The primary barrier to HRC playing a more significant role in helping New Zealand to further capitalise on the enormous world-wide health technology market is our current level of funding. R&D expenditure as a proportion of GDP declined across all sectors in 2014 compared to 2012 levels (1.25 per cent in 2012 to 1.13 per cent in 2014), while the OECD R&D expenditure as a proportion of GDP rose from 2.33 per cent to 2.40 per cent. These ratios are considerably less...
than those for other economies similar to that of New Zealand. 19

**HRC has not had an increase in funding since 2009 which considerably weakens our ability to continue to support the full value chain from discovery to exploitation.** There is evidence that our static (in real terms, declining) budget, is starting to restrict the sector as we would like, or can be moving forward.

**The future**

“Never before has the call for innovation technologies been so great or the pressure on healthcare budgets so acute. Consequently we have to make sure that our innovations are accompanied by data and evidence on safety, efficacy and cost-effectiveness.”

A number of emerging medical technologies may hold the key to revolutionary changes in the way we deliver healthcare in the next 10-15 years.

Telemedicine and telehealthcare are already making a huge impact on the health sector. Information technology and the expansion of the internet and broadband connections are already allowing remote monitoring and diagnosis of patients. Smart-phone apps, social media platforms, and sensor-embedded smart devices will increasingly putting health management into the hands of patients, in conjunction with healthcare providers. The rise in mobile phone ownership creates huge opportunities for remotely tackling chronic diseases, all of which improves access to health services, reduces costs, and empowers patients to take control over their own health. **HRC has supported a small number of** pipeline that ultimately feeds the most significant advances in health care and medical technologies. This is best demonstrated by a steady decline in the number of HRC-funded patents filed (from 44 in 2007 to 4 in 2014).

The other barrier that we have identified and plan to address is that we are not as linked-in to New Zealand’s innovation **successful clinical trials which demonstrate the effectiveness of this kind of technology, but there is more that we would like to contribute in this space.**

**Key opportunities for HRC to strengthen the innovation value chain**

We need to:

- improve our linkages, networks and knowledge sharing with MBIE and Callaghan Innovation;
- encourage exploration of technology, either improved or the wider application of existing technology;
- better support the exploration of commercial potential arising from other research domains – such as clinical, public health and health services delivery research, where innovative interventions, clinical decision-making tools and models of service delivery may evolve;
- encourage and incentivise research in areas of converging technologies;
- boost our support for comparative data review - new medical technology and data increasingly require comparative-effectiveness evidence to increase marketing power and sales;
  - the HRC can build on our current experience and developing expertise, through our Health

Innovation Partnership with the National Health Committee (NHC), to provide evidence of the cost-effectiveness of new and existing technologies;

- **support critical research capability and provide targeted training opportunities to meet important research capability gaps, such as in health informatics, telehealth and health economics;**

- **continue to build our clinical trial assessment and clinical trial monitoring expertise,**
  
  “*a fertile clinical trials sector in NZ will help the country continue to be a great market for innovation*” (*A Global Ambition: A Thriving Medtech Economy, Medical Technology Industry Sector Blueprint, 2011*), and

- **make sure we continue to provide the right signals, incentives and opportunities that enable our researchers to pursue their ideas in multiple directions and not restrict them to a pre-defined pathway that is limited by what is known and expected.*