

Te Ara Paerangi Future Pathways submission from KiwiNet Emerging Innovators

The KiwiNet Emerging Innovator programme, established in 2015, delivers results. Through this small discrete intervention, KiwiNet has helped more than 70 scientists from across New Zealand's Research, Science and Innovation system see the value of their research in a new light. The programme transforms New Zealand's scientists by changing how *they think about their science*.

Scientists are already innovators. Many innovate, then put their discovery in a box in the lab, publish a paper, then move on to their next scientific adventure following the mandates of their institution. This programme targets specific scientists with potentially world-changing ideas, unlocking a mindset that reframes scientists' research efforts to creating real world impact – creating brilliance 'out there' *in addition to* 'brilliance inside the lab'.

Central to creating 'real world impact is the process of 'commercialisation' – a critical but oft overlooked function of the RSI system.

This submission is put together by a cohort of 'KiwiNet Emerging Innovator' alumni. They are early and mid-career scientists from Universities, Crown Research Institutes, and independent research institutes.

They provide a unique view of the RSI system elucidating critical gaps and opportunities to develop a well-functioning, effective, impactful sector.

Emerging Innovators represent a small percentage of scientists who have had the opportunity to traverse the Research Phase (research activity) and the Development Phase (commercialisation activity) towards creating a commercial asset. Many have insight into both as they have gone on to create a commercial asset undergoing market/product development, and achieving impact for New Zealand.

This cohort has provided broad feedback which has been distilled into the three most pertinent themes effecting early to mid-stage entrepreneurial scientists who have an interest in real-world application of scientific discovery. The three themes they focused on are:

- 1. Te Tiriti, Mātauranga Māori and supporting Māori aspirations**
- 2. Funding**
- 3. Workforce**

These three themes are intimately related.

Te Tiriti, Mātauranga Māori and supporting Māori aspirations

How would you like to be engaged?

What are your thoughts on how to enable and protect mātauranga Māori in the research system?

What are your thoughts on regionally based Māori knowledge hubs?

Current state

There is widespread understanding across the RSI sector around the importance of Māori engagement at all stages of research. However, recognising that it is important, does not necessarily lead to effective engagement.

Why is this the case?

The RSI sector is not currently equipped to deliver on the expectation of effective Māori engagement from MBIE and the obligations inherent in Te Tiriti.

- At an individual level, there is significant variation in knowledge, skills, and confidence, across the RSI sector to engage effectively with Māori.
- The baseline for effective engagement across the RSI sector is poor.

Knowledge and experience

The low baseline of knowledge and experience in Te Ao Māori and the Tiriti is the summation of:

- a) An historic and systemic lack of training and experiential support through all levels of New Zealand's education system around Te Ao Māori, Te Tiriti obligations.
- b) A science system which is inaccessible to people with significant financial or family responsibilities and an area which presents a non-whānau-centric career option. (See 'Workforce' section) This has limited and continues to limit Māori participation within the system.
- c) A science system which requires and preferentially seeks the recruitment of specialist overseas talent, new to New Zealand.
- d) A sector in which remedial training and education is not prioritised and, by and large, undertaken as voluntary, extramural and outside work hours.

Leadership and process

Quality engagement is uneven.

- a) Engagement does not always occur.
- b) At a process level, where engagement occurs, research ideas/programmes are created through a Western construct. Consultation is sought through Māori stakeholders to apply a Te Ao Māori view. This is retrospective as the programme is developed.
- c) New Zealand-trained scientists and others in the RSI sector have a low understanding of Te Ao Māori generally and are unable to act as role models or direct others new to New Zealand in appropriate process.
- d) Onboarding of the Government's Vision Mātauranga strategy is inadequate for staff to use the strategy as an effective tool. The intention of the strategy is understood, however the process is compared to a 'corporate check box' which provides no authentic change.
- e) Generally, there is a widespread perception that Vision Mātauranga cannot be embedded in the Western scientific method.

MAORI ENGAGEMENT, VISION MATAURANGA AND THE SCIENTIFIC METHOD

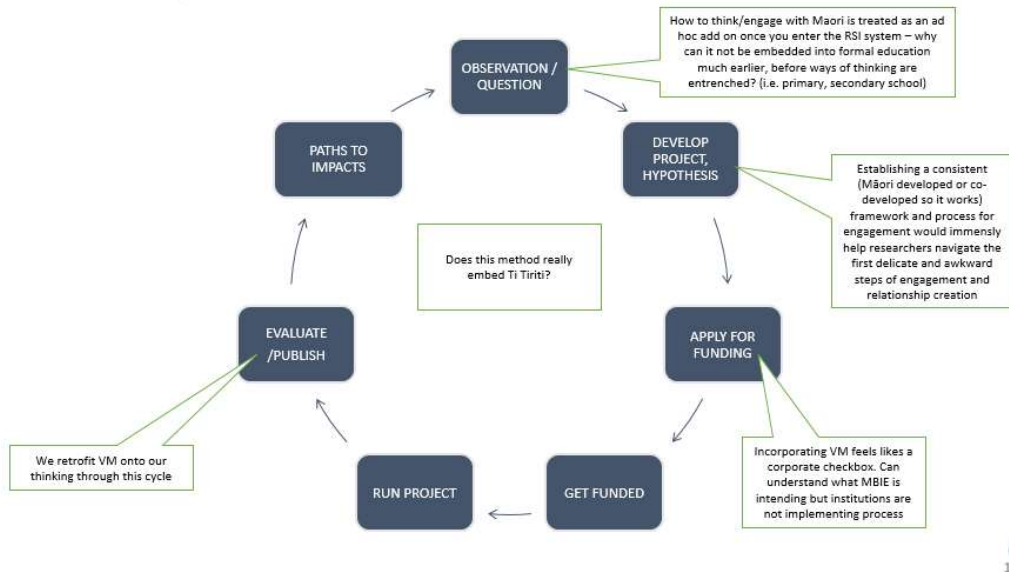


Image 1: Discussion inputs from Emerging Innovators on current situation of weaving Vision Mātauranga and the Scientific method

Future state: Effective engagement and the enablement and protection of Mātauranga Māori.

- a) Alongside Māori, co-create engagement frameworks and processes from the earliest stages of engagement through to relationship building.
- b) Build, recruit, and support leadership from individuals at all levels of the RSI workforce to normalise and model effective behaviour and processes.
- c) Prioritise education and experience as part of, not adjacent to, the RSI system to raise the baseline understanding of Te Ao Māori and Te Tiriti.
- d) Current NZ RSI system emphasises overseas recruitment to bring foreign talent and capability to NZ to enrich our RSI sector. Basic training of Te Tiriti should be fundamental to the professional/career development of these scientists.
- e) Education and experience of Te Ao Māori and Te Tiriti are fully embedded in all stages of New Zealand's education system and thereby provide a strong base prior to specialist understanding of Mātauranga Maori within the RSI sector.
- f) With Government, Māori and the RSI sector, co-design a Vision Mātauranga framework 2.0 which is cognisant of the current challenges aligned with the Western scientific method to develop a more effective tool for all parties.
- g) Sector-wide review of 'culture' of the RSI sector, specifically with regard to tertiary institutions, to identify inherent biases within structures and processes which serve to prevent access, retention and promotion for Māori and others within the sector.

Funding

How should we decide what constitutes a core function and how do we fund them?

Do you think a base grant funding model will improve stability and resilience for research organisations, and how should we go about designing and implementing such a funding model?

Current state

New Zealand's RSI institutions are risk-averse structures. By and large, their systems, processes and communications act to maintain the status quo. This is exacerbated by cost-sensitive and competitive funding processes which inadvertently drive instability and an absence of diversity through the workforce. Business imperatives drive an expectation of short-term returns and competitive behaviours which reduce stability, collaboration, connection, and resilience.

Once in the RSI system, the informal message (or cultural norm) is 'do not rock the boat'. The RSI system self-monitors by harshly penalizing activities outside pure science. Management efforts have tried to address this culture. However, cultural changes have not been effective at all levels.

New Zealand's RSI institutions differentiate themselves through their perceived value of impact. Universities for example, highlight academic publishing as 'impact', while devaluing areas such as contract research or commercialisation outcomes, which are critical pathways for longer-term and wider-reaching impact.. The splintered or polarised value of 'impact' creates more barriers between institutions, obfuscates reporting, limits planning and results in a workforce with lower mobility between institutions.

Focus on 'best and brightest' does not lead to valuable science

In practice, the competitive and narrow approach of 'best and brightest' funding fuels an 'over-promise and promotion' response from the science community whereby projects which tout greatest efficacy and impact are rewarded with Government funds. Valuable projects without the 'sales pitch' are discarded or continue more slowly to fruition – *if at all*.

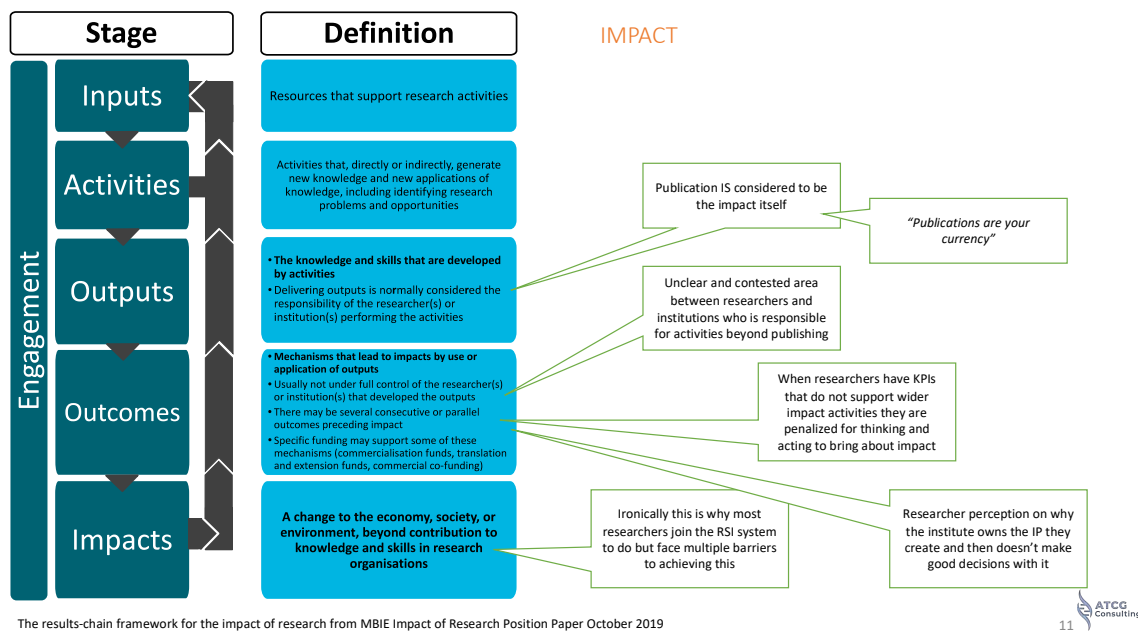


Image 2: Discussion inputs from Emerging Innovators on how the focus on an “Impact” which is well beyond their RSI Outputs leads to aberrant funding actions

Unintended consequences unfold when the Government promotes the prioritisation of the 'best and brightest research'. These consequences are manifested in systemic waste through the science community, workforce attrition, repetitive underperformance for delivery milestones and impact, and a degrading relationship through under-delivery between Treasury and the science community at large. For example:

- 1) The ambiguity of 'impact' is exploited to deliver publication outcomes in preference to more complex commercialisation outcomes.
- 2) Short-term funding equates to short term contracts for a section of the RSI workforce – creating negative and destabilising social and sector implications (see Workforce).
- 3) The current funding model creates a barrier for international collaboration. New Zealand's RSI funding system (overheads versus base funding) is challenging for potential clients and collaborators to understand. This causes frustration and requires explanation. If this barrier is overcome, there is a rolling effect. Research Offices are driven to support work from which they can secure overheads (often at KPI level). It is perceived they drive up costs in research that allows it, and do not help in instances where overheads cannot be collected.

Future state – Funding grounded in outcomes and real-world impact, with longer lead times

Regardless of the funding principles or models adopted, explicit consideration by Government of the unintended consequences of each funding model is necessary.

A broad view of priorities may reduce unnecessary competition and promotion from the science community. Note, a five-year horizon is too short to develop sound science outcomes. A lead time for research & discovery of 15 years is a better core unit of time.

Equally, a broad view of funding may reduce unnecessary competition and promotion from the science community, and research priorities which support mid to long-horizon returns may resolve siloed competition between institutions.

Max Planck Institutes in Germany provide an interesting model worth exploring. Anecdotally, there is no competitive process for funding. Funding is on application for world class science programmes/research operating in a high-trust environment. We note that these Institutes benefit from an economy of scale which is not applicable to the New Zealand situation.

There are advantages for international collaborations if New Zealand adopts a base funding model.

The design of new funding mechanisms should recognise and fund commercialisation activity, professionals, and programmes as an essential and critical component to unleashing economic and social impact from science discoveries. A new funding mechanism could incentivise a more even distribution of funds towards valuable science outputs including scientific research, academic publication, commercialisation activity, and applied research.

Workforce

How should we include workforce considerations in the design of national research Priorities?

What impact would a base grant have on the research workforce?

How do we design new funding mechanisms that strongly focus on workforce outcomes?

Current state

Three features of the sector combine to create a precarious gap between completing study and securing permanent employment, which creates a thinning effect on the available RSI workforce pool.

- a) Entry into the RSI workforce is marked by a significant period of employment/placement of very highly qualified individuals working below their skill level.
- b) From the entry point, early to mid-career individuals experience the work and social insecurity of recurrent temporary contracts. This rolling temporary period can continue for approximately six years. Temporary contracts are often tied to Government-funded programme timeframes.
- c) Preference for permanent roles is given to individuals with Post Doctorate qualifications and experience gained overseas. Equivalent experience can often not be obtained within New Zealand's RSI sector. Overseas study, training, and work experience is so highly valued in the RSI sector, many of New Zealand's workforce are 'driven' overseas by the lack of opportunities at home when trying to enter the RSI system.

These features exacerbate inequality across the RSI workforce.

As examples: individuals who require the financial stability of steady employment (entry into home ownership, planning or starting a family) and individuals who have New Zealand based dependents are actively disadvantaged by the soft infrastructure (low-skilled work requiring high qualification entry, temporary contracts, and limited permanent opportunities for experience obtained within New Zealand). Furthermore in the academic world, permanent roles come with heavy teaching workload, which restricts the time available for scientists to do research, discovery and commercialisation.

If these individuals have entered the RSI system at all, they are at higher risk of exiting to address the incompatibility of values, family and financial situations. This drives the lack of diversity seen within the RSI system - it is geared to only support those who can 'afford' to stay. Ultimately, the accepted systems and processes are an anathema to a whānau-centric model, disadvantaging Māori, Pasifika, and women. The system is acknowledged as being a risk to mental health.

COMMON CAREER PATHS IN THE RSI

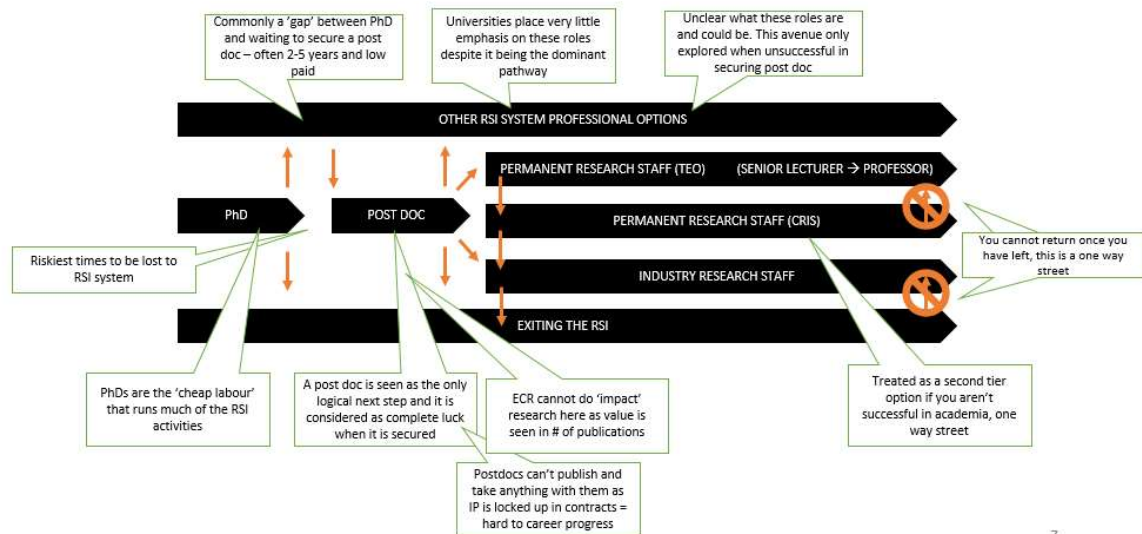


Image 3: Discussion inputs from Emerging Innovators on current common career pathways they have observed first hand.

Transitioning between projects/institutions

RSI entities weigh the value of academic publication, commercialisation activity, and contract research in different measure. This not only determines where science and workforce funding is directed by institutions but also affects and limits the ability for a skilled science workforce to transition between entities.

Commercialisation workforce

- Commercialisation is a specialist field with skills that are hard to come by.

Commercialisation activities involve developing patents, licensing, research-product prototyping and market validation, activity taking scientific discovery towards investment and spinout companies. These activities are critical mechanisms in realising impact (social, health, environmental and economic) from scientific endeavour. Commercialisation activities are considered non-core elements, or outside of the scope, for most RSI roles.

At the same time, commercialisation requires skills, knowledge, and contacts beyond an individual. Successful commercialisation requires groups of people with different drivers. For example, different people may be required to help identify and navigate what is 'best' for the technology versus what is 'best' for the university.

- Institutions discredit commercialisation and its endeavour is not rewarded

Commercialisation is often judged as a contaminating phenomenon that pollutes or misdirects pure scientific endeavour. This is particularly evident in universities where 'impact' is viewed as a value somewhat directly proportional to number of academic publications. Additionally, impact is viewed as grant money obtained, rather than outcomes and products resulting from that funding. This derives competition securing funding, rather than efficient use of funding/resources.

Institutions, through formal and informal systems and processes, do not encourage or actively discourage individuals from thinking about their research in broader terms of impact.

Individuals in their early career must carefully balance impactful science (that may have a commercial, economic, and resultant social impact) versus seeking academic publication. Pursuing commercialisation activities is considered 'rocking the boat' – a risky, undesirable activity. "The worst thing you could do for your career at the time".

For individuals who are not in lockstep with their institutions view of impact, any activities beyond the institutional view will penalise career progress. Note, that by the time commercialisation opportunities become apparent, researchers have spent many years 'not rocking the boat' and may require support and a mindset shift to engage.

- The current model of IP rights creates distrust between institutes and researchers

Within RSI, there is complexity around Intellectual Property rights of scientific discovery. Where cooperation is key to successful commercialisation, the understanding of who, why and what Intellectual Property falls where can drive distrust between the institution and its researchers.

The KiwiNet Emerging Innovator programme is one of the few avenues for scientists to learn about, and have a 'Licence' to pursue wider impact activities.

Connections and communication

The RSI system is built on institutional and individual connections and collaboration within New Zealand and beyond. These connections are considered as incredibly important. These networks are a fundamental part of the infrastructure of the system. However, there is a significant barrier to translating connections into valuable resources due to an overall perception that New Zealand science is secretive and extremely expensive.

This perception is formed through:

- a) Tensions arising between the careful navigation of Intellectual Property protection and effective collaboration. The directive of "keep intellectual property confidential" filters down to "don't talk about your research". This causes an uncertain, secretive climate on what may be discussed with potential collaborators and is not conducive to open trusting relationship building.
- b) The current funding model causes a barrier for international collaboration. New Zealand's RSI funding system (overheads versus base funding) is challenging for potential clients and collaborators to understand. This causes frustration and requires explanation. If this barrier is overcome, there is a rolling effect. Research Offices are driven to support work from which they can secure overheads (often at KPI level). It is perceived they drive up costs in research that allows it, and do not help in instances where overheads cannot be collected. This is further impacted by governance level directives not being operationalised on the shop floor effectively, such as not changing KPIs or existing operations to encourage wider impact behaviour.
- c) There is significant room for miscommunication within New Zealand's RSI system. Entities, groups, and individuals have different drivers, value systems, and different currencies of value and impact. Speaking clearly on common ground can prove difficult.
- d) Studying or working overseas is highly valued in the RSI. Many are 'driven' overseas by the lack of opportunities at home when trying to enter the RSI system. This has both positive and negative effects on the RSI system. New Zealand gains its overseas connections while devaluing those who have not left or cannot or leave New Zealand.

Future state – A diverse and empowered science workforce, recognised through greater permanency, funding, and better incentives to operate.

A five-year horizon too short, because science needs to be sound and requires lead time for research & discovery. A 15 year funding forecast would allow for three cycles (every five years) of hiring young researchers and would provide greater opportunity for permanent careers (time to work through cycle of activity and outcome – iterative cycle – towards impact). There should also be a separate and distinct funding mechanism when dealing with short term responsive science goals.

The design of new funding mechanisms should aim for longer horizons which support more permanent positions for the RSI workforce.