SCIENCE FOR TECHNOLOGICAL INNOVATION

Kia kotahi mai – Te Ao Pūtaiao me Te Ao Hangarau

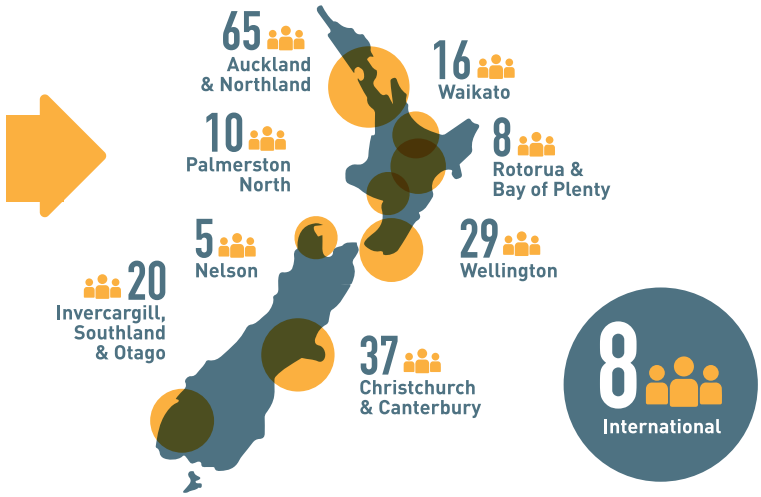
SCIENCE FOR TECHNOLOGICAL INNOVATION AT A GLANCE

OUR PEOPLE

198 RESEARCHERS
17 have completed their contribution

- 12 Māori
- 50 Women
- 22 Students

29 ORGANISATIONS
including 4 international



OUR PROJECTS

4 THEMES

- VISION MĀTAURANGA
- SENSORS, ROBOTICS & AUTOMATION
- MATERIALS, MANUFACTURING & DESIGN
- IT, DATA ANALYTICS & MODELLING

STRETCH SCIENCE

7 SPEARHEAD PROJECTS
Large teams

28 SEED PROJECTS
Small teams
including 1 completed

OUR DEVELOPMENT

COMMERCIALISATION
INNOVATION MEDIA TRAINING
ENTREPRENEURSHIP
MĀORI ECONOMY
TECHNOLOGY
BUSINESS AWARDS LEADERSHIP
SPEAKING WITH PURPOSE
PITCHING SKILLS
COMPANY VISITS
MISSION LED SCIENCE
STAKEHOLDER ENGAGEMENT

OUR ATTENDANCE RECORD

- **126** at 2 All-of-SfTI Workshops
- **160** at 23 Courses and Workshops
- **29** at 8 Innovation Showcases
- **37** at 9 Conferences to network

VISION MĀTAURANGA

208 at 14 Events featuring Māori & the Māori Economy

National SCIENCE Challenges

SCIENCE FOR TECHNOLOGICAL INNOVATION

Kia kotahi mai – Te Ao Pūtaiao me Te Ao Hangarau

Contents

Science for Technological Innovation (SfTI) Challenge background

The Science for Technological Innovation Challenge (SfTI) launched in 2015. One of 11 National Science Challenges, SfTI is a 10-year, multi-million dollar Government investment whose mission is to grow a high-tech New Zealand economy via the physical sciences and engineering.

The SfTI challenge is generously hosted by Callaghan Innovation primarily at 69 Gracefield Road, Lower Hutt.

Our vision

'New Zealand is a vibrant and prosperous technology-driven economy, with new businesses offering high-value services and products that may not yet have been invented.'

What we do

Kia kotahi mai - Te Ao Pūtaiao me Te Ao Hangarau: to come together, to join as one, the world of Science, the world of Innovation.

SfTI aims to develop world-leading science and technology relevant to New Zealand. Our focus is on building enduring partnerships between researchers, business, and Māori organisations.

How we operate

SfTI brings together some of New Zealand's best physical science and engineering talent from our partner organisations.

Our researchers work in mission-led, multi-organisational, multi-disciplinary, science and engineering research teams that work closely with industry and Māori organisations.

Our partner organisations are:

- The University of Auckland
- The University of Waikato
- Massey University
- AgResearch
- Victoria University
- Scion
- Auckland University of Technology
- University of Canterbury
- Lincoln Agritech
- University of Otago
- Lincoln University
- GNS Science

SfTI who's who

The Science for Technological Innovation (SfTI) National Science Challenge is generously hosted by Callaghan Innovation, primarily at 69 Gracefield Rd, Lower Hutt.

Science for Technological Innovation Board

Chair - John Bongard ONZM

SfTI's inaugural Chair, John was appointed in March 2016 for three years. Retiring in 2009 after almost 36 years with Fisher & Paykel Appliances, including as CEO and Managing Director, John is a Deputy Chairman of the Totara Foundation, Chairman of the Sky City Auckland Community Trust, of PSCTH Thailand, Director of H J Asmuss, NARTA Australia, and WilliamsWarn.

Board member – Linda Cooper

Currently Chief Financial Officer for Livestock Improvement Corporation, Linda has a successful financial and operational management background in manufacturing, telecommunications, and agri-business.

Board member – Gottfried Pausch

Gottfried brings senior level executive experience with multi-national engineering and technology corporation Siemens AG in New Zealand and overseas. A Director of Blackhawk Tracking Systems, Wellington Drive Technologies, McKay Ltd, and AuCom Electronics, in 2009 he was Executive in Residence at business incubator the ICEHOUSE, and an investor with Ice Angels.

Board member – Craig Ellison

Chair of Ngāi Tahu Seafood, Seafood New Zealand, and Wellington Zoo, Craig is also Director of Aotearoa Fisheries, and the Sealord Group, as well as a trustee of Poutama Trust. He is a past Chair of the NZ Seafood Standards' Council.

Host observer – **Rosalie Nelson: Callaghan Innovation, GM Strategy, Impact and Insights**

Independent Science Advisors

The SfTI Board values the expertise of its three science advisors:

- **Richard Blaikie** – Deputy Vice-Chancellor, Research and Enterprise, and Professor in Physics, Otago University
- **John Raine** – Professor of Mechanical Engineering, Pro Vice-Chancellor Research and Innovation, AUT University
- **David Williams** – Professor in Electrochemistry, Auckland University

SfTI management team

Director – **Sally Davenport**

Professor of Management at Victoria University Business School, and a Commissioner with the New Zealand Productivity Commission, Sally's academic life began as a research chemist.

An Emeritus Investigator with the MacDiarmid Institute for Advanced Materials and Nanotechnology, Sally is also a Principal Investigator with Te Pūnaha Matatini, which develops methods and tools for transforming complex data into knowledge.

Sally is also an Adjunct Professor in the College of Business and Economics at the Australian National University, a Fellow of the International Society for Professional Innovation Management, and a member of Global Women.

Leader, Portfolio 1: Building New Zealand's Innovation Capacity – **Katharina Ruckstuhl (*Ngāi Tahu, Rangitāne*)**

Before joining Otago University in 2008, Katharina's early career included teaching in management roles, as well as five years as education manager and project consultancy with Te Rūnanga o Ngāi Tahu.

Katharina joined Otago University's Dean's Office in April 2017 to provide leadership and strategic advice to the Business School on the University's Maori Strategic Framework. Her roles within SfTI include leading Vision Mātauranga in the Challenge's Building New Zealand's Innovation portfolio, in Kahui Maori, and as a senior management team member.

Co-leader, Portfolio 1: Building New Zealand's Innovation Capacity – Urs Daellenbach

A Reader in Management at Victoria University of Wellington Business School, Urs' research interests focus on value creation and capture, and drawing on the resource-based and capabilities views of firms. His emphasis is on strategic research and development and innovation decision-making.

Leader, Portfolio 2: Agricultural and Environmental Technologies – Ian Woodhead

Ian brings SfTI 30 years' experience leading research and development projects, with a focus on agricultural and environmental sector sensors.

His background in theory and propagation of electromagnetic fields, time domain reflectometry, high-speed electronics, and a general understanding of soils, contaminant flow, and agricultural practice, is being applied to SfTI's agricultural and environmental technologies portfolio.

Leader, Portfolio 3: Medical Technology – home and community care – Geoff Chase

Distinguished Professor in Mechanical Engineering and Director of Mechatronics at Canterbury University, Geoff is a Fellow of the Royal Society of New Zealand, the American Society of Mechanical Engineers, and Engineers New Zealand.

A NZ Consortia for Medical Device Technology management board member, Geoff is Deputy Director of the MedTech Centre of Research Excellence, and leads the EU-NZ eTIME clinical bio-engineering consortia. He has founded two MedTech venture-funded startup companies based around model-based therapeutics and novel breast cancer screening technology.

Leader, Portfolio 4: Smart Services – Andy Philpott

With a long career in Operations Research and its application to problems in business and industry, Andy has particular expertise in modelling and optimising decision-making under uncertainty.

Leader, Portfolio 5: Materials, Manufacturing and Applications – Elspeth MacRae

Elspeth is SCION General Manager, Manufacturing and Bioproducts, leading over 100 staff involved in wood and fibre processing activities including biorefinery, biochemicals, bioplastics, clean technology and biotech/omics activities. On the Board of BPN Ltd and the NZ Packaging Council, Elspeth also has a governance/advisory role for the Bioprocessing Alliance and NSC BBHTC.

Deputy director and Theme leader Sensors, Robotics and Automation – Bruce MacDonald

SfTI's deputy director, Bruce leads the Sensors, robotics and automation research theme, and oversees Capacity Development initiatives.

Director of Auckland University's Centre for Automation and Robotic Engineer Science, Bruce also chairs the New Zealand Robotics, Automation and Sensing Association, and co-chairs the Institute of Electrical and Electronics Engineers technical committee on software engineering for robotics.

Theme leader Materials, Manufacturing and Design – Don Cleland

Professor at Massey University's School of Engineering and Advanced Technology since 1993 and Head of School from 2008 to 2017, Don's research interests include industrial refrigeration, heat pumping, energy efficiency and food processing.

Don is a founding member of Massey's Postharvest and Refrigeration Research Centre which undertakes research, consultancy and education to support the food cold chain and focusses on packaging, horticultural crops, energy and sustainability. A MacDiarmid Institute Director, he is a former Vice-President of the Science and Technology Council of the International Institute of Refrigeration.

Theme leader IT, Data Analytics and Modelling – Stephen MacDonell

Professor of Software Engineering at Auckland University of Technology, and Otago University Professor in Information Science, Stephen is a Member of the Institute of Electrical and Electronics Engineers (IEEE), the IEEE Computer Society, and the Association for Computing Machinery, and serves on the Editorial Board of Information and Software Technology. His role within SfTI is Theme Leader for IT, Data Analytics and Modelling.

Kāhui Māori Chair and Theme leader Vision Mātauranga – Te Taka Keegan (*Waikato-Maniapoto; Ngāti Porou*)

Senior lecturer in Waikato University's Computer Science Department, Te Taka's 2017 Prime Minister's Award for teaching excellence recognised his 30-year career weaving his love of te reo Māori with his love for computers.

Dr Keegan's work on numerous projects involving Maori language and technology includes the Maori Niupepa Collection, Te Kete Ipurangi, the Microsoft keyboard, Microsoft Windows and Microsoft Office in Maori, Moodle in Maori, Google Web Search in Maori, and the Maori macroniser. He remains the only person able to teach a computer science paper in te reo.

Within SfTI, Te Taka Chair's the Kāhui Māori advisory group, and is theme leader for Vision Mātauranga.

SfTI's Kāhui Māori – advisory group

Kāhui Māori ensures Vision Mātauranga and Te Ao Māori (Māori world view) principles are embedded across SfTI.

The six-member Kāhui Māori group guides SfTI researchers on incorporating Vision Mātauranga into their research so the science and innovation potential of Māori knowledge, resources, and people can be unlocked to benefit New Zealand.

As well as Sally Davenport, Te Taka Keegan, and Katharina Ruckstuhl (see above) the Kāhui Māori group includes:

- Mānuka Henare *(Ngāti Haua hapu of Te Aupouri, Te Rarawa, Ngāti Kuri and Ngāti Kahu of Muriwhenua)*
- Jason Turuwhenua *(Ngati Porou, Ngai Tuhoe)*
- Shay Wright *(Te Rarawa, Ngāpuhi, Ngāruahine)*.

SfTI's Programme Office

The SfTI Challenge is supported by six Programme Office staff: including:

- Reece Moors (Manager)
- Andre Arnold (Finance)
- Helen Corrigan (Stakeholder Engagement and Communications)
- Denise Cutler (Science Relationship Advisor)
- Alex Eleftheriadis (Office administration)
- Willy-John Martin PhD (Capacity Development).

Contact the SfTI Programme Office at:

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Media inquiries: 0275 682319

www.sftichallenge.govt.nz

SfTI Themes, Portfolios, Spearhead and SEEDs

The SfTI Challenge is governed by four areas of capability, or 'Themes'. These are large, multidisciplinary areas of innovative research spanning different applications and industry sectors.

The Themes are:

- Vision mātauranga
- Materials, manufacturing and design
- Sensors, robotics and automation
- IT, data analytics and modelling.

Portfolios

SfTI Theme areas are divided into five 'headline' Portfolios -ie industry sectors where SfTI applies funding.

Spearheads

Each portfolio is responsible for one or more of SfTI's seven 'spearhead' research projects. Spearheads are generally large, annually reviewed, include bigger teams, and continue over several years. Annual funding for Spearheads usually ranges between $750,000 – $1m.

SfTI's current portfolios and respective spearhead projects are:

Portfolio 1: Building New Zealand's innovation capacity

- Spearhead: Human capacity; relational capacity.

Portfolio 2: Agricultural and environmental technologies

- Spearheads:
  - Inverting electromagnetics – a new way to measure groundwater flow
  - Precision Farming Technology for Aquaculture
  - Adaptive Learning Robots to complement the Human Workforce.

Portfolio 3: Medical technology – home and community care

- Spearhead: Type 2 diabetes and its control via insulin management.

Portfolio 4: Smart services

- Spearhead: R Five - Combining analytics techniques and new information and communications technology.

Portfolio 5: Materials manufacturing and applications

- Spearheads:
  - Additive manufacturing and 3D and/or 4D printing of bio-composites
  - Adaptive learning robots to complement the human workforce.

SEED projects

SfTI also currently funds 28 smaller, generally one to three-year SEED projects. Generally, SEED project funding is up to $100k per annum.

SfTI Challenge SEED projects

As well as large, annually reviewed 'Spearhead' research programmes that continue over several years with annual funding that ranges between $750,000 - $1m, SfTI also funds smaller, generally one to two-year SEED projects commonly worth about $100k per project annually. During 2016 – 2017, SfTI provided funded for the following 28 SEED projects.

2016 SEED PROJECTS

	Organisation	Project Name	Description
1	University of Auckland	A giant leap for small displacements	This proposal is to accelerate development of a new, patent-pending platform machine vision technology to more reliably, accurately and efficiently determine shape, motion, surface and volume deformation data.
2	Victoria University	Magnetic silver clusters - a disruptive technology in bio imaging	This project will develop new, highly efficient magnetic resonance imaging (MRI) contrast agents for early disease detection.
3	University of Canterbury	Enabling sustainable economic development with advanced additive manufacturing of wood	The objective of this project is to manufacture a wood product (a non-living 3D structure) without the need for the destructive harvesting of trees.
4	University of Otago	Mechanically induced drug release	The aim of this project is to develop a new technology for controlled drug release based on mechanically-sensitive soft materials.
5	Lincoln Agritech	Controlling spray droplets in flight: new science enhancing innovative capacity	Project researchers will develop the science required to create a "perfect sprayer" – one that can sense the crop canopy location and apply agrichemicals to achieve optimal leaf coverage, while minimising chemical wastage and loss to the environment.
6	Landcare Research	Algae-derived food supplement	This project meets market demand for more acceptable, high-EPA materials for food supplements.
7	University of Auckland	A self-healing silicon electrode for lithium battery applications	Developing a stretchable binder coating that will maintain the mechanical and electrical integrity of silicon anode during charge-discharge cycles is the aim of this research project.
8	University of Auckland	Golden Polymer for Enriching Biogas to Biomethane	This proposal focuses on developing "golden" polymers that can efficiently filter CO2 from biogas, leaving biomethane with →98% purity. These polymers act as molecular sieves with pores tailor-made for CO2 separation. The researchers aim to transform biogas into a gold standard biomethane for the New Zealand domestic and export market.
9	Digital Sensing Limited	Nitrate Sensor Arrays	This project presents a collaboration between Horahora Marae (mana whenua and kaitiaki of the Waikato River at Rangiriri), Auckland University, and Digital Sensing Ltd, to develop a low-cost, fit for purpose sensor network that provides continuous real-time monitoring of the quality of freshwater supply, with an initial emphasis on nitrate levels in the Waikato River.
10	University of Waikato	Te Tāhū o te Pātaka Whakairinga Kōrero: Next Generation Indigenous Knowledge	This proposal addresses the pressing need to formulate a framework for Next Generation Indigenous Data and Knowledge Management (IKM) in eResearch.

2017 SEED PROJECTS

	Organisation	Project Name	Description
1	Canterbury University	In-Vehicle Touchscreens: Improving Human Performance and Reducing Attentional Demands	Developing new understanding of touchscreen interaction during vibration, and improving interaction with touchscreens in vibrating environments is the aim of this project.
2	Otago University	Computational Glasses – Headmounted displays for the visually impaired	The project will develop prototypes for computational glasses that analyse the environment and change it to compensate for user impairment.
3	University of Auckland	Mechanochemical conversion of biomass into commodity chemicals	Researchers will look to convert suberic acid, a compound present in cork and castor oil, into phthalates, and to transform cyclopentanone, a compound attainable from agricultural waste and forest residues, into adipic acid.
4	Waikato University	Secure, shared and collaborative: treasure in the block chain	The distributed ledger technology known as 'Blockchain' shows considerable promise for use in secure, distributed systems of collections of information across traditional boundaries.
5	University of Auckland	Executable Heart-On-Chip for validating cardiac devices against drug effects	A project to develop technological innovation for pacemaker certification that accommodates drug induced effects.
6	Massey University	Closing the Gaps in Static Programme Analysis	Poor software quality and vulnerabilities can be exploited for malicious activities. Static Program Analysis, where bugs and vulnerabilities are detected by models extracted from code without executing the program, will be the focus of this project.
7	University of Auckland	Womb with a view: Software connecting pregnant women and fetus	Aimed at encouraging pregnant women to quit smoking, this project will develop a 3D model for web pages and mobile devices that demonstrate how smoking impacts their own, and their unborn children's, circulatory systems.
8	University of Auckland	Wearable sensors for gait assessment in lower extremity disability population	A project to take a novel approach to address limitations of current 'best practice' rehabilitation for gait disorders by exploiting advances in wearable sensors and computational modelling.
9	University of Auckland	Underground wireless data acquisition network using Low Power Wide Area Network	Focusing on ensuring long term, reliable, wireless data acquisition by investigating underground agriculture sensing.
10	University of Auckland	Modelling and improving emissions / energy efficiency in NZ's transport systems	This project will look to model vehicle emissions in strategic transport modelling tools.

	Organisation	Project Name	Description
11	Victoria University of Wellington	Machine Learning Based on Rat Brains	Researchers will seek to identify models of learning based on rat-neuroscience to develop new artificial intelligence (AI) algorithms.
12	Victoria University of Wellington	Landscape-scale augmented reality: enhancing public understanding of our cultural heritage	Potential economic and social impacts of this project include enabling increased cultural understanding by augmenting virtual reality.
13	University of Auckland	Deployable Nano-Satellite Synthetic Aperture Radar for Monitoring NZ's EEZ	Developing underlying science and technology needed to provide NZ with an overhead monitoring capability using space-based assets will be the focus of this project.
14	Massey University	Novel Approaches for Impaired-Speech Recognition	Researchers will seek to develop adaptive personalised speech systems recognising individual impaired speech and generate intelligible speech. The systems are based on a unique music retrieval technique and could be used on mobile devices, like smart phones, tablets and PCs, such as human to robot interactions.
15	University of Waikato	Acoustic Vector Network Analyser	This project aims to improve measurement of object acoustic properties, e.g. the acoustic permeability of pasture as a function of its dry matter yield.
16	Massey University	Distance and Direction Estimation for Acoustic Bird Monitoring	Estimating population densities by locating bird calls using mathematical and statistical methods.
17	Scion Research	Visual recommender technology for exploratory analytics: predicting forests futures	This project will explore the potential to use visual recommender technology to analyse complex spatiotemporal data sets.
18	Victoria University of Wellington	Data analytics to enable wide-area monitoring of electricity distribution lines	Use of new, automated data-analytics and modelling to extract information from 3-dimensional solid state magnetic field sensor measurements.

Recent SfTI media:

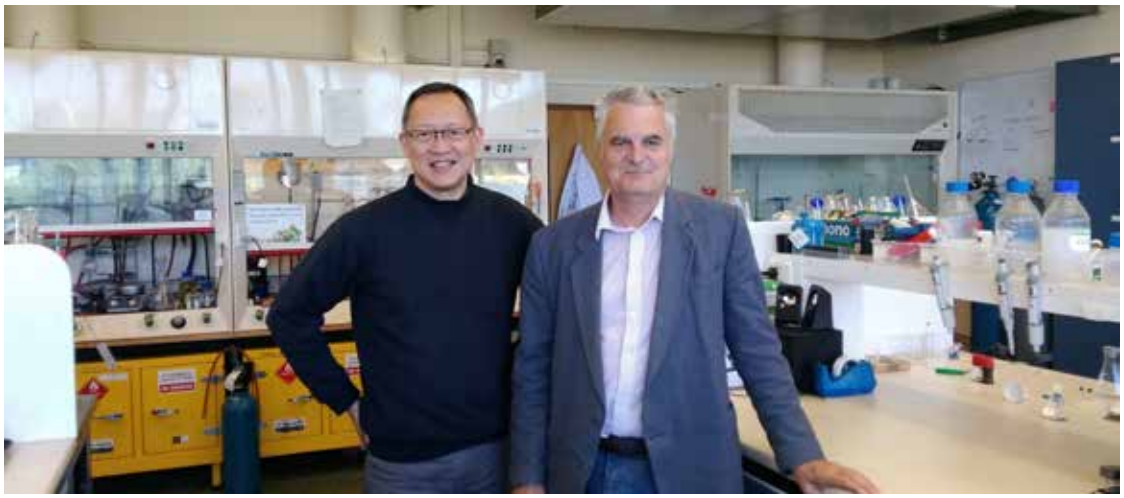
+NEWS |

Gel implants on the horizon for targeting cancer drugs

0

Aaron van Delden
avandelden@nzdoctor.co.nz

Friday 3 November 2017, 01:09 PM



Otago University chemists Eng Wui Tan and Steve Moratti are working on unique gels that can deliver drugs at a controlled rate into the body

> Other conditions that may benefit from targeted doses of drugs include epilepsy, arrhythmia and pain

University of Otago researchers are using ultrasound to improve the release of anti-cancer drugs into the body.

Working in the field of polymer and supramolecular chemistry, the researchers are refining the action of drug-containing implants, already in use to treat brain cancer.

Their innovations are allowing them to use ultrasound to control when and how much of a drug is released from a new type of gel implant that was developed in-house.

Associate professor Steve Moratti can't be 100 per cent sure whether they have a world-first discovery on their hands, but believes it is a unique approach.

His team has developed stretchy gels which, though 90 per cent water, remain intact under pressure.

By chemically linking ultrasound-sensitive nanoparticles developed by chemistry senior lecturer Eng Wui Tan with the gels, the team produced drug reservoirs that can release some of their payload when ultrasound is applied.

Brain cancer is the initial target, but Dr Moratti says other applications may be possible. The researchers are keen to hear from doctors with suggestions.

Other conditions that may benefit from targeted doses of drugs include epilepsy, arrhythmia and pain.

Boosting the healing process

For brain cancer, having control over when an implant releases drugs could be beneficial in healing after tumour removal, Dr Moratti says.

A pulsating dose, rather than a constant one, might make it less likely the cancer becomes resistant to a drug.

Nanoparticles are normally injected into the bloodstream or swallowed in a capsule. In the Otago innovation, the gel would be implanted in the part of the body undergoing treatment.

The next steps are to refine dosages at different ultrasound intensities and to test the gel on tumours in animals, comparing it with conventional treatments.

The researchers are seeking $1 million from the Ministry of Business, Innovation and Employment. The initial research has been done part time over nine months for less than $100,000. The team had seed funding from the Science for Technological Innovation National Science Challenge.

Dr Moratti can be contacted at smoratti@chemistry.otago.ac.nz

Recent SfTI media:

Birth of Blockchain Researchers of New Zealand Aotearoa – BRONZA

What's believed to be New Zealand's first Blockchain researchers' group has been set up by SfTI 2017 SEED project lead, Waikato University Computer Science Professor, Steve Reeves.

Held at the University in mid-December, the Blockchain Researchers of New Zealand Aotearoa group (BRONZA) aims to allow researchers and stakeholders interested in Blockchain to discuss current issues and potential directions.
BRONZA goals include:

- ensuring public and NZ interests are prioritised in Blockchain development
- fostering of academia-based NZ Blockchain projects
- lobbying for Government engagement with Blockchain
- increasing public understanding of Blockchain.

No, not some experienced alt rock band – members of the inaugural Blockchain Researchers of New Zealand Aotearoa (BRONZA) group:

(L-R): Kade Morton, Security Consultant, Deloittes; Alex Sims, Associate Professor of Commercial Law, Auckland University; Warwick McNaughton, Deputy Electoral Officer, Auckland Council; Steve Reeves, Professor of Computer Sciences, Waikato University; Michael Delgrosso, Election Services.

SfTI Vision Ma-tauranga Theme leader Dr Te Taka Keegan, and SfTI Capacity Development Advisor Dr Willy-John Martin also attended the meeting.

SfTI

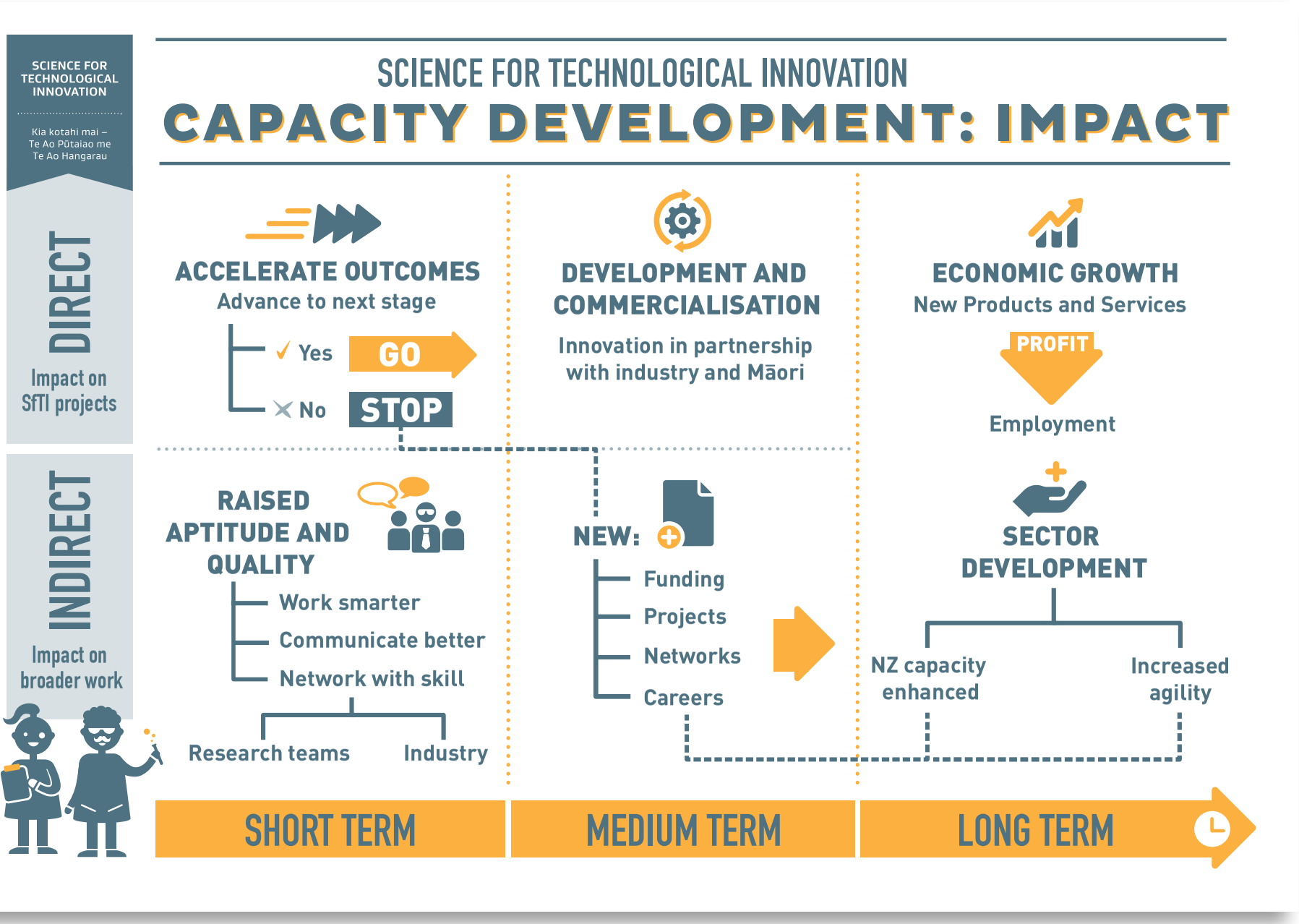
Capacity Development for researchers

SfTI is unique among the National Science Challenges in offering significant professional development to its 200+ researchers through a comprehensive Capacity Development programme.

Open to all SfTI researchers, the programme funds diverse training opportunities in areas including business pitching, networking, media training, leadership development, Māori Economy, stakeholder engagement, and more.

The aim is to give researchers human and relational skills to assemble and coordinate the best teams to accelerate the economic impact of their work for New Zealand. These teams are multidisciplinary, and include research, Māori and Industry organisations working together.

Vision Mātauranga is an exciting thread within Capacity Development. SfTI is committed to the development of distinctive products, processes, systems and services from Māori knowledge, resources and people for the benefit of New Zealand.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Kia kotahi mai – Te Ao Pūtaiao me Te Ao Hangarau
SCIENCE FOR TECHNOLOGICAL INNOVATION
CAPACITY DEVELOPMENT: IMPACT
DIRECT
Impact on SfTI projects
INDIRECT
Impact on broader work
ACCELERATE OUTCOMES
Advance to next stage
Yes
GO
No
STOP
DEVELOPMENT AND COMMERCIALISATION
Innovation in partnership with industry and Māori
ECONOMIC GROWTH
New Products and Services
PROFIT
Employment
RAISED APTITUDE AND QUALITY
Work smarter
Communicate better
Network with skill
Research teams
Industry
NEW:
Funding
Projects
Networks
Careers
SECTOR DEVELOPMENT
NZ capacity enhanced
Increased agility
SHORT TERM
MEDIUM TERM
LONG TERM

Six months of SfTI honours

Several SfTI leaders and researchers received New Zealand and overseas honours recently

August 2017

- SfTI Portfolio 3: Medical Technology (Home and Community care) lead, Geoff Chase, won Canterbury University's 2017 Research Medal, awarded to a UoC researcher whose work is recognised as world class.
- Also in August SfTI Vision Mātauranga Theme leader and Kāhui Māori chair, Te Taka Keegan, won the 2017 Prime Minister's Supreme Award for Excellence in Tertiary Teaching.

September 2017

- Andy Philpott, SfTI Portfolio 4 (Smart Services) head became a new INFORMS Fellow Class of 2017, an honour reserved for distinguished individuals who have demonstrated 'outstanding and exceptional accomplishments in operations research and management sciences'.

October 2017

- SfTI Portfolio 2 (Agri-environmental technologies) leader Ian Woodhead received the 2017 Royal Society Te ApÐrangi Scott Medal - awarded for engineering science and technology work of great merit by a researcher in New Zealand - for his work in advancing electronic engineering.
- SfTI Portfolio 5 (Materials, Manufacturing and Applications) team member, Kim Pickering also received the medal for her development of sustainable composite materials.

Professor Kim Pickering

November 2017

- Geoff Chase became Canterbury University's first Distinguished Professor.

January 2018

- SfTI Director became Sally Davenport MNZM in the News Year's Honours list.
- Geoff Chase, and Portfolio 1 (Building New Zealand's Innovation Capacity) researcher Professor Jarrod Haar, appointed to Marsden Fund Council.

Recent SfTI media:

"Additionality": How will we know the National Science Challenges are making a difference?

by Professor Sally Davenport

Many of us in the innovation system have been hearing this 'additionality' word a lot recently. For some it's an odd term they have never heard before and, relative to many words, it is a youngster.

It apparently first surfaced in the 1950s as a concept in economics.

The Oxford Dictionary defines it as: *the fact or concept of being additional; especially any principle or policy that involves pursuing economic or financial practice according to this concept*. In plain(er) language, it is the extra value generated by a policy intervention over and above what is already happening. And it's notoriously hard to measure[1]!

Yet it's a core plank of the National Science Challenges (NSCs) – the potential for which helped the eleven challenges achieve their status. In 2013 the NSC Panel argued that additionality was evident enough to establish a challenge approach *"where additional research, progress, and impact can be generated by collaborative research"*[2]. Thus those of us involved in NSCs will need to demonstrate that we are generating additionality to be deemed successful up to and beyond 2019.

The MBIE NSCs website asks[3]: *"How are the National Science Challenges different from other MBIE investment processes?"* Their answer states: *"The National Science Challenges are significant mission-led investments that focus on defined issues of national importance. Each Challenge encourages proposals from New Zealand's 'best team' and looks for additionality, e.g. new ways of doing things in terms of scientific approaches, collaboration between researchers, disciplines, and research organisations, and new ways to manage research activities"*. In the NSC MBIE performance framework, additionality is said to be demonstrated when the Challenge *"funds a coherent set of projects rather than disparate projects"*.

Additionality – what does it mean?

Additionality is common parlance around R&D subsidies to firms but also increasingly in environmental and climate change interventions. Three different types of additionality are usually described: input, behavioural and output additionalities[4]. Input additionality, in the case of firms, is when they increase their own investment in R&D as a result of public funding. In the NSCs, we might observe input additionality either by seeing increased alignment and cross-fertilisation between our research and other funded programmes, or when we attract co-funding or in-kind support from other sources.

Output additionality covers the direct outputs of the intervention – which can be in increased scale/quantity, enhanced quality, results achieved in an earlier time-frame, or more benefits targeted to a specific group. Typical innovation project outputs are patents and publications, new start-ups or products. Outputs are measured assuming they represent an intermediate step to the policy's desired outcomes which, in the case of the Science for Technological Innovation (SfTI) challenge is more technologically driven economic growth. As we well know, there is often a delay between investment and outputs, and an even longer, and more tenuous, casual path to outcomes. But that shouldn't stop the NSCs keeping our sights on those outcomes.

Behavioural additionality (sometimes called second-order additionality) is an intermediate form that is really important for the SfTI challenge. It encompasses individual and organisational learning and beneficial process change that arise from participating in a policy scheme. Years ago a master's student studied the additionality evident from a NZ policy intervention called the Technology for Business Growth scheme[5]. She found that even though some input and output additionality was (inconsistently) evident, the most benefit came from the businesses having to fill out what was effectively a business plan in order to be eligible (even though they complained bitterly about it at first). Longer term, this planning behaviour served the firms well as a new or enhanced organisational skill.

SfTI's mission includes behavioural additionality as we aim to enhance New Zealand's capacity to use physical sciences and engineering for economic growth. SfTI's particular focus on building not just technical, but also the human and relational capacity of our researchers, is why we are doing more than just funding research projects. It is why, for example, we work with others, such as Kiwinet, to provide commerciality oriented learning opportunities for our research community. It is why we have been developing new collaborative processes between researchers and industry/MĐori leaders to define and build new mission-led 'best NZ team' spearhead projects. It is why we also have our theme leaders mentoring the lead researchers of our 28 seed projects. These processes can be more time-consuming than a traditional approach but it is our hope that, if (when) proven beneficial, they will become 'business as usual' for our wider research community.

That other meme – impact

You might well ask, is this additionality concept any different from generating impact, another meme in our research world? In MBIE's recently released discussion paper[6], impact is defined as "the final, long-term effect in a causal results chain" from a science investment, which sounds remarkably like outcome additionality. The subtle difference is that additionality is meant to take into account the counter-factual of no investment. A simple formula describes the link between additionality and impact:

$$A = I_{in} - I_{rc}$$

where A is the additionality, Iin is the impact of the intervention, and Irc is the impact of a reference case or baseline. It is clear from the MBIE website that the reference case for the challenge is MBIE (or equivalent) investment processes.

So is SfTI making a difference? As we approach our second year anniversary since the challenge was launched on 16 September 2015, it is a question we will be asking a lot more in coming months leading up to our mid-term review. Thanks to all of you that have helped us so far with our experiments with new ways of developing and managing edgy mission-led research. Thanks to you, SfTI will be able to tell a strong additionality story on many dimensions.

Sally Davenport IS Director – National Science Challenge, Science for Technological Innovation (SfTI). www.sftichallenge.govt.nz

[1] For the UK Treasury's guide: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/191511/Additionality_Guide_0.pdf

[2] http://www.pmcsa.org.nz/wp-content/uploads/Report-of-National-Science-Challenges.pdf

[3] http://www.mbie.govt.nz/info-services/science-innovation/national-science-challenges/features#3

[4] Clarysse, B., Wright, M., & Mustar, P. (2009). Behavioural additionality of R&D subsidies: A learning perspective. *Research Policy*, 38(10), 1517-1533;.

[5] Davenport, S., Grimes, C., & Davies, J. (1998). Research collaboration and behavioural additionality: a New Zealand case study. *Technology Analysis & Strategic Management*, 10(1), 55-68

[6] http://www.mbie.govt.nz/info-services/science-innovation/national-statement-science-investment/science-impact-discussion-paper-june-2017.pdf

Recent SfTI media:

NZBusiness
The owner manager's magazine

Where science benefits business and society

Friday, 15 December 2017

NZBusiness interviews Victoria University Business School Management Professor Sally Davenport on the work and achievements of Science for Technological Innovation, and what it all means for New Zealand small and medium enterprises.

Victoria University Business School Management Professor, Sally Davenport, is a renowned science, innovation and entrepreneurship academic with a background in Chemistry.

On the strength of her research into sustainable collective productivity in New Zealand firms, Sally became a Productivity Commissioner in 2011.

Earlier this year Sally became the Director of the Science for Technological Innovation (SfTI) National Science Challenge - one of 11 such Challenges set up over the last few years. Their aim is to take a more strategic approach to the government's science investment by targeting goals which, if achieved, will have major and enduring benefits for New Zealand.

NZB: Our readership is made up of SMEs employing up to about 20 employees. How do you see the SfTI Challenge helping them?

Sally: Our aim is right up SMEs' alley given that New Zealand's SMEs carry out over three-quarters of our R&D spend – one of the highest in the OECD. SfTI is all about innovation through physical science and engineering, and growing New Zealand's economy and through that our social well-being.

Interestingly we're finding that New Zealand companies are asking to be part of our industry advisory groups so they can keep in touch with what new tech is coming down the pipeline.

In short, SfTI is focused on developing unique, potentially exportable kiwi technology. We see ourselves as the 'technology for' challenge, and are agnostic about what sector it might be for as long as it benefits New Zealand.

NZB: But there're issues?

Sally: Yes. Collaboration with researchers or other companies on R&D is not so common as in-house R&D. Yet we know that those that do collaborate with external knowledge sources tend to get a bigger productivity hit from innovation.

Making it easier for SMEs to collaborate with public sector researchers and vice versa, can only be good both for our SMEs as well as our economy and societal well-being flow on.

NZB: So, what's SfTI's scope?

Sally: We're literally the 'tech' challenge. And we're all about New Zealand. Our four research themes are Sensors, Robotics and Automation; IT, Data Analytics and Modelling; Materials, Manufacturing and Design and Vision MĐtauranga.

But there has to be a logic for developing the technology in New Zealand.

NZB: How do you go about that?

Sally: We look for 'missions' that make sense for a Kiwi approach. And we work closely with industry and MĐori business leaders to indicate what missions we should be pursuing.

NZB: Any examples?

Sally: Yes, early in 2017 several 'missions' came out of a series of workshops we held including 'Intelligent oceans' – makes sense with our huge deep sea EEZ; 'rugged/ flexible robots' – great for our small scale, flexible, manufacturing and rugged outdoor work environments; and 'Digital Marae' - aimed at bringing the latest tech to our unique indigenous culture. We're also scoping a new research concept called the Personalised Value Chain/the individual as a customer.

NZB: SfTI launched in 2015 with a research budget of $39.2 million. What have you achieved so far?

Sally: We currently fund nearly 200 engineers and physical scientists researching in a virtual network within multi-disciplinary teams across New Zealand. They're some of New Zealand's leading talent from public and independent research institutes and private organisations, and they're involved in 35 projects across 25 local and four international organisations.

We've also been innovative in how we've formed these research teams: it's a new approach to move from researchers proposing projects to developing best teams with complementary skills that have never worked together before.

NZB: Any big breakthroughs yet?

Sally: We're about the 'stretch' technology New Zealand needs in 5-10 years, but we've already accomplished new things. There's a lot on our menu, but current highlights include the clinical trials happening in Christchurch around home delivery of diabetic treatment. One team has developed a drug delivery system that can be stimulated in situ through UV which is now moving towards commercialisation. Another team is making progress with simple to use nitrate sensors essential to help clean up our waterways. We have innovation researchers studying our projects to develop unique NZ-based notions about how collaborative ventures can best work in New Zealand.

NZB: What's the role of Vision Mātauranga in SfTI's work?

Sally: A key thing about SfTI, and this is likely unique in the world, is that Vision Mā tauranga (VM) - a New Zealand government science policy framework - is integrated into all Challenge activity, working and thinking. Our Māori name is Kia Kotahi Mai–Te Ao Pūtaiao me Te Ao Hangarau – to come together as one uniting the world of science with the world of innovation. The idea is to unlock the science and innovation potential of Māori knowledge, resources and people to benefit all New Zealanders. Committing 20 percent of our SEED funding to Māori projects and partnering with the Federation of Māori Authorities are just two examples of SfTI's support for VM so far.

Mangopare
(Hammerhead shark)

The motif of Mangopare (Hammerhead shark) found throughout the SfTI site and publications is from a design by Tyler Dixon (*Waikato-Maniapoto, Ngāti Porou, Ngāi Tūhoe, Ngāi Tahu*).

It symbolises the strength in duality when combing traditional Māori knowledge and modern western science.

National Science Challenges

SCIENCE FOR TECHNOLOGICAL INNOVATION

Kia kotahi mai –
Te Ao Pūtaiao me
Te Ao Hangarau

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