SCIENCE FOR TECHNOLOGICAL INNOVATION

Kia kotahi mai –
Te Ao Pūtaiao me
Te Ao Hangarau

National SCIENCE Challenges

THE CHANGING LANDSCAPE OF MĀORI IN SCIENCE;

Lessons from the Science for Technological Innovation NSC Kāhui Māori

AUGUST 2024

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Thank you to those who made themselves available to be interviewed for this legacy piece, including members of the Kāhui Māori and individuals who have had a significant role in the rōpū's success. Thank you also to those who have read drafts and given feedback along the way, especially Nancy Garrity, the Kaihautū of the Kāhui Māori.

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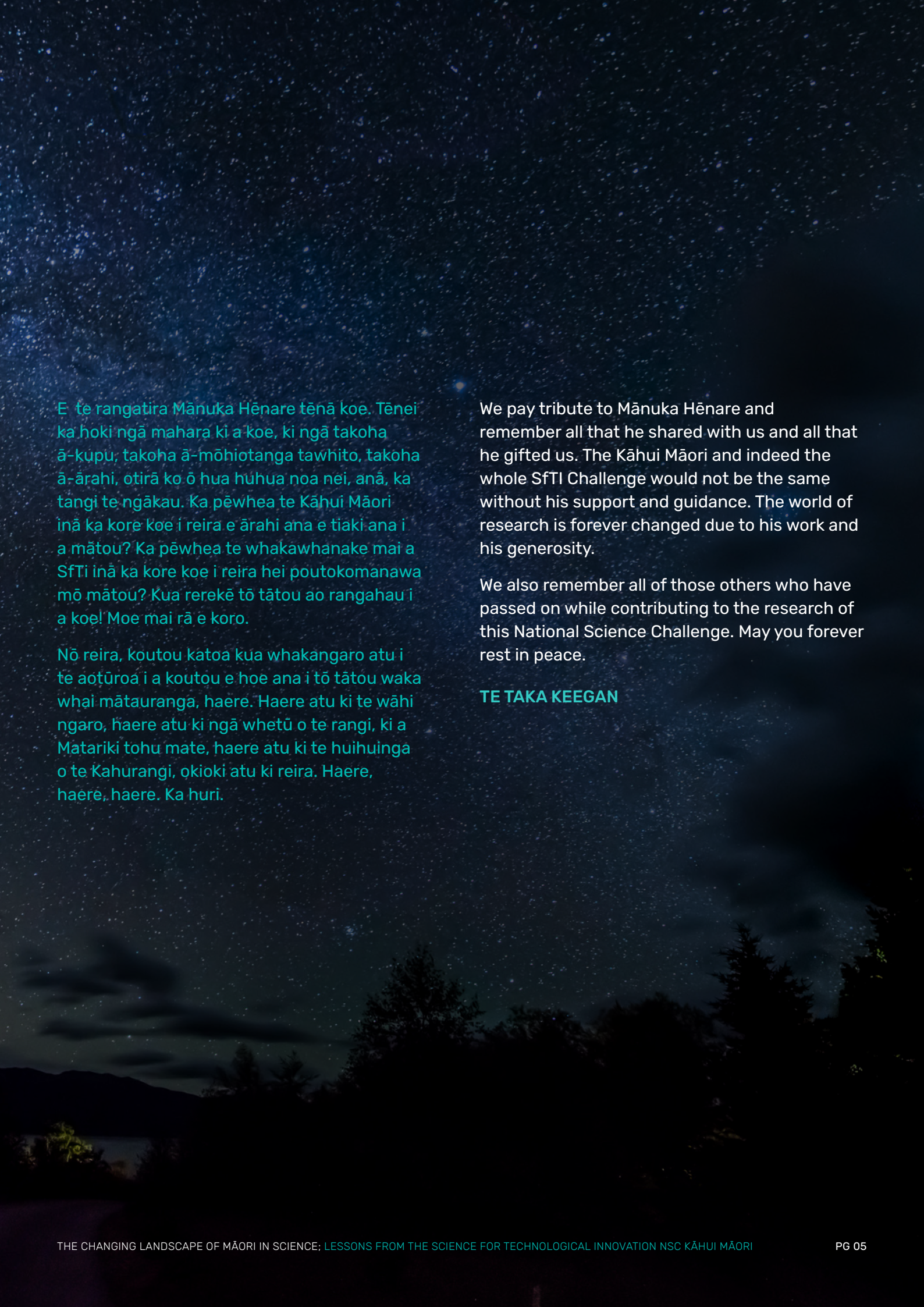


E te rangatira Mānuka Hēnare tēnā koe. Tēnei ka hoki ngā mahara ki a koe, ki ngā takoha ā-kupu, takoha ā-mōhiotanga tawhito, takoha ā-ārahi, otirā ko ō hua huhua noa nei, anā, ka tangi te ngākau. Ka pēwhea te Kāhui Māori inā ka kore koe i reira e ārahi ana e tiaki ana i a mātou? Ka pēwhea te whakawhanake mai a SfTi inā ka kore koe i reira hei poutokomanawa mō mātou? Kua rerekē tō tātou ao rangahau i a koe! Moe mai rā e koro.

Nō reira, koutou katoa kua whakangaro atu i te aotūroa i a koutou e hoe ana i tō tātou waka whai mātauranga, haere. Haere atu ki te wāhi ngaro, haere atu ki ngā whetū o te rangi, ki a Matariki tohu mate, haere atu ki te huihuinga o te Kahurangi, okioki atu ki reira. Haere, haere, haere. Ka huri.

We pay tribute to Mānuka Hēnare and remember all that he shared with us and all that he gifted us. The Kāhui Māori and indeed the whole SfTI Challenge would not be the same without his support and guidance. The world of research is forever changed due to his work and his generosity.

We also remember all of those others who have passed on while contributing to the research of this National Science Challenge. May you forever rest in peace.

TE TAKA KEEGAN

Foreword

He aha te mea nui o te ao? He tāngata, he tāngata, he tāngata.

What is the most important thing in this world? It is people, it is people, it is people.

The science system navigated today has evolved from what was presented to Māori researchers and academics a decade ago, pre–National Science Challenges (NSCs). The landscape has shifted in ways that provide challenges and offer opportunities for all. For Māori researchers and scientists trained in western institutions, navigating this system can be particularly challenging. Western academic systems are often rooted in frameworks that prioritise individual achievement and competition. These frameworks tend to value knowledge construction and dissemination practices that emphasise singular authorship, personal accolades, and the pursuit of recognition, sometimes at the expense of collective benefit. This can be at odds with the values many Māori researchers hold, where knowledge is seen as a collective resource, and where the sharing and application of that knowledge for the benefit of the community is paramount. In these academic settings, the pressure to conform to Western paradigms can be intense, leading to potential conflicts between personal and cultural values, and the demands of the academic environment. This creates a complex terrain for Māori in the research sector who strive to uphold their cultural principles while also seeking to succeed in a system that does not always recognise or reward those principles.

However, the changing dynamics within the science sector, including an increasing awareness and respect for indigenous knowledge systems, offer a chance for Māori researchers to redefine success on their own terms. By advocating for collective benefit sharing, and integrating Māori perspectives and methodologies into their research, they contribute to a more inclusive and diverse transdisciplinary discourse. The challenge, then, is not just to navigate these waters, but to actively shape them, ensuring that the value of collective benefit is recognised.

The approach of the SfTI Kāhui Māori was in keeping with the values upheld by the Rauika Māngai that is always to work on behalf of wider, collective Māori aspirations, to uplift new practice, and to seek better pathways for Māori in science and research.[1]

This resource is a collation of the thought leadership that influenced decision-making processes, and a collection of resources that came out of those decisions. It was indeed intentional and deliberate to bring to the surface more Māori role models doing awesome things in the science and research sector. It is by no means a complete list - those identified in this document are a mere fraction. The beauty of SfTI was that it pulled, pooled and surfaced Māori expertise together in all aspects of science and mātauranga, and we didn't feel so alone.

When boiled down to its sum parts, the work that all the SfTI Kāhu worked towards was to bring people back to the centre of why we do the work that we do: it's about research that makes the world better for this generation and the generations to come. The legacy, put simply, is a reminder of what is most important – He tāngata, he tāngata, he tāngata. It is people, it is people, it is people.

Nancy Garrity
Kaihautū of SfTI's Kāhui Māori

1. Potter, Helen Helen Marie. A WAI 262 best practice guide for science partnerships with kaitiaki for research involving taonga: lessons from Māori voices in the New Zealand Science Sector/ngā kaituhi| authors: Helen Potter & Rauika Māngai. Dunedin: Rauika Māngai,[2022], 2022.


He tāngata, he
tāngata, he tāngata.
It is people, it is
people, it is people

Executive Summary

Māori have a history as pioneers and innovators using intergenerational experimentation to develop expertise that enabled the long journey to this land, and continued to be developed during settlement. A rich body of knowledge, mātauranga Māori, has resulted, but this has tended to be ignored or disregarded by Aotearoa New Zealand's science community. It is only more recently that acceptance of this country's Indigenous knowledge system has grown, both abroad and at home. The National Science Challenges have been an important part of this movement.

This document, initiated by the Science for Technological Innovation (SfTI) National Science Challenge Kāhui Māori, explores the work of the Kāhui over the past decade in terms of its thought leadership, relationship building and myriad other activities. We relate this work to changes within the wider RSI sector over the past 30 years in order to better understand the impacts achieved.

SfTI's Whakatauākī, *He hiringa hangarau, he oranga tangata,* has inspired the telling of this story because it encapsulates the intent of the Challenge: to connect technology and people in ways that are beneficial and reflect Te Ao Māori. We have utilised the Kāhui's *Te Tihi o te Maunga* with its three pou - Māori Knowledge, Māori Participation and Māori Benefit - as a framework for explaining why and how the Kāhui has worked, and how it has achieved the influence it has across the Challenge.

We acknowledge the people who have been involved in this mahi along the way. Some have moved on to other endeavours and others may best be described as close allies to the Kāhui, but all have brought their unique skills and abilities to the task.

In the first instance, the Kāhui has been successful through purposefully *bringing a Māori lens into the Challenge leadership*, and one way it has achieved this is through guiding capacity development. *Utilising the Vision Mātauranga (VM) Policy* as an enabler for infusing mātauranga Māori throughout the Challenge has been another strategy; VM is an artefact that has offered a starting point from which to extend practices and procedures with positive impacts for Māori. Further, the rōpū has taken a hands-on approach to *supporting Māori researchers* in the Challenge through providing mentoring and advice, and making connections as needed. Finally, identifying opportunities to *connect with Māori stakeholders* has increased research participation by, and benefits for, Māori.

Some historical context is provided for how the RSI system has arrived at the current point, including the introduction of competitive funding in the late 1980s and the VM Policy in the early 2000s, the establishment of the National Science Challenges in 2014, and finally, the recently proposed Te Ara Paerangi science system review that ultimately failed to be formalised. The science research sector has been impacted by each of these events in different ways, the echoes of which can be seen in the current time, and yet they also suggest that systems can and do change, offering hope that current challenges can be overcome.

Coming back to the story of the Kāhui, *Te Tihi o te Maunga* highlights the importance of Māori Knowledge within research. This pou refers to the level of mātauranga Māori utilised, including Māori values, principles, processes, approaches, knowledge of history and resources, relationships, language and technical knowledge. When these elements were incorporated into questions for *Te Aromatawai*, the Kāhui's formal research proposal assessment tool, it identified very clearly some of the most important ingredients for successful projects. As a result of this mahi, SfTI allocated a significant proportion of its funding to Māori-led research, in contrast to the underfunding observed elsewhere. Additionally, the Kāhui has guided changes to SfTI's Intellectual Property Management practice in ways that safeguard Māori control over mātauranga Māori and taonga species as it relates to research projects, something that is still not common practice throughout the RSI system.

Māori Participation is the second pou, something of a central focus for the Kāhui. It addresses the extent to which Māori participate in a specific research project from beginning to end, including in leadership roles. Again, these considerations have been incorporated into *Te Aromatawai* to guide assessment of research proposals at the funding stage, and also to very clearly guide the researchers themselves in how they should be developing their teams and methodologies. Even outside the research itself, Māori have occupied numerous influential senior roles within the SfTI organisation, including within the Programme Office, Leadership Team, Advisory Groups and Board. High Māori participation is not a feature of Aotearoa New Zealand's RSI system, and the current document provides qualitative and quantitative evidence of how this plays out in practice.

The third pou contained in *Te Tihi o te Maunga* is Māori Benefit, which reminds us that science does, and should, have implications and impacts. Again, specific questions have been incorporated into *Te Aromatawai* that zero in on the extent to which a project understands Māori priorities and intergenerational impacts, and/or considers aspects such as capability development. Interestingly, there has been a low level of demand from hapori Māori for physical science and engineering input, however, the Kāhui has contributed to increasing interest, for example, by framing these science domains in relation to Te Ao Māori to demonstrate connections. This document provides several examples of research undertaken collaboratively by the SfTI community and hapori Māori that either have or are on the way to delivering benefits with and for Māori.

In conclusion, it is clear that the RSI status quo is moving forward in some areas of importance to Māori, for example, in Māori Data Sovereignty, while other issues remain stagnant, such as participation in research institutions. In contrast, however, and with the guidance of the Kāhui Māori, SfTI has effected significant improvements, and this is directly related to creating a space where Māori can be integrally involved in technological innovation.

1. Introduction

Māori have a rich innovation history; it was no mistake that early Māori travelled to Aotearoa New Zealand around the middle of the 12th century, hundreds of years earlier than the first European explorers.[1] They navigated that journey from their original homelands on well-designed and constructed waka, drawing on sophisticated knowledge of ocean and wind currents, and using the stars as their guide. As one of Aotearoa New Zealand's most successful Māori tech entrepreneurs, Sir Ian Taylor[2] (Ngāti Kahungunu, Ngāpuhi), has said, early Māori voyagers must be recognised as more than just sailors:

"They had to be astronomers, astrologers, scientists, engineers, mathematicians, they had to be innovators. The voyage they made, as we are only just beginning to discover, is arguably the greatest story of human migration in the history of mankind."[3]

Once their epic journey was completed, Māori settled here and developed a rich, place-based body of knowledge, making them the first researchers and knowledge holders in Aotearoa. For example, generations of lived experience saw the development of detailed local knowledge of native flora and fauna, including discovery of their uses for sustenance, clothing and pharmacology, and these resources were protected through application of customary management practices. The approach taken to understanding the world was highly interconnected with social structures and relationships, and founded within a collective worldview as it still is today. Through Māori innovation, those early adventurers prospered in these lands:

"Historically, Māori innovation was grounded on controlled intergenerational experimentation based on meeting need, there wasn't a reliance to have to write it down. It's more inclusive than it is reductive in the way that we think of things. We have a history of it. If we think about our master navigators, and about the fact that our people came to a land we didn't know and we thrived, that was due to a history of innovation that we can lean on and pull into contemporary applications. We have a 150 to 200 year head start in terms of the knowledge of Aotearoa."[4]

The history of scientific endeavour clearly extends back to when Māori first arrived in Aotearoa all those centuries ago.[5] The mātauranga Māori (Māori knowledge) that developed during that time (and continues to develop today) spans Māori culture, values and perspectives, and "includes knowledge generated using techniques consistent with the scientific method, but explained according to a Māori world view."[6] Resulting narratives, which may appear unscientific to the inexperienced ear, are actually heuristic tropes that "communicate deeper insights in easily understood forms."[7]

Despite this, mātauranga Māori has historically been ignored or disregarded by Aotearoa New Zealand's science community, relegated to a position of myth and legend, seen more as relating to the historical and personal rather than to contemporary, verifiable fact. Recently, a letter to the Listener signed by six well-regarded scientists illustrated that colonial opinions of mātauranga still exist in corners of the research, science and innovation (RSI). The authors stated that:

"Indigenous knowledge is critical for the preservation and perpetuation of culture and local practices, and plays key roles in management and policy. However, in discovery of empirical, universal truths, it falls far short of what we can define as science."[8]

1. Abel Tasman arrived in 1642, and Captain James Cook in 1769.
2. Sir Ian Taylor is the founder of Animation Research Ltd, a technology company that turns data into digital images for a range of applications including sports broadcasting, film and television, and interactive entertainment. It is used by companies across the globe.
3. https://www.thevoyage.co.nz/en/landing
4. Nancy Garrity
5. Hikuroa, D. (2016). Mātauranga Māori—the ūkaipō of knowledge in New Zealand. *Journal of the Royal Society of New Zealand*, *47*(1), 5–10. https://doi.org/10.1080/03036758.2016.1252407
6. Hikroa, D. (2018). *Mātauranga Māori – the ūkaipō of knowledge in New Zealand.* Public Policy Institute, The University of Auckland, NZ. https://www.auckland.ac.nz/assets/arts/our-research/research-institutes-centres-groups/ppi/policy-briefings/maatauranga-maaori.pdf
7. Rout, M., Awatere, S., Reid, J., Campbell, E., Huang, A., & Warmenhoven, T. (2024). A 'Te Ao Māori' disaster risk reduction framework. *Disasters*, e12622.
8. Clements, K., Cooper, G., Corballis, M., Elliffe, D., Nola, R. (2021). In Defence of Science. *The Listener*, 31 July 2021, 4.

The longstanding undervaluing of Te Ao Māori, mātauranga Māori and kaupapa Māori methodologies within the RSI system has had several limiting effects. These include the underfunding of research that legitimately draws (collaborative rather than extractive) on Māori knowledge, the under-representation of Māori researchers, and the under-delivery of benefits to Māori communities and businesses.

Yet, more recently, there has been a groundswell of international recognition regarding the value of this country's Indigenous culture as providing a unique lens which offers opportunities that set Aotearoa apart from the rest of the world.

This growing acceptance has also been seen within mainstream Aotearoa New Zealand as mātauranga Māori is increasingly drawn upon by people engaging in efforts to understand what it means in different contexts.[9] In 2019, the New Zealand Science Review published a 2-part special issue exploring the changing relationship between mātauranga Māori and western science from the perspectives of Māori researchers working at this interface. The authors noted that: *"Increasingly mātauranga Māori – encompassing Māori knowledge, Māori methods of knowledge creation and Māori ways of knowing – is being consulted, aligned with or brought into conversation with science."*[10]

Some Māori academics, such as Distinguished Professor of Law Jacinta Ruru (Raukawa, Ngāti Ranginui), have observed this shift first hand:

"In Aotearoa New Zealand there is certainly a growing recognition that Māori engagement and leadership across the science and research sector is essential for addressing national challenges and realising the distinctive contribution of mātauranga Māori to innovation and knowledge creation."[11]

The National Science Challenges have been an important part of this movement. Additionally, the previous Labour Government recognised the RSI system's disconnect with Te Ao Māori, and began a reimagining of the sector. Te Ara Paerangi Future Pathways drew on the voices of innovators, scientists, kaitiaki and leaders from around the country, as well as considering a range of other priorities, and signalled a movement towards placing greater emphasis on the value, expectations, and future management of Indigenous collaboration and Māori knowledge. Despite good progress being made, the process was discontinued by the incoming Coalition Government elected in late 2023.[12]

The current document was initiated by the Science for Technological Innovation (SfTI) National Science Challenge Kāhui Māori to explore the impact of this rōpū during the past decade. Their thought leadership and relationship building, often behind the scenes, has helped create a better space for Māori researchers and Māori communities within the science sector, something that would likely not have happened organically without their influence.

We have been inspired by SfTI's Whakatauākī:

He hiringa hangarau, he oranga tangata; Innovation in technology for the benefit of people.

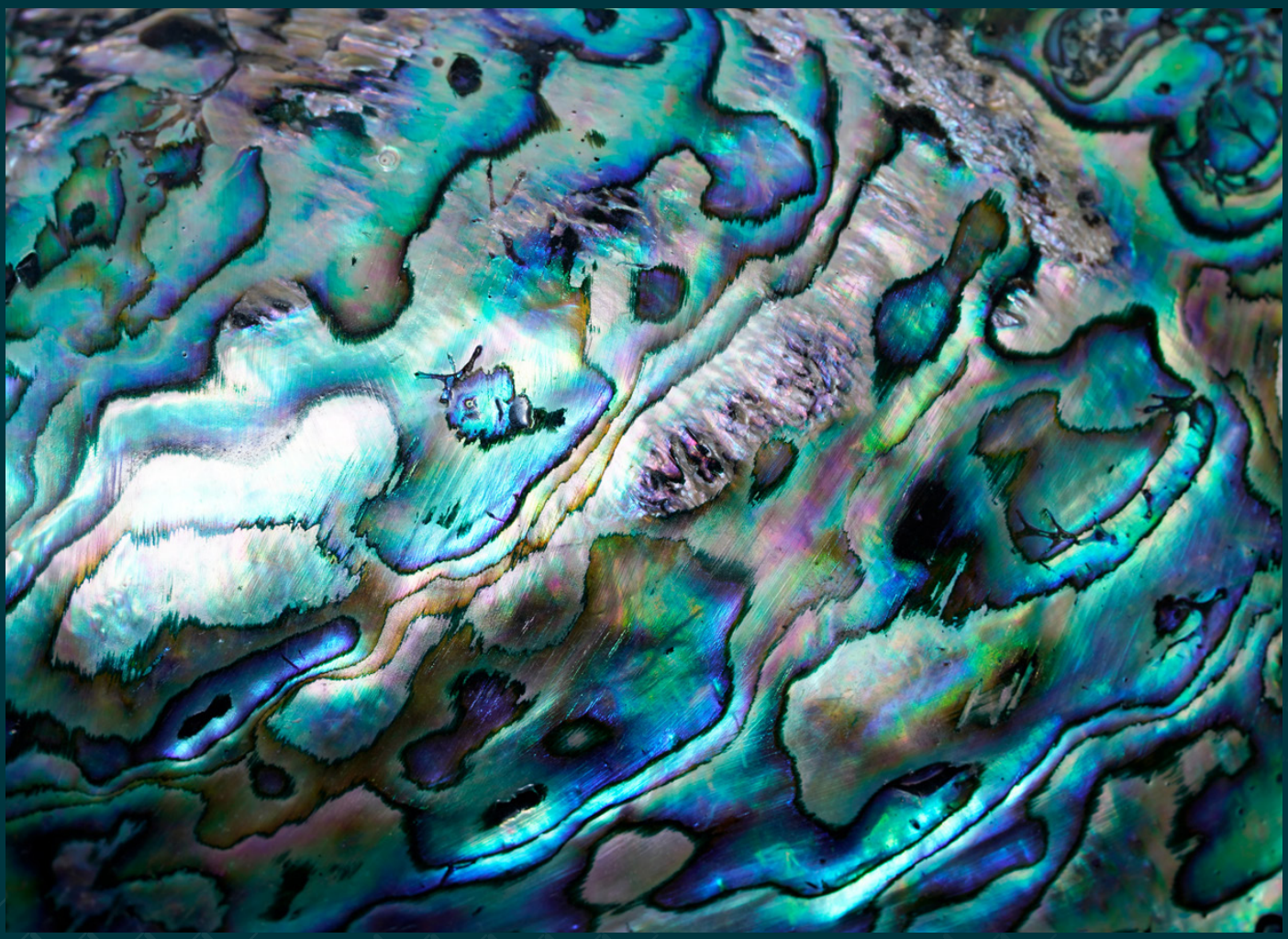
Gifted by renowned Māori orator, tikanga and te reo Māori expert and academic, Tā Pou Temara (Ngāi Tūhoe, KNZM), this whakatauākī represents the intent of the Challenge: to connect technology and people in ways that are beneficial and reflect Te Ao Māori. Throughout the following pages, this document seeks to better understand how the relationship as described by the whakatauākī occurs, emphasising that under the guidance of the Kāhui, this interplay has been a two-way, symbiotic exchange where both technology and people have benefitted each other.

9. Moko Mead, Sir Hirini. (2022, 19 June). Understanding Mātauranga Māori. *E-Tangata*. https://e-tangata.co.nz/comment-and-analysis/understanding-mātauranga-Māori/
10. Mercier, O., & Jackson, A-M. (2019). Mātauranga and Science – Introduction. *New Zealand Science Review, V75(4)*: 63-64. (p63)
11. Ruru, J. (2021). Our Baskets of Knowledge. In J. Ruru, & L. Nikora (Eds.), *Ngā Kete Mātauranga. Māori scholars at the research interface*. Otago University Press. (p12-20) (p17)
12. Te Ara Paerangi Future Pathways has been replaced with a Science System Advisory Group (SSAG) which will provide advice to the government on how to best strengthen the science, innovation and technology system, in light of its aspirations, challenges and opportunities. A newly formed University Advisory Group (UAG) will run concurrently, with the aim of carrying out a similar exploration but with its focus on the country's universities.

In order to explore this connection, we have structured the report using the Te Tihi o te Maunga Model (described in some depth in section 3.3 below), which highlights three pou that help to elevate attention on Māori-oriented research and impact: *Māori Knowledge*, *Māori Participation* and *Māori Benefit*. The Model has been used in several ways, such as to guide SfTI's expectations for researchers working with Māori, to influence funding decisions, and to inform the Challenge's capacity development programme.

As these pou are explored in greater depth throughout this report, we also look back over past decades and through to the present day to identify areas of change. We ask how we can collectively create a thriving science and research system that is relevant, equitable and reflective of all Aotearoa. Within the SfTI NSC, and founded by a strong, guiding Kāhui Māori, Māori have been forging a pathway towards the system we would like to see.

Image: The pōwhiri at Te Puia, Rotorua, for SfTI's final All of Researcher's Workshop in November 2023



2. The Kāhui Māori

The Kāhui Māori can be described as a korowai cloak of safety to provide protection of all things Māori. It holds SfTI to account in terms of what it does in the Māori space, and more informally, it is the enabler and connector for the research community as things arise and need attention.

For many years, Māori have struggled to be heard in western spaces such as parliament, workplaces, and boardrooms. Yet there have been key influencers who have left their footprints in the public arena, and in doing so, have helped set the scene for their mokopuna to flourish.

These leaders include **Te Puea Hērangi**, who built Turangawaewae Marae mō te kīngitanga for her children and her people to come together, a place to stand. *Ki te moemoea ahau, ko ahau anake. Ki te moemoea tatou, ka taea e tātaou*.[13] **Hana Te Hemara** and Ngā Tamatoa presented a petition at parliament demanding that reo Māori be taught in schools. *Tama tu, tama ora; tama noho, tama mate*.[14] **Dame Whina Cooper** proclaimed "*Not one more acre,*" walking to parliament from Te Hāpua in the far north with Te Rōpū Matakite o Aotearoa, chanting and reciting karakia, in the hope of reclaiming Turangawaewae for her people.

Just as those individuals were leaders who brought people together to effect political and social change, there are influencers working at the interface of mātauranga Māori and western science who play a pivotal role in advancing Indigenous science. They link traditional knowledge and tikanga with contemporary scientific methodologies, fostering a more holistic and culturally grounded approach to research. Their influence helps to break down barriers, promote inclusivity, and encourage collaboration between the science sector and Māori communities and business, bringing two knowledge systems alongside one another to address current challenges. Through their leadership, these influencers contribute to the recognition and respect of Māori perspectives in scientific discourse, ultimately enriching the field with diverse insights and promoting the sustainable development of both knowledge systems.

The Kāhui Māori is made up of thought leaders who want to see the RSI sector better serve Māori communities and researchers alike, and who understand that the benefits will overflow to all Aotearoa. Alongside their day-to-day roles, these individuals have worked inside the SfTI NSC over the past decade to support Māori to be Māori in their research, and to enable mātauranga Māori to filter through into SfTI research and the wider science system.

The current section provides some context in terms of the SfTI Challenge, and recounts the story of how the Kāhui Māori formed and how it was fitted into the larger SfTI organisation. It also introduces key members of the rōpū as well as two honorary members.

2.1 SCIENCE FOR TECHNOLOGICAL INNOVATION

The 11 National Science Challenges were established as cross-disciplinary, Mission-led programmes of work aimed at tackling Aotearoa New Zealand's biggest science-based challenges. Collaboration between researchers from across organisations was a key operational directive as was the involvement of stakeholders and the public. The government originally planned to fund this initiative for 10 years.

The Challenges were guided by five principles, which together made them unique within the RSI system. They would: be Mission-led, prioritise science quality, ensure best research team collaboration, include stakeholder engagement and public participation, and give effect to the Vision Mātauranga policy.

The Science for Technological Innovation (SfTI) Challenge focused on a Mission *to enhance the capacity of Aotearoa-New Zealand to use physical sciences and engineering for economic growth and prosperity*. The ultimate vision was to contribute to a future Aotearoa New Zealand that had a vibrant and prosperous technology-driven economy, with new businesses offering high-value services and products that may not yet have been invented.

13. If I dream, I dream alone. If we dream together, we shall achieve.
14. He who stands, lives; he who sits, perishes.

Through bringing together some of New Zealand's best physical science and engineering researchers from across its research partners, Māori and industry, and taking a very collaborative approach, SfTI worked to develop relevant, world-leading science and technology. Further, to achieve the aim of 'enhancing capacity' the Challenge invested in the Building New Zealand's Innovation Capacity (BNZIC) Spearhead to better understand how collaborative innovation happens within the RSI sector.

SCIENCE FOR TECHNOLOGICAL INNOVATION

At a Glance

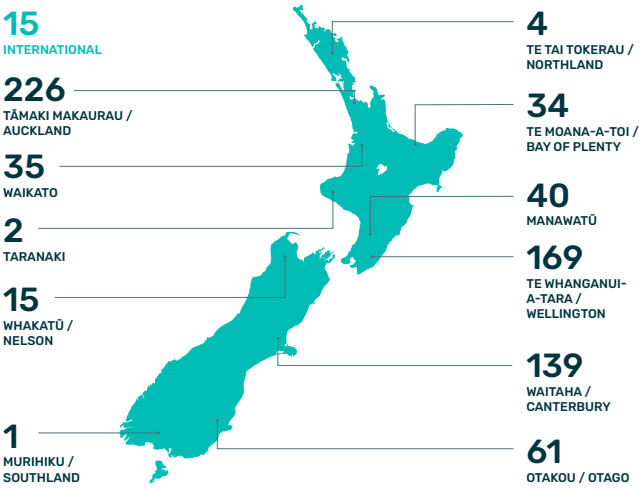
OUR PEOPLE

741 RESEARCHERS

95 MĀORI | **219** WOMEN

307 EMERGING RESEARCHERS

58 ORGANISATIONS
Including 9 international



OUR PROJECTS

4 THEMES

01 VISION MĀTAURANGA

02 SENSORS, ROBOTICS & AUTOMATION

03 MATERIALS, MANUFACTURING TECHNOLOGY & DESIGN

04 DATA SCIENCE & DIGITAL TECHNOLOGIES

STRETCH SCIENCE

11 SPEARHEAD PROJECTS
Large teams

86 SEED PROJECTS
Small teams

10 EWIPs NSC
Ending with Impact Projects

5 ECRBOPs
ECR 'Bolt-on' Projects

OUR DEVELOPMENT

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

OUR ATTENDANCE RECORD

618 ALL OF SFTI WORKSHOPS

3166 AT 262 COURSES AND WORKSHOPS

554 AT 78 CONFERENCES

VISION MĀTAURANGA

914 AT 88 EVENTS INTRODUCING TE AO MĀORI AND THE MĀORI ECONOMY

$33m PHASE 1 (2014 - 2019) + **$73m** PHASE 2 (2019 - 2024) = **$106m**

2.2 ESTABLISHING THE KĀHUI MĀORI

"We could define a kāhui as an influential and knowledgeable collective, experienced in operating at the interface of two knowledge systems that serves to, in this case, foster, guide or inspire Māori-focused opportunities derived from science and technology."[15]

At the time the National Science Challenges were being established (2013-2014), Indigenous advisory and governance groups were extremely rare within mainstream RSI, however, they have become more common over recent years in Aotearoa New Zealand.[16] Te Taka Keegan, who became the inaugural Kāhui Kaihautū (Chair), was surprised when, at the second SfTI Proposal Formation meeting, participants floated the idea that the Challenge would need a group focused on bringing a Māori perspective to the fore, and the notion of a Kāhui Māori followed:

"I hadn't heard of that before, and so that's what kept me coming back - the fact that there was going to be a Kāhui that could have influence. I thought, 'Okay, maybe this should require a bit more of my time and support'."[17]

The idea continued to gain traction. Formation of a SfTI Kāhui Māori was written into the Challenge's original proposal as a vehicle for unlocking the innovation potential of Māori knowledge, resources and people for the benefit of the nation as envisioned by the Vision Mātauranga (VM) policy.

A small establishment group took on the task of creating Terms of Reference for the SfTI Kāhui Māori. Put simply, the purpose of the Kāhui was to: *"provide more of a structure and enable ways of working that were a good fit for Māori."*[18]

The Kāhui Māori was influential on the Challenge's direction from the outset, achieving its aims via formal and informal means. For example, in terms of SfTI's Mission *to enhance the capacity of Aotearoa-New Zealand to use physical sciences and engineering for economic growth and prosperity*, the Kāhui Māori had a broad interpretation of 'prosperity' beyond simply 'economic', in that it included social, cultural and environmental elements; this view has filtered into the wider narrative used across the Challenge.

The Kāhui has been described variously as: a 'korowai' in terms of providing safety to researchers and the Challenge itself; the 'stem of an umbrella' that influences the whole Challenge by connecting all of its parts; and a 'bridge between two worlds'. The expertise held by Kāhui Māori members, including their experience of working across Māori and western science knowledge systems, has enabled them to foster the myriad of meaningful connections required to be effective:

"There's a kind of duality that we bring to the table - you can see on the one hand this way and on the other hand the other way. I think it's through that lived experience that we could open the door to others that may not have been in our (Te Ao Māori) world, or those that have only been in our Māori world, to give them a nudge to think differently: here's some other ways to think about it.[19]

Early Kāhui members included Te Taka Keegan, Mānuka Henare, Katharina Ruckstuhl, Jason Turuwhenua, and inaugural SfTI Director Margaret Hyland.

In terms of how the Kāhui Māori would work in practice, one carefully considered decision during its establishment was to invite the (non-Māori) Director onto the rōpū. This was arguably an unconventional approach, however, it is important to remember the context of the time, particularly in terms of some Māori researchers in other Challenges feeling isolated and underfunded. The rationale for including the Director was simply to strengthen internal connections and ensure common understandings at the highest levels of the organisation, particularly amongst the Governance Group, Leadership Team and Kāhui. In this way, Māori interests could remain at the forefront.

Initially, not everyone felt completely comfortable with tauiwi participating in a Māori rōpū as it risked reducing members' freedom to speak plainly, however, it soon became clear that the concept was sound:

15. Amoamo, M., & Ruckstuhl, K. (2021). Kāhui Māori; Distinctive Leadership in Science and Technology. In M. Amoamo, M. Kawharu, & K. Ruckstuhl (Eds.), *He Pou Hiringa; Grounding Science and Technology in Te Ao Māori* (pp35-54). BWB Texts. (p39)
16. *ibid* (p35)
17. Te Taka Keegan
18. Margaret Hyland, SfTI's first Director.
19. Vanessa Ngaroimata Clark

"[In practice] it meant that if there were issues or needs that we identified, we didn't then have to go and approach the Director separately to say, 'We need this, this, and this.' She was right there, hearing all the discussions, hearing what was needed. She was right on the pulse with us. So, it actually was really clever, a really insightful move because it gave us access to decision-making around funding from the start."[20]

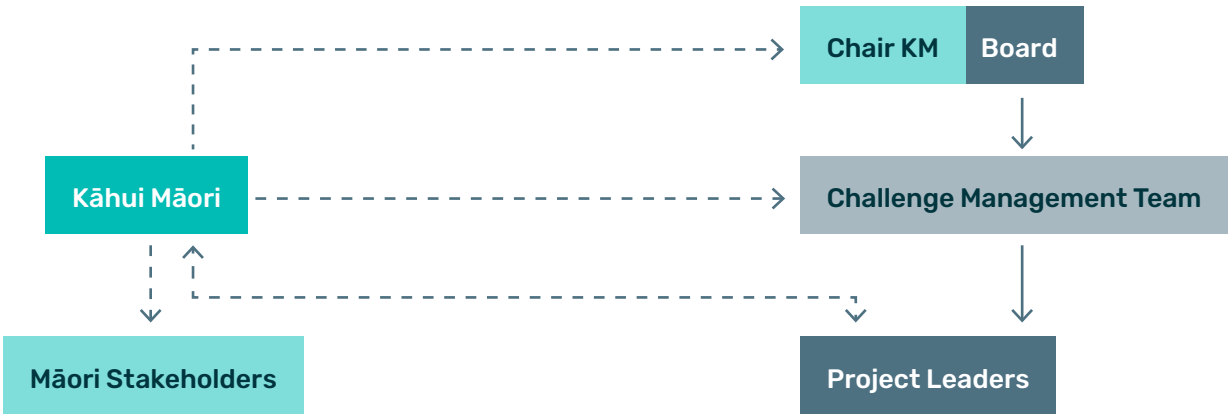
From a Director's point of view, Margaret Hyland shared some concerns herself and remembers she tried to protect against "*potentially derailing or stifling conversations*,"[21] but notes that did not appear to be a problem. The second Director, Sally Davenport, recalls her time on the Kāhui as a journey that has required her to learn about both Vision Mātauranga and Te Ao Māori, *"which I've absolutely loved, but I was very conscious of trying to be an ally rather than a handbrake on these things."*[22]

As a consequence of bringing the Director into the Kāhui, a Māori Co-Director has not been needed to the extent it may have been for other Challenges.

Reece Moors was very influential in setting up the Kāhui Māori, and the others were happy to let him drive this process given his past government experience. In terms of how it would be positioned within the organisation, one approach was for the rōpū to have equal decision-making authority with the Board, while another was to take an advisory role, with links across SfTI and externally; the latter option was chosen.

Within this structure, a strong relationship between the Kāhui and Board was essential so that if the Leadership Team became a hurdle, there was automatic access to organisational decision-makers. This connection was strengthened through periodic meetings between the Kaihautū (Chair of the Kāhui) and the Board Chair.

Relationship between the Kāhui Māori and SfTI (2015)



KEY	
- - -	Indicates an advisory/ communication function
———	Indicates a decision-making function

20. Te Taka Keegan
21. Margaret Hyland
22. Sally Davenport

The inaugural Board Chair had been very supportive of Māori, but Te Taka Keegan notes this may not have been the case for all Challenges:

"Maybe others have had a Chairperson or Director who doesn't really believe that mātauranga is a valid science, and so whenever they've asked for funding, projects or initiatives, the response has always been: 'Well, what do you need to be doing that for?' You'd have to justify the funding. Whereas we've never had to do that because: A. we've had the Director on the Kāhui Māori the whole way through, so she's understanding what we're trying to do; and B. the Chairperson of the Board has been understanding as well."[23]

Other Challenges took different pathways, with many choosing to merge their Kāhui Māori and Governance Groups, but SfTI did not take this step. There were several reasons for this. When the option was explored, a relatively high number of Māori were already in senior, influential roles, including within the Leadership Team, Board, Kāhui Māori and Programme Office, and this had infused a high degree of cultural capacity throughout the Challenge. Additionally, the Kaihautū had a very specific vision for the Kāhui Māori and was adamant it should remain distinct:

"Te Taka said, 'No, we are an Advisory Group. We advise the Board, but our main job is advising the researchers.' And so he saw it as much more of an operational role. It's strategic, but not at a governance level. He wanted to be more hands-on, I think, and so we respected that and I think that's served us well."[24]

As one senior Māori SfTI researcher noted, being separate from the Board has guaranteed the Kāhui Māori its own independent voice, and maintained separation of the two types of governance. If the two groups had merged, attention would have been diverted towards broader concerns.

While a merger did not happen, co-Chairs were put in place in 2022. From Te Taka Keegan's point of view, this constituted a clear signal that partnership was a foundational aspect of the Challenge, rather than being a necessary response to an internal need. Nevertheless, the move was seen by Kāhui members as a significant shift that gave the rōpū more influence, even though the previous structure had also worked well.

While incumbent Kāhui Kaihautū, Te Taka Keegan, may initially have been reluctant to move into the newly formed co-Chair role, he was strongly encouraged to do so as the best person for the job. As he vacated the Kaihautū position, Nancy Garrity took on this responsibility - although she was relatively new to SfTI, she was recognised as an "*obvious leader*."[25]

In terms of Tiriti-oriented language, changing the governance structure in this way recognised the Mana to Mana conversation; the discourse around Māori data sovereignty, for example, is essentially a te Tiriti conversation:

"A lot of the Māori data sovereignty principles have come from understanding deeply how a te Tiriti process works. So it's Mana to Mana, rangatira to rangatira, mahi to mahi, and you see those things show up inside Te Taka's placement onto the Board, rangatira to rangatira. We never called it co-Governance, we never called it co-Management. We just said, 'We have a rangatira on the SfTI Kāhui - that rangatira needs to be over there (on the Board)."[26]

Within the SfTI environment, there has been a free flow of information and positive regard amongst senior personnel, and with that has come a sense of comfort, allowing leaders to gather together informally from time to time to create connections and explore the Challenge's research rather than having to use these forums to lobby or persuade.

23. Te Taka Keegan
24. Sally Davenport
25. Reece Moors
26. Vanessa Ngaroimata Clark

2.3 KĀHUI MEMBERS

Collectively, Kāhui members came with a set of tools to contribute, which came together to create incredible solutions.

Because of the influential role of the Kāhui Māori, care was taken in identifying and inviting the right people into the fold. Assisted by a considered list of desirable attributes, the process of selecting Kāhui members with a range of experiences and knowledge related to Te Ao Māori, science and business, has been successful. That is not to say the task was easy, because unlike some other domains such as education or the environment, there are fewer Māori physical scientists and engineers.

Skills and Experience Required for KM Members:[27]

- Understanding of the VM policy framework
- Strong connections to and familiar with Te Ao Māori (the Māori world)
- Comfortable in engaging with and navigating the machinery of government and with the NZ Science system.
- Understanding of the challenges and opportunities faced by the modern yet developing Māori economy.
- Respected in their specialist fields by their peers and have mana with Māori stakeholders.

While the current report is focussed on the collective achievements of the Kāhui Māori, each of the individuals involved has brought particular knowledge, skills and experiences to their role, which has contributed to the group's influence.

Image: Members of SfTI's Kāhui Māori at the final meeting in May 2024

27. Kāhui Terms of Reference (2015)

Kaihautū - Dr Nancy Kay Garrity
(Ngāti Makirangi, Ngāti Pāoa, Ngāti Hine)

As the National Science Challenges come to a close, Nancy Garrity is the sitting Kāhui Kaihautū. Nancy came into the Challenge in 2017 after being approached by Reece Moors and Willy-John Martin about the Kāhui Māori, and remembers that they held similar views on the existing poor situation for Māori in the science system, as well as a shared desire for change.

Later, she was Principle Investigator for a Seed research project that drew on traditional tikanga-led fibre collection and extraction techniques to develop a polymer composite material with tī kōuka (cabbage tree).

Nancy had trained and worked as a Materials Scientist for over a decade, and this type of domain expertise is important for a group such as the Kāhui Māori because it needs people who can talk knowledgeably about the science and understand the benefits of that science from a Māori perspective.

Since coming onto the Kāhui Māori, Nancy has completed a Chemistry PhD with a background in Materials Science. She has worked as a researcher and research leader alongside iwi and hapū to explore opportunities to better align science and mātauranga methodologies, knowing that when they work harmoniously together, powerful solutions will be delivered for Aotearoa. Now working at Manaaki Whenua Landcare Research as the General Manager Māori Partnerships, Nancy is taking learnings and experiences from her time with the Challenge into developing and implementing strategies that promote equitable relationships and benefit-sharing in regards to Māori.

Te Taka Keegan
(Waikato-Maniapoto, Ngāti Porou, Ngāti Whakaaue)

Board Co-Chair, and inaugural Kāhui Kaihautū

Te Taka was the inaugural Kāhui Kaihautū. He says he quickly became more involved than he had anticipated, in part because there are not large numbers of Māori in the physical sciences and engineering space, SfTI's area of focus.

With his dual knowledge of Te Ao Māori and software engineering and AI, Te Taka has gone on to occupy a range of senior roles within the Challenge, including Board Co-Chair, Kāhui Kaihautū, member of the Leadership Team, and senior Ātea Spearhead researcher. He has been described as a '*lifesaver*', due to tirelessly and expertly performing countless tasks whenever called upon: "*He has that magic combination of not only talent, but also personality and domain knowledge.*"[28]

Te Taka has taken experiences gained through working with SfTI and the Kāhui into his roles as Associate Dean Māori and Co-Director for Māori within the Artificial Intelligence Institute at the University of Waikato. Part of this work involves seeking wide-ranging solutions to specific issues, and he says he has seen first-hand the benefits of collaborating around science for Māori, and has extended his networks significantly.

28. Dr Willy-John Martin

Dr Katharina Ruckstuhl
(Ngāi Tahu, Rangitāne)

Theme co-Leader,
Vision Mātauranga

Theme co-Leader,
Building New Zealand's Innovation Capacity (BNZIC) Spearhead project

Katharina was one of the original Kāhui Māori architects. She brings behavioural and social science expertise to the Kāhui, and with her extensive iwi experience, Katharina cogently explores how SfTI's research can benefit Māori. In fact, her role as co-Leader of Building New Zealand's Innovation Capacity (BNZIC) Spearhead has seen her focus directly on how scientists and Māori communities and businesses can best collaborate together, as well as the role of human and relational capability within this space.

As a senior member of Otago university's Business School, and Kaitohutohu of the School's Te Maea: Māori and Indigenous Economy and Enterprise Network, Katharina encourages students to use their skills and knowledge to contribute to the Māori economy. She is also Associate Director Māori on the Dodd-Walls Centre of Research Excellence.

Vanessa Ngaroimata Clark
(Waikato; Ngāti Tīpa, Ngāti Tahinga, Ngāti Āmaru)

Vanessa had been working in technology in the United States at a senior level for a number of years, so was an obvious choice to be invited onto the Kāhui Māori when she returned to New Zealand in 2011. In addition to being strong in commercial tech knowledge, Vanessa has brought strong international experience into the Kāhui. She also has a firm focus on how iwi and hapū are impacted by the rōpū's decisions: *"she pulled our lens out a little further to ensure that what we were doing met community aspirations and needs for Māori."*[29]

Vanessa is currently the Pouhere | Executive Director of Kanapu, a MBIE-funded initiative of Ngā Pae o te Māramatanga that takes a Māori-led approach to growing Māori talent and leadership in the RSI sector, and is a member of the Te Mana Raraunga network, which advocates for Māori Data Sovereignty rights and interests. Vanessa also serves on Te Whakakitenga o Waikato (tribal authority) representing Te Kotahitanga marae.

29. Dr Nancy Garrity

Dr Pauline Harris
(Rongomaiwahine, Ngāti Rakaipaka, Ngāti Kahungunu ki Wairoa)

Theme co-Leader - Vision Mātauranga

Pauline became a member of the Kāhui Māori shortly after being appointed to SfTI's Leadership Team in 2021. In terms of her contribution to the Kāhui, Pauline has brought expert Te Ao Māori and scientific knowledge, as well as a drive to create spaces for rangatahi in science and research. While she was initially unsure if she could make a contribution, other Kāhui members have described her as '*savvy*', and also as having had a mentoring and nurturing influence.

When she began with SfTI, Pauline was a Senior Lecturer at Victoria University of Wellington's Centre for Science and Society. She has since moved to Massey University's Te Pūtahi a Toi: School of Māori Knowledge, and has also taken up a role as Deputy Director Māori at the McDiarmid Institute. Calling on her knowledge of mātauranga Māori associated with Māori astronomy and Maramataka, Pauline is the Chairperson of the Society of Māori Astronomy Research and Traditions (SMART), and was part of the Government-appointed Matariki Advisory Group that determined how and when to celebrate Matariki as a nation.

Pauline was awarded the Murray Geddis Medal of the Royal Astronomical Society of New Zealand in 2024, in recognition of her far reaching contributions to astronomy in both education and dissemination.

Dr Mānuka Henare
(Ngāti Hauā, Te Aupouri, Te Rarawa, Ngāti Kahu)

Mānuka was an inaugural member of the Kāhui Māori who brought expertise in history and Māori business economics to the rōpū, and was highly regarded across SfTI, in academia and throughout the Māori world, as a wise and thoughtful person who "*would bring mana to any occasion*."[30]

While Mānuka reportedly '*made meetings more fun*', one skill he is most remembered for is keeping Kāhui discussions focused and practical, making him something of a North Star (in a European context) for the rōpū:

"He was the person who made sure we stayed on track, and he held the conscience of the room."[31]

"He provided that kind of guiding backstop, or that rock in the middle of your meeting, and knowing that if you strayed too far away, that he could be there to bring you back in … I think in the early days it grounded us into quite a good place. I don't think we would be in the same place without him here."[32]

"We were really fortunate to have someone of his stature sitting in that space, and he asked some really out there questions, but he gave some really good practical advice."[33]

Kāhui Kaihautū Nancy Garrity described one occasion when the Kāhui was discussing how to support and resource Rangatahi in their careers, "*and then in the most lovely, yet direct way, Mānuka said, 'Who cares about that? If they don't have the role models now to guide and support them in this, why are we supporting Rangatahi when there's this missed step?' And it never occurred to us that our Rangatahi, who are super confident, still need more guidance in this space, as opposed to, 'Let's just give them a whole heap of money and see where they go'. Mānuka had a way of seeing our purpose and gently reminding us of that."*[34]

Mānuka made a significant contribution to the korowai role undertaken by the Kāhui - to keep Māori working within and beside SfTI safe:

"It comes back to that protection bit because not only did the Kāhui protect the Science Challenge in its role, but it also protected the members of the Kāhui itself. If you're going to do something that's quite innovative, for example, you start taking AI into a Marae context before it was really starting to come into its own, someone like Mānuka would say, 'Yeah, that'll be okay, that'll be fine.' The moment people felt the likes of Mānuka was there, they were comfortable that what SfTI was doing was not going to be detrimental or have adverse outcomes."[35]

Mānuka sadly passed in early 2021.

30. Vanessa Ngaroimata Clark
31. Reece Moors
32. Te Taka Keegan
33. Vanessa Ngaroimata Clark
34. Nancy Garrity
35. Reece Moors

Professor Sally Davenport (MNZM) SfTI Director	A decision was made at the outset that SfTI's Director would be included within the Kāhui Māori. This has proven to be a beneficial arrangement, not least because of the personal attributes of each Director, first Margaret Hyland, and then Sally Davenport, who was described as having the ability to '*listen and absorb*'. Sally's areas of focus include technological innovation, growth of hi-tech firms, commercialisation of science and innovation, and researcher capability development, which all served her well in helping to establish BNZIC[36] early in the Challenge. She has most recently been a Professor of Management at Wellington School of Business & Government, Victoria University of Wellington, and has also worked as an investigator with the MacDiarmid Institute for Advanced Materials and Nanotechnology, and Te Pūnaha Matatini. Sally was a Commissioner on the New Zealand Productivity Commission between 2011 and 2020.
Shay Wright (Te Rarawa, Ngāpuhi, Taranaki)	Shay joined the Kāhui in 2019 and was influential in bringing a younger demographic into the Challenge. In the first instance, he recommended that Rangatahi would make a valuable addition to the rōpū - Te Rina Kowhai andTe Mauri Kingi subsequently became Rangatahi Observers. Shay was also instrumental in organising the Rangatahi Mission Lab held in 2019, which culminated in Rangatahi Boly-On projects being funded in the final months of the Challenge. He resigned from the Kāhui in 2021. Shay is a co-founder of Te Whare Hukuhuka, a social enterprise that supports the effectiveness of Indigenous community organisations, particularly in terms of guiding innovation and strategy.
Jason Turuwhenua (Ngā Tūhoe, Ngāti Porou)	Jason was a founding member of the Kāhui Māori, and resigned in 2020 to pursue his Seed research into improving vision testing measurements using a novel mobile device. He was later awarded a large Health Research Council Projects Grant to begin testing his new technology.
Jeremy Banks (Ngāti Rārua, Rangitāne, Ngāti Kuia)	Jeremy sat on the Kāhui between 2020 and 2022, and as a computer science graduate, he brought technical expertise to this role. He is also a tech entrepreneur, having founded Plink Software, a business that uses software to help connect Māori to their identity through language and whakapapa.
Margaret Hyland	Margaret was the inaugural SfTI Director and one of the founding Kāhui members until leaving in early 2017 to take up the position of Chief Scientists for MBIE.

SfTI's Programme Office was extremely helpful to the Kāhui Māori in achieving its aims, and this was in no small part due to the efforts of Reece Moors and Willy-John Martin, who are considered honorary Kāhui members.

36. One of SfTI's early, large Spearhead research projects: Building New Zealand's Innovation Capacity.

Reece Moors (Tainui, Te Arawa) Past SfTI Manager Programme Office & Strategic Relationships	Reece had a significant impact on developing the Challenge from the early days, drawing on his extensive government experience to guide SfTI in aligning its science work with wider political realities while also achieving benefit for Māori. While Reece was not a formal member of the Kāhui, he was integrally involved in its formation, and is held in high regard by current members. Reece resigned from SfTI late in Tranche 2 to take a role at Victoria University of Wellington as Director, Office of the Vice-Chancellor.
Dr Willy-John Martin (Ngātiwai, Ngāti Whātua, Ngāti Tamaterā, Ngāpuhi) Past SfTI Manager Vision Mātauranga and Capacity Development	Willy-John was another key influencer who was not formally part of the Kāhui, but worked closely with it. As SfTI's Manager of Vision Mātauranga and Capacity Development, Willy-John took the lead on organising training and development events such as the VM Leadership Hui and the two Māori Data Sovereignty Hui, all of which were supported by the Kāhui, and resulted in impactful publications which he co-wrote. Willy-John brought strong science expertise to his SfTI Programme Office role. He has a PhD in Cellular and Molecular Bioscience, and has worked as a scientist at the Malaghan Institute of Medical Research in Wellington, and the Walter and Eliza Hall Institute of Medical Research in Melbourne. Since leaving SfTI in late 2020, Willy-John has been the Director Māori Science, Innovation and Technology at MBIE.

3. Kāhui Māori Kaupapa

This section takes a closer look at how the Kāhui has influenced SfTI through: bringing a Māori lens into Challenge leadership, ensuring Vision Mātauranga was applied as an enabler to infuse mātauranga Māori throughout the Challenge, guiding researchers, and connecting with Māori stakeholders. It also discusses two of the most impactful pieces of work the rōpū has supported: SfTI's Whakatauākī and Te Tihi o te Maunga.

The Kāhui Māori terms of reference identified six foci that would cover *SfTI's strategic, operational and scientific activities:*[37]

- F1 – Strategic direction of SfTI from a Te Ao Māori lens;
- F2 – Identifying research and engagement opportunities for Māori;
- F3 – Project assessment to ensure due consideration to the Vision Mātauranga policy throughout a project's development and planning;
- F4 – Capacity and capability building for Māori and non-Māori in the NSC;
- F5 – Knowledge translation, ensuring that there were processes in place to ensure that SfTI delivers tangible benefits for and with Māori; and
- F6 – Gap and risk analysis to anticipate and remove barriers of delivery to Māori.

3.1 AREAS OF KĀHUI FOCUS

While the Kāhui Māori has been involved in a range of activities, such as developing He Ritenga and contributing to capacity development across the SfTI community, first and foremost, the focus has been on Māori

Bringing a Māori lens into Challenge Leadership

A key Kāhui Māori role has been to act as kaitiaki (guardians) of, and pou tangata (advocates) for, the development of mātauranga Māori across the life of the Challenge, incorporating considerations of tikanga (customary approaches) and te reo Māori (Māori language).[38]

Kāhui Māori members have drawn on their Ao Māori lens, a holistic world view made specific through their tribal differences, which allowed them to think more broadly about what the Challenge could achieve, particularly in terms of using science and technology to create a future better aligned with Māori aspirations. The Kāhui has been a place for information exchange, generating discussion and providing advice and guidance, all through a Te Ao Māori lens.

When she became part of the rōpū, new Kaihautū Nancy Garrity heard a common view of an aspirational RSI system future:

"*Once I got to the table, I just looked at the quality of expertise that was sitting around, and they all had the research and the reputation behind them already. And we were all fairly consistent in terms of the direction that we wanted for Māori within the sector*."[39]

Through its work, the Kāhui Māori not only included Māori voices in decision-making, governance and advisory roles, it also ensured Māori values, including tikanga Māori for example,[40] were integrated across the organisation.

One way that this rōpū has been able to integrate a Māori world view into Challenge planning and activities has been to focus on capacity development of the leadership team so that both Māori and science/technology aspirations could be met concurrently. Supported by the Kāhui, Reece Moors and Willy-John Martin were key to building this cultural competency, both informally and through more structured means. The outcome has been that senior decision-makers within SfTI could more easily understand what was being advocated for, and in fact the non-Māori Directorate and Theme Leaders soon became advocates themselves for empowering Māori knowledge and people, and realising benefits with and for Māori.

37. Ruckstuhl, K., & Martin, W. (2019). Mātauranga Māori and the high-tech interface. *New Zealand Science Review*, *75*(4), 87-91. (p88)
38. Kāhui Māori Terms of Reference, 2015.
39. Nancy Garrity
40. Amoamo, M., & Ruckstuhl, K. (2021). Kāhui Māori; Distinctive Leadership in Science and Technology. In M. Amoamo, M. Kawharu, & K. Ruckstuhl (Eds.), *He Pou Hiringa; Grounding Science and Technology in Te Ao Māori* (pp35-54). BWB Texts.

Ensuring the Vision Mātauranga Policy was Applied as an Enabler for Infusing Māori Throughout the Challenge

The requirement to put Vision Mātauranga into effect was written into establishment guidelines for all National Science Challenges, and a primary purpose of the Kāhui Māori was to ensure this happened, albeit recognising the shortcomings of this Crown-generated policy. It was in itself insufficient for achieving the Kāhui's more holistic aims of supporting Māori to be Māori in their research, and enabling mātauranga Māori to filter through into SfTI research and the wider science system. Nevertheless, work in this area has involved collaborating on development and monitoring of appropriate guidelines and metrics aligned with Vision Mātauranga, as well as advocating for meaningful levels of funding for Māori-relevant research.

Vision Mātauranga considerations were already well-entrenched in SfTI's decision-making processes by the end of Tranche 1, and this was true at Board and management team levels, as well as during project assessment and approval processes. However, SfTI leadership understood there was more work to do for this approach to be normalised across the wider RSI sector. The Challenge's Tranche 2 Forward Strategy notes the need for VM to be better integrated across physical sciences and engineering so that it becomes "*business-as-usual as the impact potential is genuinely understood as unique to Aotearoa New Zealand*."[41]

Guiding Researchers

The Kāhui Māori took a hands-on approach to supporting researchers in the Challenge, and an important aspect of this was enabling Māori to be Māori in their research. Researchers were told they could access the rōpū whenever they needed to:

"The Kāhui's perspective was, 'How do we help Māori research?', 'How do we help Māori researchers?' and, 'Let's figure it out."[42]

Members took time to have useful conversations with these researchers that covered far more than exclusively technical matters, they also shared general information, provided advice, made beneficial connections, and generally helped 'get things done':

"*It is a group of experts that have my back. Their job is to look after us all*."[43]

"[The Kāhui, working collectively with other Māori in senior SfTI roles] provided an environment where Māori capacity development could be understood, championed, empowered, deployed and supported."[44]

Building capacity and capability for Māori and non-Māori researchers required the provision of adequate infrastructure, resources, people and training to deliver on the opportunities identified, which the Kāhui Māori informed. It also committed to ensuring each of the three technical Research Themes[45] gave due consideration to VM and mātauranga Māori through the project assessment and planning process.

Setting conditions that would support non-Māori researchers to work with and for Māori communities and businesses has also been important. In addition to the wider Capacity Development training offerings, resources such as He Ritenga, a pocket-sized guide to incorporating Māori values and principles into meetings and other events, were developed. It is important to remember that while SfTI-led hui have started and finished with karakia from relatively early in Tranche 1, this practice was not commonplace within the RSI system when the Challenges began.

"*[He Ritenga] opened up Te Ao Māori to a whole new audience, just in your back pocket."*[46]

41. Science for Technological Innovation. (2018). *Second Tranche Forward Strategy (2019-2024).*
42. Te Taka Keegan
43. Hēmi Whaanga, Senior Māori researcher and Ātea Spearhead Leader
44. Martin, W. (2021). Building Māori Capacity; Accelerating Access to Physical Sciences and Engineering Research. In M. Amoamo, M. Kawharu & K. Ruckstuhl (Eds.), *He Pou Hiringa; Grounding Science and Technology in Te Ao Māori* (pp100-118). BWB Texts. (p107)
45. Research Themes: Material, manufacturing and design; Sensors, robotics and automation; Data science and digital technologies. The fourth SfTI research theme is Vision Mātauranga.
46. Vanessa Ngaroimata Clark

He Ritenga

He hiringa hangarau,
he oranga tangata

Innovation in technology
for the benefit of people

The SfTI Whakatauākī was gifted to us by Tā (Sir) Pou Temara - Ngāi Tūhoe (KNZM) renowned Māori orator, tikanga and te reo Māori expert and academic

2 WHAKAKAPI
TO CLOSE AN EVENT

MIHI / THANKS

Acknowledge all those who ran the event or prepared food.

KARAKIA / BENEDICTION

Close with karakia.

HE MEA ATU ANŌ / NOTE

- Show aroha - caring and manaaki - hospitality
- Use karakia before major meals. They're not needed for snacks.
- Remove hats during karakia.
- Don't sit, or place clothes, on tables where food is served.

KARAKIA TĪMATANGA
OPENING INVOCATION

Whakataka te hau ki te uru,
whakataka te hau ki te tonga.
Kia mākinakina ki uta,
kia mātaratara ki tai.
E hī ake ana te atakura,
he tio, he huka, he hauhunga.
Haumi ē! Hui ē! Tāiki ē.

Get ready for the westerly
and be prepared for the southerly.
It will be icy cold inland
and icy cold on the shore.

The scarlet dawn rises
over ice, snow, and frost.
Let us face it together.

KARAKIA WHAKAMUTUNGA
CLOSING BENEDICTION

Unuhia, unuhia.
Unuhia ki te uru tapu nui.
Kia watea, kia māmā,
Te ngākau, te tinana, Te wairua,
i te ara takatū.
Koia rā e Rongo, e whakairia
ake ki runga.
Kia tina, TINA! Hui ē, TĀIKI ē.

Lighten the weight of this occasion
So that spirit, heart and body
can be light and free as we depart.
Oh Rongo, above (symbol of peace).
Let this all be done in unity.

KARAKIA MŌ TE KAI
INVOCATION OVER A MEAL

Whakapaingia ēnei kai
hei oranga mō ō matou tinana.

Whāngaia hoki ō mātou wairua
ki te taro o te ora.
Āmine.

May this food be made fit for the nourishment of our bodies. And may our souls also receive spiritual nourishment. So be it.

WAIATA – TŪTIRA MAI

Tūtira mai ngā iwi, tātou tātou e
Tūtira mai ngā iwi, tātou tātou e
Whāia te māramatanga,
me te aroha. E ngā iwi!
Kia tapatahi, kia kotahi rā
Tātou tātou e

People, stand together
Every one of us (x2)
Seek understanding
and love for others. Everyone!
Think as one, act as one
Each and every one of us.

SCIENCE FOR TECHNOLOGICAL INNOVATION

Kia kotahi mai –
Te Ao Pūtaiao me
Te Ao Hangarau

HE RITENGA

A guide to incorporating
Māori values and principles
into SfTI events and meetings.

He Ritenga

He ritenga has been produced by the SfTI Kāhui Māori Advisory Group.

NOTE
These guidelines work well in the order given. Some steps may be omitted to suit the occasion.

1 WHAKATŪWHERA
TO OPEN AN EVENT

MIHI
WELCOME

KARAKIA
INVOCATION

WHENUA
LOCATION

KAUPAPA
PURPOSE

WHAKAWHANAUNGATANGA
RELATING

WAIATA
SONG

WHENUA
LOCATION

Acknowledge the local iwi and hapū, even when they're not in the room.

Share your personal history with the location, if appropriate.

On special occasions, invite the local iwi or hapū to open and close the event.

KAUPAPA
PURPOSE

Outline the meeting's purpose and goals to align everyone to the same vision.

MIHI
WELCOME

Begin meetings by welcoming all attending.

TIP

A mihi can be in Māori or another language.

KARAKIA
INVOCATION

Begin and end meetings with a general request for a good tone to be set.

TIP

This request can be spiritual, cultural, or a communal call for unity.

Karakia can be in Māori or another language.

WHAKAWHANAUNGATANGA
RELATING

Acknowledge every person in the room either as individuals or organisations.

This welcomes people and allows them to discover any relationships to others present.

WAIATA
SONG

Waiata are used to support the speaker, reinforce the subject matter, honour the occasion, or entertain. Any language may be used.

SCIENCE FOR TECHNOLOGICAL INNOVATION / 2014-2024

701 RESEARCHERS

87 MĀORI | **205** WOMEN

173 EMERGING RESEARCHERS

58 ORGANISATIONS
Including 9 international

$106 mil
INVESTMENT

100+ projects
BIG AND SMALL

Potential impact of SFTI supported high-tech innovation in Aotearoa; **$billions**

Connecting with Māori stakeholders

Another task was identifying opportunities for engagement with Iwi/Māori in ways that facilitated their contribution to, and benefit from, Challenge activities. Closely related to this was maximising the benefits possible through drawing on both mātauranga Māori and western science within SFTI research, and minimising barriers to Māori accessing findings and outcomes from such research. Optimal knowledge transfer, knowledge translation and knowledge protection practices were identified and advocated for by the Kāhui, most particularly those of interest to Māori.

Te Tihi o te Maunga is a resource developed by the Kāhui Māori that has helped identify the extent to which research projects represent genuine collaboration with Māori. In a sense, the Maunga Model and accompanying assessment tool, Te Aromatawai, have facilitated both Māori and non-Māori researchers to come together with Māori working outside of institutional research organisations in ways that create benefit for Māori communities and business:

"*...participatory science has developed to include stakeholders to provide local, culturally situated and contextualised knowledge about complex problems that are unknown or unavailable to a science team but essential to its success.*"[47]

This is explored in greater depth in section 3.3 below.

3.2 SfTI'S WHAKATAUĀKĪ

He hiringa hangarau, he oranga tangata
Innovation in technology for the benefit of people

Tā Pou Temara, creator of SfTI's whakatauākī, is a prominent Māori academic and expert in traditional Māori knowledge and practices. With a background in education and a focus on the revitalisation of the Māori language and cultural heritage, he has contributed significantly to Indigenous scholarship and the promotion of Māori perspectives in academic and cultural domains.

Te Taka Keegan, together with senior SfTI researcher, Hēmi Whaanga (Ngāti Kahungunu, Ngāi Tahu, Ngāti Mamoe, Waitaha), approached Professor Pou Temara for his advice and guidance on writing a whakatauākī for the Challenge:

"Following many meetings over a few months, we sat with Professor Temara and discussed, to and fro, the true meaning and essence of the Challenge and what SfTI is aiming to achieve. After some consideration he offered the name 'Te Hiringa' and the whakatauākī, the foundation that gives the name its mana. The whakatauākī embodies the way technology will develop us as a people."[48]

Science for Technological Innovation National Science Challenge Mission:

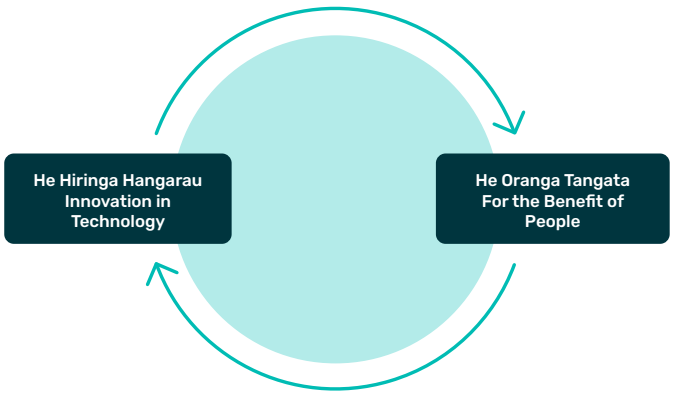
to enhance the capacity of Aotearoa-New Zealand to use physical sciences and engineering for economic growth and prosperity.

Essentially, the aim of the Challenge has been to be purposeful about taking technology out of laboratory conditions into the real world so that businesses and communities, including Māori, can engage with the discovery process and resulting advancements in knowledge, translating them into benefits.

We might understand this whakatauākī by comparing science and mātauranga Māori to raranga (weaving). Raranga is weaving together harakeke to create something beautiful that is also useful, with the relationship between the aho (weft) and whenu (warp) making the fabric stronger.

As SfTI has seen, while innovation in technology can indeed benefit people, particularly when genuine and thoughtful collaboration is practiced, so too people can benefit science and technology. Within such a reciprocal exchange, two knowledge systems can be woven together, making each stronger.

He Hiringa Hangarau; He Oranga Tangata - A Symbiotic Relationship



47. Amoamo, M., & Ruckstuhl, K. (2021). Kāhui Māori; Distinctive Leadership in Science and Technology. In M. Amoamo, M. Kawharu, & K. Ruckstuhl (Eds.), *He Pou Hiringa; Grounding Science and Technology in Te Ao Māori* (pp35-54). BWB Texts. (p38)
48. Hēmi Whaanga

Illustration designed by Tyler Dixon, Waikato-Maniapoto, Ngāti Porou, Ngāi Tūhoe, Ngāi Tahu depicts a Mangopare (Hammerhead shark). It symbolises the strength in duality to be found in uniting Māori knowledge with western science.

In his own words, Professor Temara explains how he arrived at the whakatauākī gifted to SfTI:

He Hiringa Hangarau, He Oranga Tangata

Innovation in technology for the benefit of people

AN EXPLANATION BY POU TEMARA

The focus of this explanation is on the modern whakatauākī, He hiringa hangarau, he oranga tangata.

Hiringa

The word hiringa is defined by Williams[49] as:

- Eagerly desire, long for
- Spring up, rise up (of thoughts)
- Perseverance, energy, determination = mana

In the oriori for Tuteremoana[50], we find the words:

Whakarongo mai e tama
Kotahi tonu te hiringa
I kake ai a Tāne ki Tikitikiōrangi,
Ko te hiringa mahara...

Kotahi tonu te hiringa is translated as 'there was only one implanting' while te hiringa te

mahara is translated as 'the implanting of the mind'. "Implanting" does not line up with all the definitions by Williams.

A part of the karakia whakapūmau[51] we find the lines:

Kia tāmāua ki te hiringa i roto
Kia tāwhia ki te hiringa matua
Kia whanake ki te pū,
Te hiringa tawhito ururangi.
Kia whanake ki roto i te koronga
Te hiringa tupua
Kia whanake i te iho tō hiringa,
Te hiringa te mahara
te hiringa te wānanga...

In the last verse of the same karakia we find:

He pukenga tupua, he koronga atua
Whiwhia i roto i te hiringa atua
Nōu e Rangi e.

In another karakia that is intoned to inspire the student we find:

Pou hihiri, pou rarama
Tiaho i roto, mārama i roto,
Wānanga i roto,
Ko te pou kei a koe
Ko te pou o ngā kōrero o te wānanga.[52]

In the context of these karakia, including the oriori for Tuteremoana, it is my considered opinion that the word hihiri is the inspiration, the quest, the welling up of the desire to know and to understand the unknown. It therefore lines up with Williams' definitions.

Hangarau

In its traditional definition hangarau describes a person of a tricky disposition, therefore we have Māui hangarau, Māui the trickster. Māui immediately comes to mind when hangarau is mentioned. However, Māui was also innovative in his desire to acquire ongoing life for humankind. He was innovative in the technology that allowed him to do many wonderous feats that challenged the very gods. He used technology to fish up the great fish of Māui and to destroy Tunanui. Technology and the quest for technology is not new to the culture of Māori, however there are some caveats as Maui experienced. He paid dearly with his life.

Hangarau is a modern adaptation of the traditional word to describe technology and the adaptation is an apt one to the student of the Māori language.

Oranga tangata

Oranga tangata is easy to decipher. Both words are in common use and it simply means 'health of people'. Oranga is derived from the base word ora which means life. Tangata is humankind.

Context

In the context of the whakatauākī, He hiringa hangarau, he oranga tangata, we conclude that the ongoing and progressive health of people is dependent on their ability to search, to be inspired and innovated to rise to unknown and untested spaces in the quest for new technology. In poeticising the interpretation we then have Innovation in technology for the benefit of people.

Conclusion

The whakatauākī is offered as the lead Māori proposition for the project. It is proposed that it be called Te Hiringa and the whakatauākī is the bedrock that gives it mana.

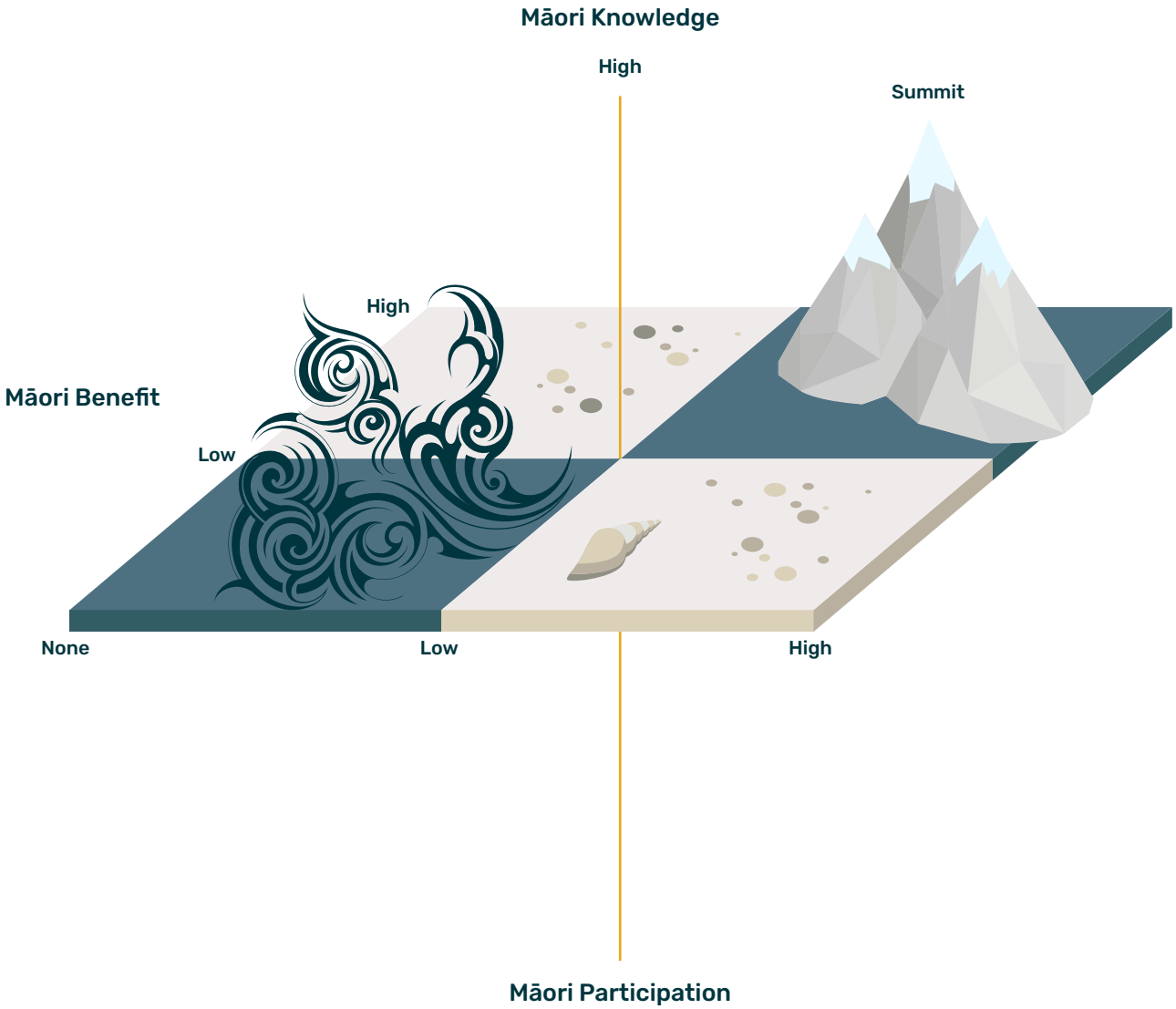
49. Williams, H. W. (1971). A dictionary of the Māori language. Wellington: Government Printer. (p53)
50. Te Reo Rangatira Trust. (1998). He Waiata Onamata. Auckland: Huia. (p15)
51. Making knowledge firm in a student.
52. Karakia of Rawiri Te Kokau (unpublished manuscript).

3.3 TE TIHI O TE MAUNGA MODEL

The Model has informed a pathway towards increasing the incidence of SfTI research with higher levels of Māori knowledge and participation, and realising more relevant benefits for Māori.

The Kāhui Māori developed Te Tihi o te Maunga based on the ruminations of Mānuka Henare, which were then converted by Willy-John Martin into a model of assessment that could feed into Challenge activities. In essence it *"provides a framework, conceptualised as a journey, that maps projects from having little or no Māori innovation (viewed as landing on the shore), to incorporating some potential for Māori (arriving at the base of the mountain), to high levels at the summit where science and mātauranga innovation occur."*[53]

Te Tihi o te Maunga Model



53. Amoamo, M., & Ruckstuhl, K. (2021). Kāhui Māori; Distinctive Leadership in Science and Technology. In M. Amoamo, M. Kawharu, & K. Ruckstuhl (Eds.), *He Pou Hiringa; Grounding Science and Technology in Te Ao Māori* (pp35-54). BWB Texts. (p44)

There is a close relationship between Te Tihi o te Maunga and SfTI's Capacity Development Programme. Scientists need help to build skills outside of technical scientific expertise that enable them to "*interact with, and understand, business and Māori communities' values, perspectives and priorities,*"[54] increasing the likelihood of early and meaningful collaboration. The Model essentially links the development of *human capacity*[55] and *relational capacity*[56] to its potential for embedding Māori-oriented research processes and impacts.

Given the relatively low existing numbers of Māori physical scientists and engineers, and with little expectation that this will change in the short to medium term, SfTI and the Kāhui Māori have seen the merit of taking non-Māori researchers and research assessors along the Te Tihi o te Maunga journey. This is how one moves from sea to shore to summit:

"First, the sci-tech researcher is ignorant of or sees no relevance in connecting with the Māori world, represented in the model as the researcher being offshore. This represents a state where no Māori knowledge is incorporated, where Māori are not involved and where there is no direct Māori benefit. Then the researcher lands on the developing shores of understanding, perhaps through undertaking some of the human capacity development activities.

However, there is a further journey to reach the summit where the technical capacity incorporates a high degree of Māori knowledge, where Māori participation is likewise high and where the benefits are Māori focussed."[57]

As a practical tool, Te Tihi o te Maunga has helped to highlight **where** researchers should focus and **what** they can improve in terms of meeting the VM policy guidelines, while Capacity Development has shown **how** such improvements can be achieved.[58]

Te Tihi o te Maunga highlights that knowledge and skills beyond technical capacity are required to develop and commercialise science in partnership with Māori; it supports a 'mental shift' that scientists need to make if they are to work fruitfully with Māori.[59] In fact, "*Despite the current small numbers of Māori with technical expertise in the research domains of SfTI,… this need not be a barrier. Rather, these novel approaches have allowed Māori to take a more active role within the Challenge which not only diversifies participation but has the potential to diversify the science and technology knowledge domain itself.*"[60]

With reference to the three pou (knowledge, participation and benefit), Te Aromatawai highlights important indicators of genuine Māori involvement, for example, realistic budget allocation for Māori project participants.

Once new projects with identifiable VM components were approved, researchers were allocated mentors (both VM and technical) to support the work, and team members were invited to present to the Kāhui Māori on their progress.

In practice, *"this system enabled SfTI to assess progress and changes in Vision Mātauranga quality across its portfolio of projects."*[61] Te Tihi o te Maunga and Te Aromatawai helped the Kāhui Māori to evaluate the extent to which research projects were aligned with Māori interests, and where gaps or barriers were apparent.

Below, Section 5 Māori Knowledge, Section 6 Māori Participation and Section 7 Māori Benefit, will each provide more detail on the importance of each Pou contained within the Te Tihi o te Maunga Model, and explore their place within the wider RSI system as well as how SfTI and the Kāhui Māori have put supportive mechanisms in place using the framework.

54. Martin, W. (2021). *Building Māori Capacity; Accelerating Access to Physical Sciences and Engineering Research.* In M. Amoamo, M. Kawharu & K. Ruckstuhl (Eds.), *He Pou Hiringa; Grounding Science and Technology in Te Ao Māori* (pp100-118). BWB Texts.
55. *Human capacity* includes the skills of influencing, collaborating and communicating effectively.
56. *Relational capacity* is the ability to build and maintain networks with industry, Māori and other scientists across disciplines.
57. Ruckstuhl, K., Amoamo, M., Hart, N. H., Martin, W. J., Keegan, T. T., & Pollock, R. (2019). Research and development absorptive capacity: a Māori perspective. *Kōtuitui: New Zealand Journal of Social Sciences Online*, *14*(1), 177-197. (p187)
58. Ruckstuhl, K., & Martin, W. (2019). Mātauranga Māori and the high-tech interface. *New Zealand Science Review*, *75*(4), 87-91.
59. Ruckstuhl, K., & Martin, W. (2019). Mātauranga Māori and the high-tech interface. *New Zealand Science Review*, *75*(4), 87-91.
60. *Ibid.* (p91)
61. Martin, W. (2021). Building Māori Capacity; Accelerating Access to Physical Sciences and Engineering Research. In M. Amoamo, M. Kawharu & K. Ruckstuhl (Eds.), *He Pou Hiringa; Grounding Science and Technology in Te Ao Māori* (pp100-118). BWB Texts. (p108)

4. Historical Context

The National Science Challenges were birthed out of and into a historical RSI context that made little space for Māori science and innovation, despite an obligation held by the state to recognise Māori capability and opportunity in all its endeavours.

This section provides some limited historical context for the relationship between Māori and Aotearoa New Zealand's RSI system, which is relevant to the SfTI NSC and work of the Kāhui Māori. We first look at the birth of the science sector's competitive funding model, then discuss the creation of the Vision Mātauranga Policy, before turning to the NSC establishment phase, and finally review the promise of Te Ara Paerangi Future Pathways.

4.1 A COMPETITIVE FUNDING SYSTEM

Many of the processes and assumptions that have underpinned Aotearoa New Zealand's science funding system in the recent past can be traced back to wholesale, neoliberal policy reforms of the late 1980s.[62] The Arbuckle Report (1988) for the Science and Technology Advisory Committee (STAC) was particularly influential, recommending that contestable funding be introduced across the sector with concurrent commercialisation of research institutions "*based on the premise that the best results will occur if researchers have to compete for funding*."[63] Economists, rather than scientists or communities appear to have been given greater authority to determine how the system would function, justified in large part by New Zealand's changing economic circumstances, including rising debt and a growing public discourse criticising government spending decisions.

In line with the move to separate government functions elsewhere, the Ministry of Research, Science and Technology (MoRST) was established (1989) to **create policy direction** for the science system, while the Foundation for Research, Science and Technology (FRST) was established soon after to **oversee funding administration**, and had a firm focus on achieving return on investment. The early 1990s saw the Department of Scientific and Industrial Research (DSIR) disestablished and replaced by Crown Research Institutes (CRIs), which were responsible for **research provision**. The CRIs maintained this country's strong focus on the primary industries, which has been an ongoing area of government priority through to the current time. There was no Māori-focussed CRI.

While this shift may have aimed at improved efficiency and beneficial economic impact, Māori knowledge, participation and benefit, do not appear to have been front of mind when these new structures were put in place. Time has shown that "highly competitive and individualised benefit models have privileged some types of science while erasing or exploiting others.[64]

The negative impacts are still being experienced by Māori (and the nation) to this day. As one collective Māori submission to Te Ara Paerangi described with a nuanced eye to systems change:

"The biggest roadblock to creating collaborative and agile research institutes is the needless competition rampant within the scientific community. To generate more collaboration, it needs to be incentivised or the competitive aspect needs to be removed. Adaptive environments are created when new people enter the space and new knowledge/ideas are allowed to flourish. Making it easier for research teams to hire a diverse crew would enable the flexibility and adaptability desired by the green paper."[65]

The National Science Challenges were developed as a new, Mission-led way of carrying out research, and were afforded greater flexibility in funding decisions, with some of the more important initiatives being greater collaboration in team formation, project design and funding processes. This has created quite a different environment that has countered some of the disadvantages of the overwhelmingly competitive research resourcing approach seen elsewhere.

62. McGuinness, W., McCarter, J., Newton, M., & Aitken, C. (2009). *A History of Government-Funded Science from 1865–2009*.McGuiness Institute: NZ. https://www.mcguinnessinstitute.org/wp-content/uploads/2016/08/Project-2058-Report-9a-Web.pdf
63. *bid*. (p23)
64. Kukutai, T., Parr-Brownlie, L., & Pitama, S. (2022). A bridge between: Te Ao Māori and Te Ara Paerangi. *New Zealand Science Review*, 78(1-4), 12-20. (p14)
65. Te Ara Paerangi Future Pathways: Wāhanga 2 He Whakarāpopototanga Mō Ngā Toronga Me Ngāvtāpaetanga Māori | Part 2 Summary of Māori Engagements and Submissions. 2022. (p39)

4.2 THE VISION MĀTAURANGA POLICY

Fast forward a decade, and the sitting Labour Government had put in place a raft of Māori-relevant policies impacting the Research, Science and Technology system. However, these mechanisms were primarily concerned with either increasing the number of Māori in science, or reducing Māori health inequities. Notably, as with other Māori-focused government policies, there was a distinct deficit mentality that failed to recognise the positive opportunities inherent in Te Ao Māori.

Te Ahukaramū Charles Royal, who would later become the chief Vision Mātauranga architect, took a role with MoRST in 2003, coming from an unapologetically aspirational kaupapa Māori organisation. The deficit view he observed within government was something of a shock, and he decided he wanted to effect a culture change:

"'Māori' was not regarded positively, and any Māori-specific policy, at that time, was only about addressing Māori problems. I was offended by that because I'd just come from a situation where being Māori was so positive – my uncle thought we should create a wānanga and so we did it. I wanted to change the story. I started to foster the idea of seeing Māori as a 'Net National Opportunity'."[66]

Don Brash delivered his infamous Ōrewa speech the following year, in which he observed a "*dangerous drift towards racial separatism in New Zealand*."[67] The speech and its aftermath triggered the Labour Government to institute the State Services Commission Review of Ethnically Targeted Programmes to reassure the public that targeted funding was being allocated on the basis of need not race. The effect was that MoRST was no longer able to prioritise Māori recruitment, fund research with a Māori focus, or support initiatives specifically for Māori.

It was in this environment that the Vision Mātauranga Policy was written - it reflected that there was a measure of government support for Māori research, albeit somewhat covert in form. Languaging was important in the policy's construction in that it was ostensibly about creating **national benefit** rather than **benefits targeted towards Māori**:

The Mission Statement of Vision Mātauranga:

To unlock the innovation potential of Māori knowledge, resources and people to assist New Zealanders to create a better future.[68]

66. Rauika Māngai. (2020). *A Guide to Vision Mātauranga: Lessons from Māori Voices in the New Zealand Sector*. Wellington, NZ: Rauika Māngai. (p16)
67. Brash, D. (2004, 27 January). Nationhood. *Scoop Independent News*. https://www.scoop.co.nz/stories/PA0401/S00220/nationhood-don-brash-speech-orewa-rotary-club.htm
68. Ministry of Research, Science and Technology. (2005). *Vision Mātauranga; Unlocking the Innovation Potential of Māori Knowledge, Resources and People*. Wellington, NZ: MoRST. (p1)

The purpose of the Vision Mātauranga policy is to provide strategic direction for research funding relevant to four themes:[69]

- **Indigenous Innovation**: Contributing to Economic Growth through Distinctive R&D. New Zealand needs its businesses and for-profit enterprises to perform at an optimum level and contribute to economic growth. This theme concerns the development of distinctive products, processes, systems and services from Māori knowledge, resources and people. Of particular interest are products that may be distinctive in the international marketplace.
- **Taiao**: Achieving Environmental Sustainability through Iwi and Hapū Relationships with land and sea. Like all communities, Māori communities aspire to live in sustainable communities dwelling in healthy environments. Much general environmental research is relevant to Māori. Distinctive environmental research arising in Māori communities relates to the expression of iwi and hapū knowledge, culture and experience – including kaitiakitanga – in New Zealand land and seascapes.
- **Hauora/Oranga**: Improving Health and Social Wellbeing. Distinctive challenges to Māori health and social wellbeing continue to arise within Māori communities. Research is needed to meet these on-going needs.
- **Mātauranga**: Exploring Indigenous Knowledge and RS&T. This exploratory theme aims to develop a body of knowledge, as a contribution to RS&T, at the interface between indigenous knowledge – including mātauranga Māori – and RS&T.

While the policy was an attempt to bring an element of positive aspiration to relationships between Māori and the RSI system outside of simply "*increasing participation and addressing needs,*"[70] implementation has been problematic. Despite this, the policy does offer a framework for managing research at the interface, particularly through emphasising the importance and place for Māori knowledge, resources and people within the RSI system.

4.3 ESTABLISHING THE NATIONAL SCIENCE CHALLENGES

Leaping into the future another decade, and a novel RSI initiative was being established, one which would go on to have a significant influence on the mātauranga Māori-western science interface: the National Science Challenges.

Early development of the NSCs lacked specific inclusion of Māori dimensions. Ngā Pae o te Māramatanga responded quickly by bringing together Māori academics at a hui in mid-2013 in order to form a collective, constructive response to this glaring omission. Given this was a substantial new avenue of science and research funding, it was important to ensure that Māori-led research would be resourced and that potential benefits could be realised by Māori communities.[71]

The 2012 CoRE funding round was open at around this time, and Ngā Pae o te Māramatanga was initially told it would not be re-funded, which "*arguably helped to prompt a stronger and more coordinated response from frustrated Māori academics and non-Māori allies.*"[72] Once again, decisions were being made using reference to a western framework "*by those who couldn't appreciate [NPM's] value and potential.*"[73] This incident speaks to how crucial it is to have Māori experts on mātauranga Māori in leadership and evaluation roles to help steer the RSI system.

69. Ministry of Research, Science and Technology. (2005). *Vision Mātauranga; Unlocking the Innovation Potential of Māori Knowledge, Resources and People*. Wellington, NZ: MoRST. (p4)
70. Rauika Māngai. (2020). *A Guide to Vision Mātauranga; Lessons from Māori Voices in the New Zealand Science Sector*. Wellington, NZ: Rauika Māngai. (p17)
71. Te Pūwānanga Kōanga | Spring 2013 | ISSN 1179-7134 (Online) Ngā Pae o te Māramatanga.
72. Hazel, J-A., & Tunui, P-M. (2024). *Te Tiriti Partnerships Enhance Research, Science and Innovation; National Science Challenges share their experiences*. (p25)
73. Muru-Lanning, C. (2022, June 1). The place for mātauranga Māori is alongside science. *The Spinoff*. https://thespinoff.co.nz/atea/01-06-2022/the-place-for-mātauranga-Māori-is-alongside-science

More meetings took place, and they reinforced the importance of Te Tiriti o Waitangi and mātauranga Māori in the RSI context - strong concerns were voiced around their invisibility within Challenge themes and processes.

Some SfTI Kāhui Māori members recall the debate around how the NSCs were being set up, including whether there should be a separate Māori Challenge, and if this was not to be the case, how could Māori interests be incorporated into every Challenge?

Ultimately, a set of key principles and values were collated and offered to the NSC architects as essential guidelines to be embedded across the Challenges:

- Te Ao Māori, Māori world views, Tikanga, Te Reo
- Te Tiriti o Waitangi
- Mātauranga Māori: Māori Knowledge
- Rangahau orite – Equity
- Rangahau whai hua – Transformative focus
- Kaitiakitanga – Inter-generational custodianship, protection/enhancement of mauri[74]

In response, MBIE made minimal changes to the Challenge's Establishment Criteria apart from adding that each Challenge was required to give effect to the Vision Mātauranga policy through its research.[75] But despite Challenges being set up "*without contractual or specific performance requirements to include Māori communities, researchers and governance, or to enable kaupapa* Māori research,"[76] each one has gone on to create small pockets of science and research activity that have honoured te Tiriti and ensured meaningful participation by, and benefit for, Māori.

4.4 ASPIRATIONAL FUTURES - TE ARA PAERANGI FUTURE PATHWAYS

"The current system is failing Māori, it does not understand nor cater for Māori ways of knowing, working and being. Therefore, proposed changes must include Māori worldviews, values and mātauranga (knowledge). Additionally, protecting mātauranga (and associated taonga including data resources, reo, and indigenous biodiversity), must be central to the new system."[77]

Although it may not have been purposefully aimed at countering the racism evident within the wider science sector, Te Ara Paerangi Future Pathways was in effect a small, hopeful site of reform for the science, innovation and technology sector where Māori knowledge, participation and benefit could thrive.

The Vision of Te Ara Paerangi was to build an RSI system that "*supports wellbeing for all current and future New Zealanders, a high-wage low emissions economy, and a thriving, protected environment through excellent and impactful research, science and innovation*."[78] It acknowledged the potential contribution of science, research, innovation and technology, to all other aspects of Aotearoa New Zealand life, now and into the future. At the same time, the review highlighted a number of existing system attributes that effectively stifle best outcomes, including: underinvestment, especially when compared with other OECD countries; potentially outdated areas of focus; a lack of a big picture, future-focussed strategic direction; weak collaborative connections; and a tendency towards competition. Alongside these general challenges is an obvious underrepresentation of Māori, and a low level of Tiriti-honouring policy and funding.

74. Pihama, L. (2014, 6 March). The Denial of Māori Research Development. *Te Wharepora Hou*. https://tewhareporahou.wordpress.com/2014/03/06/the-denial-of-Māori-research-development/
75. https://www.mbie.govt.nz/science-and-technology/science-and-innovation/funding-information-and-opportunities/investment-funds/national-science-challenges/
76. Hazel, J., & Tunui, P-M. (2024) *Te Tiriti o Waitangi Partnerships Enhance Research Science and Innovation; National Science Challenges share their experiences*. (p29)
77. Te Ara Paerangi Future Pathways: Wāhanga 2 He Whakarāpopototanga Mō Ngā Toronga Me NgāvTāpaetanga Māori | Part 2 Summary of Māori Engagements and Submissions. 2022. (Collective Māori Submission, p17)
78. Ministry of Business Innovation & Employment. (2022). *Te Ara Paerangi Future Pathways White Paper 2022*. Wellington: NZ. (p7)

A great deal of consultation was carried out in the development of this policy direction, with submissions providing rich insight into an ideal future. In term of providing advice on how the review should progress, the Kāhui Māori provided detailed guidance including:

"At a foundational level, the review should acknowledge the complexity of the Māori world and the consequent need for bold thinking and action in order to leverage research, science and innovation to generate solutions. Challenges such as climate change and intergenerational inequality will not be overcome using Western science alone, rather, Aotearoa New Zealand's other primary knowledge system, Mātauranga Māori, is needed. Ideally we will transform from a system that is extractive and deficit-focused to one that is generative and ethical."[79]

Te Ara Paerangi was to be implemented over a number of years, beginning with workforce reform, followed by identifying a set of appropriate new Research Priorities, and then focusing on reforming science and research institutions in line with policy aspirations.

This initiative has been discontinued by the incoming Coalition Government (2023), and replaced by a Science System Advisory Group and University Advisory Group, both headed by Sir Peter Gluckman. They are responsible for providing recommendations to the government on how best to reform the science sector and university system.

Nevertheless, the Te Ara Paerangi policy documents and the raft of submissions gathered, remain a resource with much to offer as this country continues to debate the RSI system's future configuration.

Image: SfTI Seed researcher, Dr Leonie Jones (Ngāpuhi, Ngāti Kahungunu ki Wairarapa) demonstrating her real-time river water sensor.

79. Kāhui Māori for Science for Technological Innovation. (2022). *Te Ara Paerangi Future Pathways: Green paper consultation; Submission for the Kāhui Māori for Science for Technological Innovation National Science Challenge.* (p4)

Māori Knowledge is Vital for Generating Innovation in Technology for the Benefit of People

5. Māori Knowledge

'As advocates for and guardians of mātauranga Māori, the Kāhui has challenged SfTI as an organisation to change the way that science is enacted, located and understood"[80]

80. Amoamo, M., & Ruckstuhl, K. (2021). Kāhui Māori; Distinctive Leadership in Science and Technology. In In M. Amoamo, M. Kawharu & K. Ruckstuhl (Eds.), *He Pou Hiringa; Grounding Science and Technology in Te Ao Māori* (pp 35-54). BWB Texts. (p51)

Ensuring mātauranga Māori was being utilised across the SfTI programme of work has been a central focus for the Kāhui Māori. Within Te Tihi o te Maunga, the Māori Knowledge axis refers to the level of mātauranga Māori utilised during a piece of research, including Māori values, principles, processes, approaches, knowledge of history and resources, relationships, language and technical knowledge.[81]

As an example of this working in practice, Seed research proposal assessors using the Te Aromatawai assessment tool considered a number of questions in their determinations, including:[82]

- Have Māori principles or practices been meaningfully incorporated and practised?
- Has Māori knowledge been appropriately obtained, understood and applied?
- Is intellectual property likely to be discovered that will be of particular benefit or interest to Māori?
- Is there any novelty or opportunity by integrating science and technology and mātauranga Māori?

This approach recognises that mātauranga and embedded relationships, paired with good technical capability, are foundational ingredients of successful projects. Assessing projects in this way has been key to increasing the prevalence of mātauranga Māori and kaupapa Māori methodologies to levels not necessarily seen elsewhere in the RSI system.

For example, the first Seed funding round received a number of VM-relevant projects that did not have the requisite technical element, however, this changed and matured over successive rounds culminating in extremely high quality applications being submitted and funded later in the second tranche.

Te Tiriti o Waitangi can be applied to provide useful guidance on the application of Māori Knowledge within the RSI system:

Article 2 Tino Rangatiratanga (possession and self-determination; protection of these rights) - provides for legal recognition that mātauranga Māori, including Māori science knowledge, should be regarded as a taonga under Māori control. Inherent in this is the expectation that Māori should have legal avenues to ensure they can exercise their rights to "*own, protect, manage and develop Māori science knowledge, whether traditional or contemporary science methods are used*."[83]

Article 3 Ōritetanga (equitable citizenship rights, protections and privileges) - can be interpreted as guaranteeing equitable status for Māori science as a legitimate knowledge system. It should be funded equitably alongside other knowledge systems in ways that advance Māori aspirations.[84]

The current section takes a deeper dive into exploring what Māori knowledge is, its relationship with the RSI system, and the issues of equitable funding and appropriate protection. Relevant recent history is explored as well as the contribution of the Kāhui Māori in elevating the place of mātauranga Māori within the SfTI National Science Challenge.

81. Ruckstuhl, K., & Martin, W. (2019). Mātauranga Māori and the high-tech interface. *New Zealand Science Review*, *75*(4), 87-91. (p89)
82. Science for Technological Innovation: Kaupapa kākano Seed Project Fund 2021 Call for Proposals.
83. Martin, W. (2021). Building Māori Capacity; Accelerating Access to Physical Sciences and Engineering Research. In M. Amoamo, M. Kawharu & K. Ruckstuhl (Eds.), *He Pou Hiringa; Grounding Science and Technology in Te Ao Māori* (pp100-118). BWB Texts. (p106)
84. *Ibid*.

5.1 MĀTAURANGA MĀORI

Mātauranga Māori – a body of knowledge that was first brought to New Zealand by Polynesian ancestors of present-day Māori. It changed and grew with the experience of living in these islands. Following encounter with the European in the late 1700s and early 1800s, it grew and changed again before becoming endangered in many substantial ways in the 19th and 20th centuries. The elements that remain today – including the Māori language – have catalysed a renewed interest in this body of knowledge.[85]

First and foremost, mātauranga Māori is not an outdated body of knowledge that has ceased to develop; it is constantly evolving over time. The vast expertise built up across generations is unique to Aotearoa New Zealand, and includes both processes and knowledge domains; mātauranga Māori is a system. It is available to us in the current time to inform and improve progress within science and research, and to enhance life in general. Importantly, rangatahi (young people) need to be involved because they will take this body of knowledge into the future, building on it in their own ways.

It can be difficult to make the connection between western science and Indigenous knowledge because they look at the world through two different cultural lenses. Māori perceive the world through the use of protocols, and balancing **tapu** and **noa**.[86]

Māori understand the world through interweaving the relationships shared with the whenua, looking at how everything is connected in harmony,[87] and how Atua Māori[88] are connected through people and environment. The environment was here long before Māori arrived in Aotearoa, and it will be here long into the future; we must respect it as if it is our elders, and it will protect us in return. The entwined connections between Māori and the environment can be characterised by the whakatauakī, '*Mā te tuakana te teina e tōtika, mā te teina te tuakana e totika'*.[89]

Māori values are the foundation of strong communities, and this is clearly illustrated through the work of Māori organisations which draw on a Te Ao Māori lens and a range of uaratanga (values) including:

Pono:[90] '*Kaua te tau e pokea. Kaua te tau e rewanatia*' Tongikura tā Kīngi Tāwhiao.

Tauutuutu:[91] '*Mahia te mahi hei painga mō te iwi'*. Te Puea Herangi.

Whanaungatanga:[92] '*Ki te kōtahi te kākaho ka whāti, ki te kapuia e kore ka whati*' Kingi Tūkāroto Matutaera Pōtatau Te Wherowhero Tāshaio.

Kawenga:[93] 'Māku anō tōku whare e hanga, ko pou o roto he mahoe, he patate. Ko te hīnau, he māhoe' Kīngi Tāwhiao.

Aroha:[94] '*Kotahi anō te kōhao o ngira e kūhuna ai te miro mā, te miro whero me te miro pango. Ā i a au kia mau ki te ture, te whakapono me te aroha. Hei aha te aha! Hei aha te aha!*' Kīngi Pōtatau.

85. *Vision Mātauranga; Unlocking the Innovation Potential of Māori Knowledge, Resources and People.* Ministry of Research, Science and Technology; NZ. (p24)
86. Tapu and noa were integral to everyday life in pre-colonial Māori society, shaping relationships between tāne and wāhine and the balance between the spiritual and everyday realms. Tapu and noa impact many everyday activities in Māori life, including food, birth, and death. Witnesses described tapu as encompassing both power and constraint, implying prohibition and separation from everyday life. In contrast, noa represents an unrestricted state. https://www.waitangitribunal.govt.nz/
87. Stewart, G. (2019). Mātauranga and Pūtaiao: the question of 'Māori science'. *New Zealand science review*, *75*(4), 65-68.
88. Gods.
89. From the older sibling, the younger learns how to do it, from the younger sibling, the older learns how to be tolerant.
90. Honesty and sincerity.
91. Reciprocity.
92. Relationships and connections.
93. Obligation.
94. Love and compassion.

These values also come together to inform the types of Māori knowledge that might be used within the RSI system. Holism, for example, is the foundation of mātauranga Māori seen in the principles of whanaungatanga (interdependency between people and places) and tāwhiowhio (learning from beyond ourselves), and arguably constitutes a key difference when compared to western science.[95] Another aspect is cosmology, which serves as an underpinning framework for Māori knowledge, and could be considered a parallel alternative to the theories and practices that regulate western scientific methodologies.[96]

The Kāhui Māori has sought to safely propel mātauranga Māori into SfTI's research programme and the wider science system. This approach acknowledges the value of mātauranga Māori as a rich knowledge system, and assumes that "*finding ways to liberate Māori people and their knowledge in the science sector could enable new and distinctive innovation to benefit Māori and wider New Zealand*."[97]

One way of achieving this has been for the Kāhui to elevate the importance of Māori principles and practices generally within SfTI. For example, enabling non-Māori to participate in entry-level Māori customs (e.g. through provision of resources such as He Ritenga), which has in turn removed some of the fear of the unknown, triggered a desire for further engagement, and encouraged researchers to start the process of relationship building with Māori communities.

Through greater familiarisation, Pākehā researchers have felt more comfortable being guided by the Kāhui in terms of applying a Māori lens to research risks and opportunities. This approach has helped create allies so that "*rather than seeing research engagement as a 'tick-box', Pākehā researchers are starting to see the value and relevance of engaging early and appropriately with Māori*."[98]

Image: Dr Willy-John Martin speaking at SfTI's final All of Researcher's Workshop in November 2023

95. Rauika Māngai. (2020). *A Guide to Vision Mātauranga: Lessons from Māori Voices in the New Zealand Sector*. Wellington, NZ: Rauika Māngai.

96. Stewart, G. (2019). Mātauranga and Pūtaiao: the question of 'Māori science'. *New Zealand science review, 75*(4), 65-68.

97. Martin, W. (2021). Building Māori Capacity; Accesslerating Access to Physical Sciences and Engineering Research. In M. Amoamo, M. Kawharu & K. Ruckstuhl (Eds.), *He Pou Hiringa; Grounding Science and Technology in Te Ao Māori* (pp100-118). BWB Texts.

98. Amoamo, M., & Ruckstuhl, K. (2021). Kāhui Māori; Distinctive Leadership in Science and Technology. In M. Amoamo, M. Kawharu, & K. Ruckstuhl (Eds.), *He Pou Hiringa; Grounding Science and Technology in Te Ao Māori* (pp35-54). BWB Texts. (p49)

5.2 THE RELATIONSHIP BETWEEN MĀTAURANGA MĀORI AND THE RSI SYSTEM

"You can't understand science through the tools of Mātauranga Māori, and you can't understand Mātauranga Māori through the tools of science. They're different bodies of knowledge, and if you try to see one through the eyes of the other, you mess it up. They might be aiming at the same thing, but going there in different directions."[99]

Aotearoa New Zealand's RSI sector has two knowledge systems to draw from: mātauranga Māori and western science. As Tā Mason Durie has discussed, Māori researchers work at the interface between the two, where contrasting attributes must be negotiated. Dan Hikuroa is another academic who has explored mātauranga Māori in relation to science, and he too has identified that while there are similarities, there are also significant differences.

Some differences between mātauranga Māori and science[100]

Mātauranga Māori	Science
Participatory 'experiences of systems	Detached 'observers' of systems
Explicit intrinsic values	Implicit instrumental values
Knowledge as belonging	Knowledge for control
Intuition as method	Intuition rarely acknowledged
Inclusion of facts and values	Facts and values separated
Everything is interconnected	Everything physical is interconnected

Māori researcher, Leonie Jones, has experienced the challenge of operating between the two knowledge systems, and now having navigated this space successfully with regard to species and time cycles, recognises that it is a uniquely Māori skill and that she is an important bridging agent between the two realms:

"I believe that this is a skill that can't be taught, but rather can only be acquired from operating at the interface of the two worlds. This skill is therefore uniquely Māori, and so it is us – as Māori innovators – who must demonstrate the success of Māori-centric innovation by actively incorporating Kaupapa Māori principles in our scientific work."[101]

Can we say there is a Māori science? Georgina Tuari Stewart (Ngāti Kura, Ngāpuhi-nui-tonu, Pare Hauraki), a leading pūtaiao curriculum designer at intermediate and secondary school levels from the early 1990s, has explored the issue at length. She concludes that this question might best be viewed "*as a tangle of semantic, philosophical and political arguments, rather than a simple yes-or-no question, [and it is] a specialised form of the wider debate about the nature of science.*"[102]

Regardless of the definitions preferred, a useful view is that "*both mātauranga* Māori and science are bodies of knowledge methodically created, contextualised within a world view… some *mātauranga* Māori has been generated according to the scientific method, and can therefore be considered as science."[103]

99. Tā Mason Durie as quoted in Rauika Māngai. (2020). *A Guide to Vision Mātauranga: Lessons from Māori Voices in the New Zealand Science Sector.* Wellington, NZ: Rauika Māngai. (p26)
100. Hikuroa, D. (2018). *Mātauranga Māori – the ūkaipō of knowledge in New Zealand (Policy Briefing 1/2018).* Public Policy Institute, The University of Auckland: NZ)
101. Kawharu, M., Jones, L., & Tapsell, P. (2021). Where Tikanga Meets Technology: Connecting Hau Kāinga to Whenua ora. In M. Amoamo, M. Kawharu, & K. Ruckstuhl (Eds.), *He Pou Hiringa; Grounding Science and Technology in Te Ao Māori* (pp55-74). BWB Texts. (p68)
102. Stewart, G. (2023, March 17). Is there such a thing as Māori science? 'It depends'. *E-Tangata*. https://e-tangata.co.nz/comment-and-analysis/is-there-such-thing-as-Māori-science-it-depends/
103. Hikuroa, D. (2017). Mātauranga Māori—the ūkaipō of knowledge in New Zealand. *Journal of the Royal Society of New Zealand, 47*(1), 5-10. (p9)

In considering these two knowledge systems, it is clear that some mātauranga Māori contains more sophisticated discoveries compared with science, particularly with regard to some "*very complex phenomena, such as the essential nature of a human being, or the mysteries of reality*."[104] On a more prosaic level, there is some knowledge within Māori science that western science is only now discovering, for example, interrelationships between species. Additionally, alongside the development of theory, observation and methodological approaches, there are some unique aspects of discovery, for example, "*for Māori, we do talk about how some people are just given some sorts of knowledge and that you'll just know stuff without reading a book or hearing a story, you just know it. But that is definitely not in the realm of western science ways*."[105] Mātauranga clearly has special value to add in the field of knowledge creation.

At the same time, shortcomings of the western scientific tradition are observed by Māori scholars, one of the most obvious being flawed claims of universality and impartiality. As Georgina Stewart notes, "*there is a very large gap between epistemic ideals and the way science plays out in society. As a human product, science is subject to human failings and weaknesses, including the deep influences of non-scientific ideas such as sexist or racist ideas.*"[106]

Ocean Mercier (Ngāti Porou), an academic specialising in how mātauranga and science connect, concurs, saying, "*as much as science tries to be objective, value free, neutral … we can never disentangle ourselves from the society that we're in and the way that shapes the way we do things*."[107] This more realistic view of science must go some way to rebalancing the way in which mātauranga Māori and western science are viewed in relation to each other.

Countering the Undervaluing of Mātauranga Māori

"Māori knowledge and research struggle for space and credibility, and as a nation we fail to value and nurture the full depth of knowledge that exists in this country."[108]

While a range of differences between the two knowledge systems are apparent, it is the dismissal of mātauranga Māori by some scientists and decision-makers that is problematic. Despite being Aotearoa New Zealand's point of difference in the world, it has not been widely valued, or understood, across the traditional science establishment, and this has been a longstanding issue:

"*Researchers in Aotearoa/New Zealand have developed a tradition of research that has perpetuated colonial values, thereby undervaluing and belittling Māori knowledge and learning practices and processes in order to enhance those of the colonisers and adherents of neo-colonial paradigms.*"[109]

"Arguments around mātauranga Māori not having science are still there, they're exhausting and they're a complete waste of time. … It's up to us how we define what it is. And if you're just western science-trained and you are commenting on Māori science, well, I wouldn't be commenting on a bioengineering or genetic engineering technique. I wouldn't be putting my nose over there - it's not my area."[110]

"We have a distinct lens on our world that perhaps internally New Zealand might not appreciate. But we do know that we get a really favourable response internationally in the way that we think indigenously. So there's an opportunity there. I think the biggest challenge for that opportunity is our own science sector and not necessarily recognizing that value. But I also see that individually our researchers are slowly turning and seeing that value."[111]

104. Stewart, G. (2019). Mātauranga and Pūtaiao: the question of 'Māori science'. *New Zealand science review*, *75*(4), 65-68. (p66) Georgina Tuari
105. Pauline Harris
106. Stewart, G. (2023, March 17). Is there such a thing as Māori science? 'It depends'. *E-Tangata*. https://e-tangata.co.nz/comment-and-analysis/is-there-such-thing-as-Māori-science-it-depends/
107. Muru-Lanning, C. (2022, June 1). The place for mātauranga Māori is alongside science. *The Spinoff*. https://thespinoff.co.nz/atea/01-06-2022/the-place-for-mātauranga-Māori-is-alongside-science
108. Helen Moewaka Barnes (2006). Transforming Science: How Our Structures Limit Innovation, Social Policy Journal of New Zealand; issue 29 (p2)
109. Bishop, 1998: 200) cited in McGuinness, W., McCarter, J., Newton, M., & Aitken, C. (2009). *A History of Government-Funded Science from 1865–2009*. (p11)
110. Pauline Harris
111. Nancy Garrity

The undervaluing of mātauranga Māori was an issue highlighted early for SfTI by delegates at its *Māori Business Leaders High Tech Summit* in 2016. Led by SfTI's then Vision Mātauranga Theme Leader Te Taka Keegan in partnership with Federation of Māori Authorities (FOMA) Chair Traci Houpapa, the Summit sought a Māori perspective on which areas of physical sciences and engineering the Challenge should invest in to support Māori enterprise. It was noted that despite research funding applications across the sector containing a Vision Mātauranga section, non-Māori researchers did not necessarily understand how to engage with and involve Māori or Māori knowledge within research. Further, funding applications and business case requirements were onerous, and were not appropriate or realistic, especially for smaller Māori organisations that already have significant administration costs. These constituted specific barriers between Māori and technology research for economic development.

A number of approaches have been offered to rectify this disconnect. For example, as Tā Mason Durie has posited, "*rather than contesting relative validities, there are an increasing number of indigenous researchers who use the interface between science and indigenous knowledge as a source of inventiveness. They have access to both systems and use the insights and methods of one to enhance the other. In this approach, the focus shifts from proving the superiority of one system over another to identifying opportunities for combining both*."[112] This distinctly aspirational thinking offers a pathway forward.

Submissions received during the Te Ara Paerangi consultation in 2022 talked of overcoming the disconnect between Māori and the RSI sector in more systemic terms thereby shifting responsibility away from individual researchers. There was a strong consensus that mātauranga Māori should be formally recognised by the government as having equal value within Research, Science and Innovation. Submitters called for: "*Mātauranga Māori to be nurtured, acknowledged, and fully appreciated. We propose a 'mana ōrite' model that speaks to an agreement between Iwi-Māori and the Crown where they are both provided equal explanatory power; their knowledges and the values that underpin them are considered to be equally valid*."[113]

SfTI, with leadership from the Kāhui Māori, worked to both support individual researchers (formally and informally) and incorporate systemic changes within SfTI. The rōpū has elevated the place of mātauranga Māori within research funding processes, with a particular focus on the smaller Seed projects. This has led to better quality proposals and a larger proportion of the overall funding pool being awarded to research that is Māori-led and relevant.

Further, the Kāhui Māori has helped change the thinking and behaviour of non-Māori researchers so that they feel comfortable working with SfTI's guidance for Te Ao Māori to be embedded across the organisation's research and other activities. Non-Māori are seeing the value and relevance of co-designing research with Māori.

The Kāhui Māori has helped SfTI as an organisation, as well as individual researchers, navigate the inherent challenges and opportunities presented by the two knowledge systems at play within this country and have shown that the two can work in concert to better effect real world benefits, especially for Māori.

112. Durie, M. (2004). Exploring the interface between science and indigenous knowledge. In *Paper delivered at the 5th APEC Research and Development Leaders Forum, Christchurch, New Zealand, March* (Vol. 11, No. 2013, p. 6).

113. Te Ara Paerangi Future Pathways: Wāhanga 2 He Whakarāpopototanga Mō Ngā Toronga Me Ngāvītāpaetanga Māori | Part 2 Summary of Māori Engagements and Submissions. 2022. (Collective Māori Submission, p30)

5.3 EQUITABLE FUNDING FOR MĀORI-LED RESEARCH

"In order to align with the articles of Te Tiriti o Waitangi, science funding in New Zealand has a responsibility to realise the potential of Māori people, knowledge and resources as articulated in the Vision Mātauranga policy."[114]

Aotearoa New Zealand's spend on R&D is already significantly lower than the 2021 OECD average, at 1.5% of GDP c.f. 2.7%.[115] In 2022, the New Zealand government contributed around 17% of the NZ$5.2B annual investment on R&D.[116] Recently, the newly elected Coalition Government has put in place funding cuts of between 6.5% and 7.5% across the public sector. This move has caused some consternation within the RSI system, not least because it coincides with the pre-planned discontinuation of the NSCs.

As already discussed, Indigenous knowledge does not carry the same weight as western science in Aotearoa New Zealand's RSI system, and this influences decision-makers who determine what is funded. This has led to one of the most egregious outcomes of Māori knowledge, principles and practices, being undervalued: inequitable resourcing.

The 'power to define' has implications for policy making across the wider RSI system in that policy makers are generally inclined to default to dominant discourses. For example, policy settings can often reflect a view that 'traditional' Indigenous knowledge, that is, pre-colonisation, is the truest form of Māori knowledge and therefore most deserving of the limited funding ring-fenced for 'special' Māori projects. This is at the cost of Māori knowledge developed more recently and fails to recognise that Indigenous knowledge relates to the past, present and future:

"Under these constructs, indigenous approaches and practitioners are not given legitimacy in some areas unless they are seen as operating within "scientific" principles."[117]

Well-funded research institutions are important sites for perpetuating such misunderstanding of mātauranga Māori by overwhelmingly non-Māori policy- and decision-makers, which maintain western ideals and devalue 'other' knowledge systems. Purposefully addressing power and value within organisations is a vital first step to changing research practice.

Countering this aspect of the status quo within SfTI, the Kāhui Māori has set the scene for a more equitable funding environment and the genuine application of Māori knowledge within research projects. As already mentioned above, members of the rōpū were directly involved in developing proposal assessment artefacts and processes, including Te Aromatawai (see Figure X below).

Drawing on the three pou contained in Te Tihi o te Maunga, Te Aromatawai incorporates seven individual criteria against which research proposals were evaluated. The Challenge set a target of at least 25%[118] of available Seed funding going to VM-forward projects. To help achieve this, a multi-ballot process was put in place, whereby proposals meeting pre-defined criteria would be placed inside one of several ballot boxes to be selected randomly. The boxes were: 'general', 'early career researcher', and 'Vision Mātauranga'. With reference to Te Aromatawai, proposals received either a half or full point for each criterion that was meaningfully incorporated into the project, and a score of 3 or more was required to be eligible for the Vision Mātauranga ballot. Unselected proposals from the Vision Mātauranga ballot pool were also considered for the ECR ballot (if eligible) and the general ballot.[119]

114. Martin, W. (2021). Building Māori Capacity; Accelerating Access to Physical Sciences and Engineering Research. In M. Amoamo, M. Kawharu & K. Ruckstuhl (Eds.), *He Pou Hiringa; Grounding Science and Technology in Te Ao Māori* (pp100-118). BWB Texts. He Pou Hiringa, p105

115. https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm

116. *New Zealand scraps science reform plan, prompting fears of budget cuts; New center-right government has promised to cut taxes, reduce spending*, 16 FEB 2024, Veronika Meduna https://www.science.org/content/article/new-zealand-scraps-science-reform-plan-prompting-fears-budget-cuts

117. Helen Moewaka Barnes (2006). Transforming Science: How Our Structures Limit Innovation, *Social Policy Journal of New Zealand; issue 29* (p5)

118. As the number and quality of VM Seed Proposals increased over time, so did the proportion of ring-fenced funding, from a starting point of at least 15%.

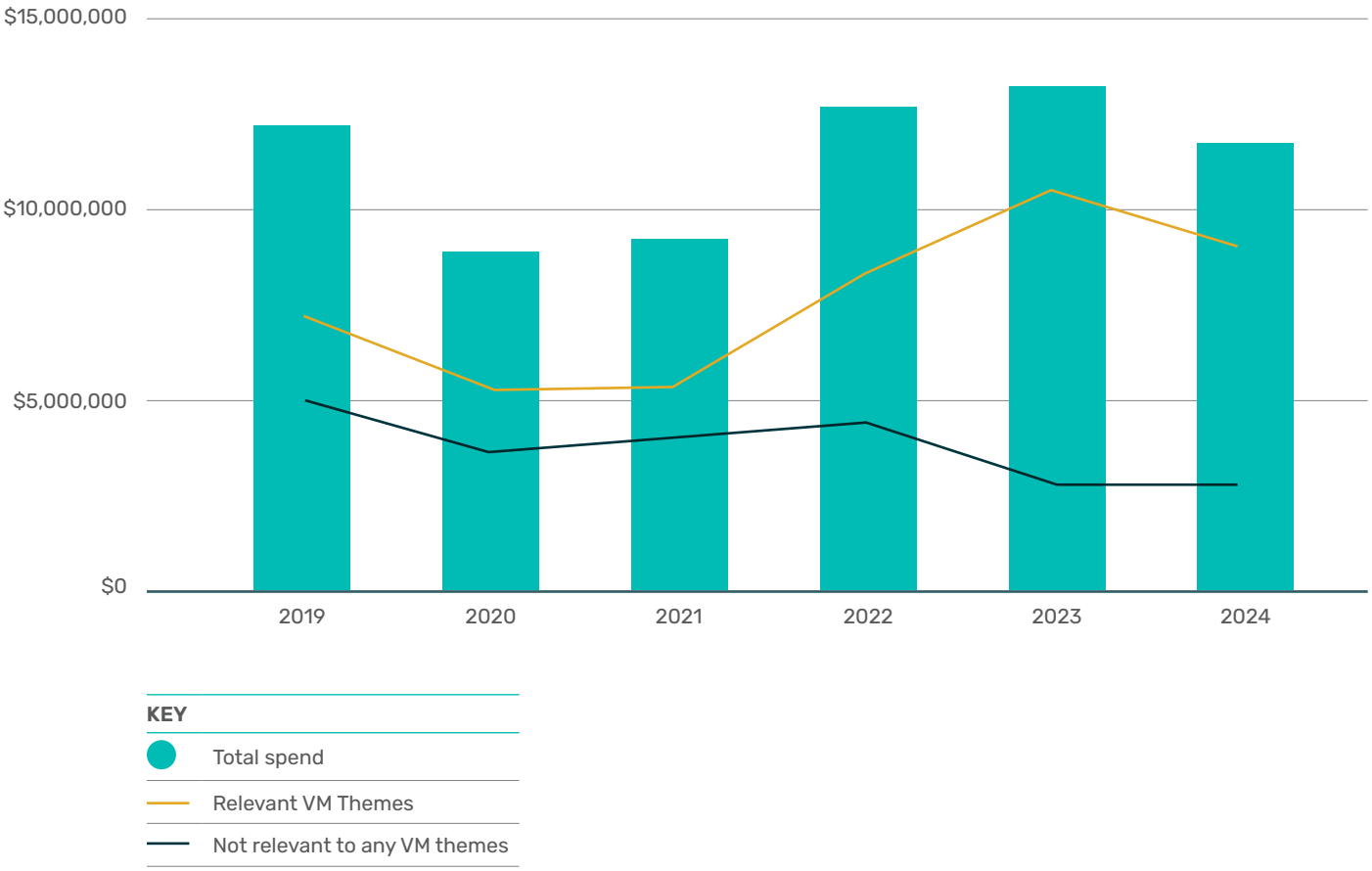
119. Kaupapa kākano Seed Project Fund 2021 Call for Proposals.

SfTI's Te Aromatawai Assessment for Seed Proposals

Criteria	Vision Mātauranga Assessment Criteria	Points
Pou Rua: Māori Participation		
1	**Māori participation is incorporated in the conception or development of the project**	**1**
2	**Indicates a decision-making function**	**1**
	Pou Tahi: Māori Knowledge	
3	The project incorporates Māori principles or practices	1
4	The project applies Māori knowledge of Māori history or resources	1
5	Tino Mātauranga – the project extends the understanding or application of Māori knowledge	1
	Pou Toru: Māori Benefit	
6	The project demonstrates a gain for Māori or Māori capability	1
7	The project addresses a topic of high impact or priority for Māori.	1
	Total Possible Score	**7**

SfTI grew its investment in research aligned with the Vision Mātauranga themes (Hauora/Oranga, Indigenous Innovation, Mātauranga and Taiao) over time, but with a small reduction for 2024 as some projects had already closed. Although less funding was released overall during 2020 and 2021 due to Covid-imposed constraints, once lockdowns came to an end, an even higher proportion of available funding was allocated to VM projects. Throughout Tranche 2, overall investment in VM-relevant research was twice that of research that did not meet the VM criteria: $45.2m v $22.1m.

SfTI Spending on VM-Relevant Research (2019-2024)



Further work aimed at countering the undervaluing (and underfunding) of mātauranga Māori included the formal and informal cultural upskilling the Kāhui has contributed to the Challenge, which has in effect pre-empted roadblocks that might have been created by non-Māori who did not understand the nature of mātauranga Māori and its legitimate place within the science and research mix.

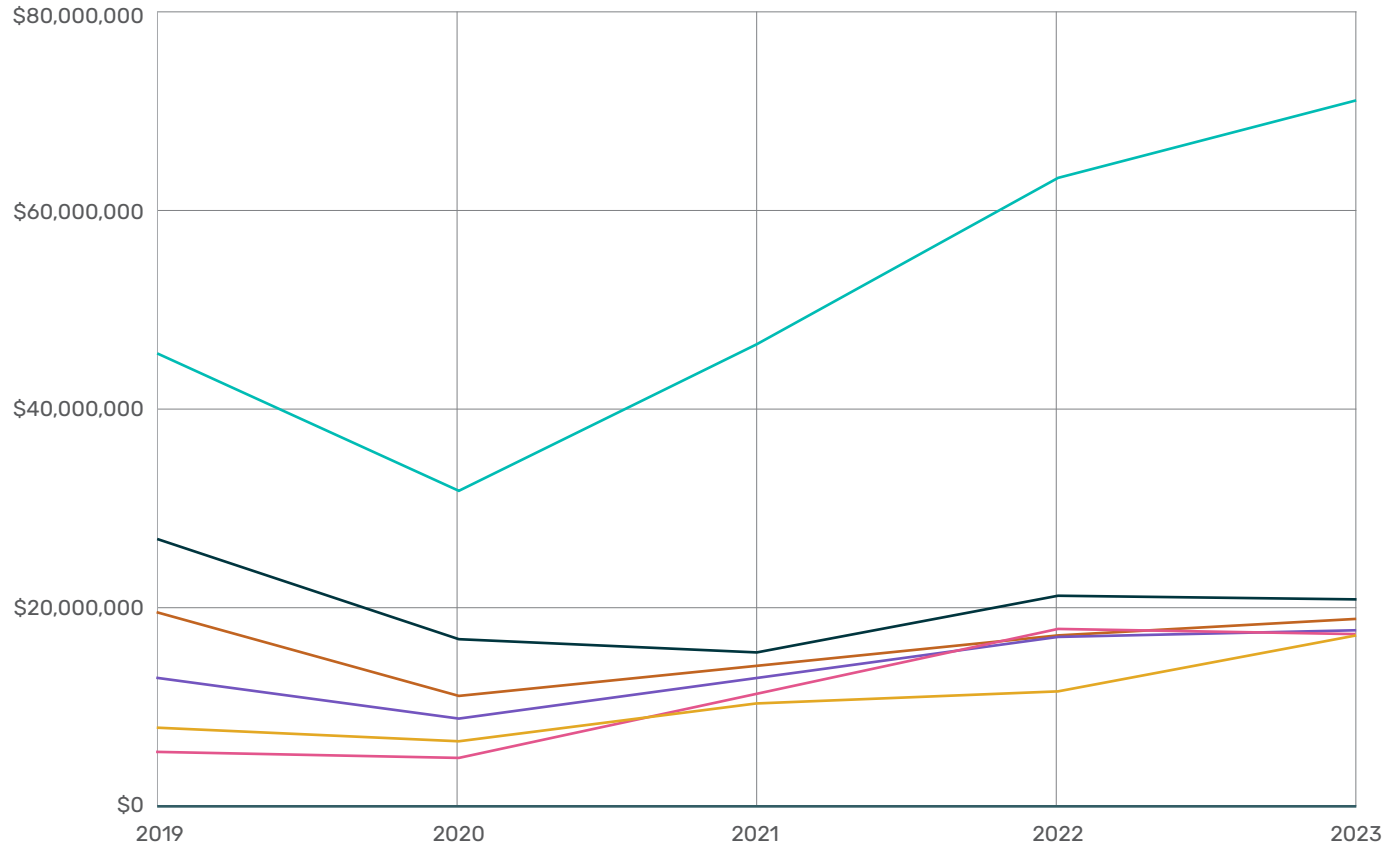
"*As advocates for and guardians of mātauranga* Māori the *Kāhui has challenged SfTI as an organisation to change the way that science is enacted, located and understood.*"[120]

Not only has this helped to create a sense of cultural safety, but also, specific actions such as formalising research assessment practices that recognise Māori knowledge, participation and benefit, give power to Māori aspirations in each of those areas.

Between 2019 and 2023, across the National Science Challenges there was a parallel increase in funding allocated to research that was either: specifically relevant to, involving, or centered on Māori, or constituted kaupapa Māori research.

120. Amoamo, M., & Ruckstuhl, K. (2021). Kāhui Māori; Distinctive Leadership in Science and Technology. In M. Amoamo, M. Kawharu, & K. Ruckstuhl (Eds.), *He Pou Hiringa; Grounding Science and Technology in Te Ao Māori* (pp35-54). BWB Texts. (p51)

NSC Allocation of Funding by 'Relevance to Māori' [121]



KEY
Kāupāpā Māori research
Māori centred research
Research involving Māori
Research specifically relevant to Māori
Total Māori research
Research not involving and not specifically relevant to Māori

121. Hazel, J-A., & Tunui, P-M. (2024). *Te Tiriti Partnerships Enhance Research, Science and Innovation; National Science Challenges share their experiences.* (p74)

Despite the progress made across the NSCs and in small pockets elsewhere, what is valued throughout the wider RSI system, and therefore funded, has remained tightly formed around colonial definitions of science excellence, resulting in "*a lack of historical investment in Māori research, knowledge and priorities.*"[122]

There is a low level of information about exactly how much RSI funding is allocated to research that is by, with, and for Māori. A study commissioned by MBIE in 2023 to fill this knowledge gap, *Exploring the use of government RSI funding for Māori,*[123] showed that "*only a small proportion of RSI funding projects had an explicit focus on producing benefit for Māori.*"[124] More specifically, 52% of funding went to proposals that were 'aligned to' Māori RSI or Vision Mātauranga, while just 2% went to projects self-identifying as at least 50% kaupapa Māori.

Unfortunately, data collection practices used in research funding rounds across the different funds have introduced a relatively large set of unknowns. In fact, the writers of the RSI Funding Review identified internal inconsistencies within research proposals that rendered the data perplexing. Further, the open-ended nature of many of the proposal template questions would require a high level of knowledge of Te Ao Māori and kaupapa Māori practices in order to interpret answers meaningfully and correctly; it is unknown whether proposal assessors have such expertise.

In effect, this means that not only is it difficult to construct an accurate picture of what is actually happening, but decisions around funding may also not be optimally informed either:

"*Decision makers are currently allocating funding using poor quality information about projects' intended outcomes for Māori RSI. Questions that are meant to identify research that will support Māori aspirations are poorly framed and inconsistently used across funds. In addition, definitions and guidance for applicants are unclear and difficult to interpret, meaning that applicants' answers may not be an accurate reflection of projects' potential benefits for Māori.*"[125]

A positive trend was observed within the stable of Marsden contracts where a growing number and proportion of funded projects had alignment with Vision Mātauranga themes, from 67 contracts (48%) in 2018, to 70 (56%) in 2019, and 78 (63%) in 2020. These 215 contracts secured 56% of the total $247.7m of available funds. So, while a significant proportion of funded projects have self-identified relevance to Vision Mātauranga, just 7.5% were considered to be Māori-led, defined as projects that have at least 20% of the key applicants identifying as Māori.

There has been an ongoing call for increased funding to be allocated for mātauranga Māori and Kaupapa Māori research. Funding increases were a key issue for Māori making submissions on Te Ara Paerangi: "*Participants universally asserted that current funding policy and processes stand in the way of Māori research excellence and recommended significant changes to RSI funding processes.*"[126]

Some call for funding to reflect population demographics, while others say the historical underfunding of Māori-led research requires significant effort and money to redress the cumulative shortfall. For example, in *Te Pūtahitanga: A Tiriti-led science-policy approach for Aotearoa New Zealand*, the authors agree that "*recovering from almost 200-years of discrimination will require significant resource and that a rebalancing is needed to compensate for the overfunding of Western science during that time.*"[127]

122. Kukutai, T., Parr-Brownlie, L., & Pitama, S. (2022). A bridge between: Te Ao Māori and Te Ara Paerangi. *New Zealand Science Review*, *78*(1-4), 12-20. (p15)

123. The study looked across 8 RSI funds over 2018, 2019 and 2020 investment rounds using self-reported quantitative data. The quantitative data was complemented by a series of qualitative interviews to construct a more detailed understanding of the situation, including researcher experiences.

124. MartinJenkins. (2023). *Exploring the use of government RSI funding for Māori*. https://www.mbie.govt.nz/assets/government-investment-in-Māori-research-science-and-innovation.pdf (p9)

125. MartinJenkins. (2023). *Exploring the use of government RSI funding for Māori*. https://www.mbie.govt.nz/assets/government-investment-in-Māori-research-science-and-innovation.pdf (p12)

126. Te Ara Paerangi Future Pathways: Wāhanga 2 He Whakarāpopototanga Mō Ngā Toronga Me NgāvTāpaetanga Māori | Part 2 Summary of Māori Engagements and Submissions. 2022. (p36)

127. Kukutai, T., McIntosh, T., Durie, M., Boulton, A., Foster, M., Hutchings, J., Mark-Shadbolt, M., Moewaka Barnes, H., Moko-Mead, TT., Paine, S-J., Pitama, S., & Ruru, J. (2021). *Te Pūtahitanga: a Tiriti-led science-policy approach for Aotearoa New Zealand*. Ngā Pae o te Māramatanga.

In their Te Ara Paerangi Submission, the Kāhui Māori similarly noted that historical preferential funding for science based on western approaches, with a corresponding dearth of support for Māori knowledge generation, is a significant inequity. Reducing this would "*require substantial targeted investment. Allocating half of the total research and science funding purse to support Mātauranga Māori and kaupapa Māori research is appropriate, and this approach has already been enacted by some NSCs. Further, funding for Māori knowledge generation should be under Māori control.*"[128] Māori should sit at the heart of decision-making and have the opportunity to participate in reimagining what counts and how funding is prioritised; this has been the case within SfTI as the Kāhui Māori have had substantial influence on funding allocation for Māori-focused projects.

"There has been a century and a half of disinvestment in Māori epistemologies and methods while, by comparison, non-Māori equivalents have been well resourced."[129]

5.4 ADEQUATE PROTECTION OF MĀORI KNOWLEDGE

"Despite the Crown's important role, Māori must lead the enablement and protection of mātauranga Māori primarily through tikanga Māori processes, but also through drawing on data sovereignty principles and setting the scene for IP protection."[130]

In Aotearoa New Zealand, Intellectual Property (IP) laws are based on western perspectives and are unlikely to be relevant for mātauranga Māori and other taonga. As Māori lawyer, Lynell Tuffery Huria (Ngāti Ruanui, Ngāruahinerangi, Ngaa Rauru Kiitahi) outlined succinctly at SfTI's second Māori Data Futures Hui in 2019:

"Laws protecting IP originally stemmed from the need to protect interests in commerce and trade. These laws were developed from a Western point of view, wherein: the government is viewed as the ultimate authority; property ownership is geared to individuals, not communities; rights are granted only for a finite period of time; and anything that has been shared in the public domain can subsequently be used by anyone, unless formally protected.

In contrast, mātauranga Māori is governed by a different set of rules. Authority over this knowledge comes from *whānau, hapū, iwi, tūpuna, tikanga and kawa. Certain members of the group will hold knowledge and pass it on when appropriate to do so. Importantly, even though Māori often share their knowledge freely, it does not mean they give up all rights to it. Māori remain kaitiaki of that knowledge. And in the Māori world, rights and responsibilities last forever."*[131]

128. Kāhui Māori for Science for Technological Innovation National Science Challenge. (2022) *Te Ara Paerangi Future Pathways: Green paper consultation submission*. (p7)
129. Helen Moewaka Barnes (2006). Transforming Science: How Our Structures Limit Innovation, Social Policy Journal of New Zealand; issue 29 (p6)
130. Kāhui Māori for Science for Technological Innovation. (2022). *Te Ara Paerangi Future Pathways: Green paper consultation; Submission for the Kāhui Māori for Science for Technological Innovation National Science Challenge*. (p6)
131. Science for Technological Innovation NSC, Data ILG, and Te Hiku Media. (2019). *Māori Data Futures – Intellectual Property, Te Aurere, Kaitaia, 20-21 March 2019*. Wellington, NZ: Science for Technological Innovation NSC. (p10)

The result of these contrasting philosophical foundations is that existing IP law *"is incapable of fully protecting mātauranga Māori because it was not designed to do so."*[132] A lack of mainstream recognition and protection of Māori knowledge and taonga is a longstanding one, despite a number of relevant events having taken place over the past 30 years attempting to rectify the situation:

1991	The WAI262 Claim was lodged with the Waitangi Tribunal. It focuses on how the Crown's policies and laws have impacted negatively on mātauranga Māori and taonga. The claim was amended in 1993, and additional claimants added in 2006.[133]
1993	The first *International Conference on the Cultural and Intellectual Property Rights of Indigenous Peoples* was held in Whakatāne, New Zealand.
1993	The *Mataatua Declaration on Cultural and Intellectual Property Rights of Indigenous Peoples* was initiated at the *International Conference on the Cultural and Intellectual Property Rights of Indigenous Peoples*, and once completed, was subsequently signed by representatives of Indigenous nations around the world. It was reinforced by the UN's commitment to strengthen the rights of Indigenous peoples, and "*includes an affirmation of Indigenous Peoples' right to self-determination, their exclusive ownership of their cultural and intellectual property, and that their knowledge is of benefit to all. It recognises that Indigenous Peoples are capable of managing their own knowledge, and clarifies that the sharing of such knowledge is conditional on the protection of their right to define and control that knowledge. It also insists that the first beneficiaries of Indigenous knowledge (cultural and intellectual property rights) must be the direct Indigenous descendants of that knowledge.*"[134]
2007	*United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP)* was passed. The resolution speaks to the rights of Indigenous peoples to retain ownership over a range of things, including cultural and ceremonial expression and intellectual property.
2011	*Ko Aotearoa Tēnei: A report into claims concerning New Zealand law and policy affecting Māori culture and identity* by the Waitangi Tribunal was released. While the report was somewhat controversial, one specific recommendation that has been followed is the establishment of a Māori Patents Advisory Committee that advises the Commissioner of Patents on mātauranga contributions, tikanga and kaitiaki relationships, in order to improve their decision-making on patent requests relevant to Māori traditional knowledge.[135]
2018	The *Ngā Taonga Tuku Iho Conference* was convened. Prompted by a lack of formal government action on either the WAI262 Claim or the Waitangi Tribunal's response, the hui addressed Māori cultural and intellectual property rights in terms of what safeguards Māori could put in place. A set of recommendations was produced and presented to the Crown the following year.
2019	*Te Pae Tawhiti* was released by the government as a long-awaited indication of how it would address key issues and recommendations already identified within WAI262 as well as subsequent work focussed on protection.
2020	A whole-of-government work programme was developed with the protection of mātauranga Māori being a key focus, based on Te Pae Tawhiti guidance. This work is ongoing.

132. Science for Technological Innovation NSC, Data ILG, and Te Hiku Media. (2019). *Māori Data Futures – Intellectual Property, Te Aurere, Kaitaia, 20-21 March 2019*. Wellington, NZ: Science for Technological Innovation NSC. (p12)

133. Potter, H., & Rauika Māngai. (2022). *A WAI 262 Best Practice Guide for Science Partnerships with Kaitiaki for Research Involving Taonga: Lessons from Māori voices in the New Zealand Science Sector*. Dunedin, NZ: Rauika Māngai.

134. Potter, H., & Rauika Māngai. (2022). *A WAI 262 Best Practice Guide for Science Partnerships with Kaitiaki for Research Involving Taonga: Lessons from Māori voices in the New Zealand Science Sector*. Dunedin, NZ: Rauika Māngai. (p19)

135. https://www.iponz.govt.nz/get-ip/Māori-ip/Māori-culture-and-intellectual-property/

Clearly, this is not an easy matter to settle, and submissions to Te Ara Paerangi indicate that how mātauranga is used and protected remains an important issue for Māori to this day. There was an expectation that within any future changes to the RSI system, Māori must have the power to "*decide the terms by which mātauranga crosses over from community spaces into the wider RSI sector, and that the bridge will have the right support in terms of policies, and data and digital infrastructure.*"[136]

Safeguarding Māori control over how mātauranga is used has been a basic requirement for creating trustful relationships in the science space. The National Science Challenges have all experienced difficulties in terms of formally creating such an environment. As they found, contracting and managing intellectual property has "*required creative thinking and flexibility to ensure collaboration with Māori partners could take place. These experiences also highlight very clearly some shortcomings in mainstream contracting practices.*"[137] Having said that, each Challenge has indeed enacted strategies to work around business-as-usual roadblocks in ways that have satisfied all parties.

This issue was raised early at SfTI's *Māori Business Leaders High Tech Summit* in 2016, where delegates explored how Māori could protect their own IP within research projects and guard against unintended negative consequences. Having listened carefully, SfTI knew it would need to treat the matter carefully.

Fledgling partnerships with Māori organisations also raised the issue, requiring SfTI to formalise an appropriate solution within its contracts. Working with two Māori lawyers, Lynell Tuffery Huria and Tai Ahu, the Programme Office drafted an ***IP Management Plan*** and accompanying ***Policies and Principles*** document to outline how mātauranga Māori and taonga would be protected. These pieces were reviewed and approved by Kāhui Māori members, and have become part of the Challenge's standard IP contract practice:

"*IP has been a confusing space for many of us. It has been challenging for us as researchers to articulate in legal terms how to protect mātauranga* Māori. *SfTI has made a positive contribution here.*"[138]

"*I was really pleased because of the recognition of taonga species, mātauranga Māori and where IP sits, it was great to have them push the boundaries as the first Challenge to come up with something. I think it set the scene in lots of different spaces. So, while it was done in the context of a SfTI project, it forced the university involved to think differently, and I think that for other projects, the expectation was high if those projects required it. It was an example - it wasn't in the too hard basket anymore.*"[139]

Vanessa Ngaroimata Clark believes that the IP Management Plan, which lists mātauranga Māori and taonga species throughout, is probably the most widely used and influential of any artefact SfTI has produced outside of individual research projects.

INTELLECTUAL PROPERTY POLICIES AND PRINCIPLES – SCIENCE FOR TECHNOLOGICAL INNOVATION NATIONAL SCIENCE CHALLENGE

In addition to changes to the Challenge's IP Contract, their specially constructed 'Policies and Principles' document outlines requirement for projects involving mātauranga Māori or Taonga Species. An excerpt from this guidance instructs project leaders to:

1. require employees, contractors, grant holders and any other personnel to acknowledge the relevant ownership and rights associated with mātauranga Māori Project IP;
2. unless agreed otherwise, keep the mātauranga Māori, Taonga Species and the mātauranga Māori Project IP out of the public domain;
3. consider whether protection options other than the statutory Intellectual Property options would better protect the mātauranga Māori Project IP;
4. consider what steps can be taken to stop misuse and misappropriation of mātauranga Māori, Taonga Species and the mātauranga Māori Project IP; and
5. work with Māori to enable Māori to exploit or commercialise any mātauranga Māori, Taonga Species or mātauranga Māori Project IP.

136. Kukutai, T., Parr-Brownlie, L., & Pitama, S. (2022). A bridge between: Te Ao Māori and Te Ara Paerangi. *New Zealand Science Review*, *78*(1-4), 12-20. (p16)
137. Hazel, J., & Tunui, P-M. (2024). *Te Tiriti o Waitangi Partnerships Enhance Research, Science and Innovation; National Science Challenges share their experiences.*
138. Pauline Harris
139. Vanessa Ngaroimata Clark

In effect, SfTI's IP directives require leaders of relevant projects to carefully consider 'mātauranga Māori, Taonga Species and the mātauranga Māori Project IP' in a number of ways. For example, all project members should acknowledge relevant ownership and rights related to this type of material, they should take the default position of keeping it out of the public domain, and also take steps to actively prevent its misuse and misappropriation. Further, there is an expectation that the research team will work with Māori to enable them to exploit or commercialise any mātauranga Māori, Taonga Species or mātauranga Māori Project IP.

Through the Kāhui Māori's guidance, an environment has been created where iwi can feel safe to bring their mātauranga into projects. In particular, Kāhui Māori members have ensured an organisation-wide understanding of not only the existence and value of Aotearoa New Zealand's two knowledge systems, but also of the requirement to negotiate how any new knowledge and applications generated through collaborative research should be managed. This has proved to be an important enabler for collaborations between SfTI's institution-based researchers and Māori businesses and communities.

While this new approach to IP management has been well-received by SfTI's Māori partners, there are aspects of knowledge protection that are yet to play out. For example, 'what should be the criteria that identifies it as *protectable*?', '*Who* are we protecting it for?' and 'How do we support mātauranga that crosses several different iwi/hapū?'. Further, while there may be a perception that all mātauranga should be protected as a taonga within the RSI system, this may not be a nuanced enough approach, rather, the more relevant question may be: what *types* of mātauranga Māori should be protected because they are of the most value to Māori? As Willy-John Martin explains:

"*To one extreme, some mātauranga is being protected by being held entirely by iwi, hapū and whānau, and kept confidential: not shared. To the other, some kinds of mātauranga are not being protected and in some cases not protectable where it is already in the public domain, widely in use, and general rather than mātauranga specific to a single hapū or iwi. In the middle, there is an ecosystem of mātauranga and various kinds of rich kōrero flowing between Māori experts and collectives to various people and platforms. How the mātauranga moves, is managed, used and stored needs greater deliberation, nuance and thoughtful execution. There are various methods of 'protection', and using the right protections for the right kinds of mātauranga, its sharing and transmission, its use and storage, is very important for both protection and use to be effective.*"[140]

Achieving protection of mātauranga Māori that is co-led and actioned by the Crown, legally binding and compatible with Te Ao Māori, remains a work in progress. It is an area ripe for alternative approaches to ensuring adequate protection is put in place for Māori knowledge (and other taonga) while at the same time allowing space for science and innovation. The National Science Challenges, and SfTI and the Kāhui Māori in particular, have brought practical leadership to the problem.

MĀORI DATA SOVEREIGNTY

Ahakoa he iti he pounamu. Although small, it is precious.

Highly related to the protection of mātauranga Māori is Māori Data Sovereignty, which refers to "*the inherent rights and interests that Māori have in relation to the collection, ownership, and application of Māori data*."[141] Māori data sovereignty empowers Māori by providing control over their own information, enabling community-driven decision-making, fostering culturally relevant research, and ensuring that data initiatives contribute positively to Māori well-being and development.

The concept of Mana Motuhake comes into play here. Mana refers to authority, power or prestige, and motuhake means independence or autonomy in English. Together, mana motuhake represents the idea of Māori self-determination and the desire for Māori communities to have control over their own affairs, land, and resources. It is an important concept in discussions about the rights and aspirations of Māori people, particularly in matters related to governance, cultural preservation, and land rights.

140. Willy-John Martin

141. Te Mana Raraunga Māori Data Sovereignty Network. (2018). *Principles of Māori Data Sovereignty Brief #1 October 2018*. https://static1.squarespace.com/static/58e9b10f9de4bb8d1fb5ebbc/t/5bda208b4ae237cd89ee16e9/1541021836126/TMR+Ma%CC%84ori+Data+Sovereignty+Principles+Oct+2018.pdf

Currently, much of the data from and about Māori is not accessible by, nor is it of benefit to, the Māori communities from which it came. Further, it is often framed in deficit terms to achieve government aims, and for the most part, this data has been held in data centres managed by multinational corporations governed by the laws of other countries.

This is not acceptable and does not reflect a state of mana motuhake, however, these practices are coming under closer scrutiny, and Māori have begun working towards solutions. For example, governments and research institutions are being called on to improve their practices and to even "*support Indigenous-controlled data repositories and, in some instances, repatriate Indigenous data back to Indigenous communities*."[142]

A positive recent move has been development of the Māori Data Governance Model, part of a larger partnership, Mana Ōrite Work Programme, between the Data Iwi Leaders Group (Data ILG) and Stats NZ. The project was prompted by the recognition that "*governance of the current official data system has not been designed in partnership with Iwi and Māori. Nor do we have a Te Ao Māori lens across the wider official data system that may support both Iwi Māori and government aspirations for data.*"[143] This has in effect eroded trust and participation by Māori in the national data system. In contrast, application of the Māori Data Governance Model is aimed at ensuring a collaborative approach to this country's data system that has input from, and is relevant for, Māori.

Within SfTI, the Kāhui Māori has taken an active role in promoting and supporting Māori Data Sovereignty efforts. Specifically, the Kāhui had a hand in organising the two Māori Data Sovereignty Hui held in 2018 and 2019 (in partnership with the Data ILG), and in exploring how learnings could sit within multiple projects:

"*We all had the same mind-set that it was an untested space, so let's put some things in place to do that. We naturally coalesced around Māori Data Sovereignty, and we all had perspectives that were complimentary, so we could help drive that kind of exploration of a project.*"[144]

The Kaihautū at that time, Te Taka Keegan, was an expert panellist at the first hui, and Mānuka Henare was in attendance. Te Taka talked about the value of technology partnerships for making the best use of Māori data. The Ātea project is particularly relevant here looking as it does at how Māori can connect: "*to each other, to our knowledge, and to our data.*"[145]

Events such as the Māori Data Sovereignty Hui allowed both Māori and non-Māori researchers to see and hear experts, researchers and the community explore this issue, and then consider how good principles could be incorporated into research.

142. Kukutai, T., Parr-Brownlie, L., & Pitama, S. (2022). A bridge between: Te Ao Māori and Te Ara Paerangi. *New Zealand Science Review*, *78*(1-4), 12-20. (p16)
143. https://data.govt.nz/toolkit/data-governance/Māori/
144. Vanessa Ngaroimata Clark.
145. Science for Technological Innovation NSC, Data ILG, and Victoria University of Wellington. (2018). *Māori Data Futures - Hui Report, 9 May 2018. Wellington, NZ: Science for Technological Innovation NSC*. (p9)

CASE STUDY

The Veracity Spearhead[146]

"How to ensure the technology is empowering for all

Current approaches seeking to verify and manage information on value chains have done this in a centralised way. This means that large corporate or government platforms have control and oversight over the data from each stage of a value chain. This approach can disadvantage smaller players. For example, both Small to Medium Enterprises (SMEs) and indigenous communities can lose control over their data.

SfTI's Vision Mātauranga Theme co-Leader explains that the contribution of Māori knowledge and resources to a product can be lost in the value chain:

"Often mātauranga Māori knowledge or resources fail to be recognised and then are appropriated by others for their own benefit. Working out how to technically prevent this will be a great advance for Māori collectives."

Tracking Indigenous intellectual and cultural property through value chains

One member of the Veracity research proposal writing team is dedicated to applying mātauranga Māori to decision-making in technology - Director of Te Kotahi Research Institute at Te Whare Wānanga o Waikato, The University of Waikato, Maui Hudson. Associate Professor Hudson currently works in the area of using 'digital tags' or Traditional Knowledge labels (TK) as a method to address indigenous intellectual and cultural property and knowledge-sharing issues.

Associate Professor Hudson says, "*Every Māori community has cultural and biological collections within national archives, libraries, and museums that they do not own, do not control, and cannot govern*."

"*A new system of 'digital tags' known as Traditional Knowledge (TK) and Biocultural (BC) Labels are being adopted by communities. The Labels support Indigenous governance and serve to promote and enhance equity in digital infrastructures*", he says.

A potential outcome of the Veracity Mission could be technology that tracks, traces and verifies TK labels. This would mean the veracity of claims made about the role of traditional knowledge in a product could be proven.

Impacts at home and globally

The Veracity Mission research team are looking for ways to employ technologies that can support a de-centralised approach to veracity challenges to level the playing field for all involved. Meaning all players will be able to contribute and contest information in a crowdsourced approach that builds a networked system of trusted information that benefits everyone.

The impacts of this research will create opportunities not only for our SMEs, farmers, Māori businesses and producers, but could potentially have applications for indigenous communities around the world.

146. Excerpt from SfTI Media article: https://www.sftichallenge.govt.nz/news/veracity-mission-update-aotearoa-new-zealands-opportunity-to-trade-in-trust/

Māori Participation is Vital for Generating Innovation in Technology for the Benefit of People

6. Māori Participation

"[The Kāhui Māori has] set an example about how Māori can be involved in science in a way that's culturally appropriate to Māori."[147]

147. Amoamo, M., & Ruckstuhl, K. (2021). Kāhui Māori; Distinctive Leadership in Science and Technology. In M. Amoamo, M. Kawharu, & K. Ruckstuhl (Eds.), *He Pou Hiringa; Grounding Science and Technology in Te Ao Māori* (pp35-54). BWB Texts. (p54)

The Vision Mātauranga policy aims to unlock the innovation potential of Māori knowledge, people and resources across the sector "*to come together to create knowledge that is positive both for Māori and the nation*";[148] this is only possible if Māori are actively participating.

Māori participation has been a central focus for the Kāhui Māori, and refers to Māori working as leaders and researchers within the formal science and research system, and also those based within Māori communities and businesses. It is particularly important in the area of physical sciences and engineering because of the striking and persistent underrepresentation of Māori at even more disparate levels than is observed within other science domains. For example, Māori are around half as likely to study STEM subjects compared with European and Asian students; this results in a very skinny pipeline of talent into the profession.[149]

The Māori Participation axis of SfTI's *Te Tihi o te Maunga Framework* addresses the extent to which Māori participate in a specific research project from beginning to end, including in leadership roles.[150] As a proposal assessment tool, *Te Aromatawai* draws attention to Māori participation during the conception and development of a piece of research, as well as during its execution, with assessors guided by a range of carefully crafted questions about how Māori are directly involved and enabled in the project:[151]

Are Māori part of the leadership or co-leadership of the project?

- Are Māori involved in the execution of the project?
- Did Māori participate in the design and development of the project? Are they the appropriate networks?
- Have sufficient resources (human, infrastructure, financial, time) been set aside for the Vision Mātauranga component of the work as a priority?
- Does the proposal manage risk (if any) to Te Ao Māori. This might include: knowledge asymmetry, consultation 'fatigue', resourcing for 'stakeholders'?

Assessing research projects in this way has been key to increasing participation of institutional and hapori Māori researchers, and is a distinct departure to what is happening elsewhere in the RSI system.

"Despite how inclusive or flexible the RSI system may intend to be (currently), the balance of power to determine and interpret priorities and scope still ultimately lies with the funder/institution. Most parts of the RSI system do not provide for Māori to determine the scope, priority areas or process and criteria of funding. Interrogating power at all levels of the system is a must."[152]

(COLLECTIVE MĀORI SUBMISSION TO TE ARA PAERANGI, 2022)

Two decades ago, at the 2003 Policy Research and Evaluation Conference, speakers noted that while there was the potential for Māori to have a meaningful role in building a knowledge society in this country (a topic of great interest in Aotearoa New Zealand at the time), the government had not apparently recognised this in any depth outside of the generative potential inherent in different ways of thinking.[153]

148. *Ibid.* (p39)
149. Ruckstuhl, K., Amoamo, M., Hart, N. H., Martin, W. J., Keegan, T. T., & Pollock, R. (2019). Research and development absorptive capacity: a Māori perspective. *Kōtuitui: New Zealand Journal of Social Sciences Online*, *14*(1), 177-197.
150. Ruckstuhl, K., & Martin, W. (2019). Mātauranga Māori and the high-tech interface. *New Zealand Science Review*, *75*(4), 87-91. (p89)
151. Science for Technological Innovation: Kaupapa kākano Seed Project Fund 2021 Call for Proposals
152. Te Ara Paerangi Future Pathways: Wāhanga 2 He Whakarāpopototanga Mō Ngā Toronga Me Ngāvtāpaetanga Māori | Part 2 Summary of Māori Engagements and Submissions. 2022. (Collective Māori Submission, p20)
153. Helen Moewaka Barnes (2006). Transforming Science: How Our Structures Limit Innovation, Social Policy Journal of New Zealand; issue 29

Fast forward to the present day, and Te Ara Paerangi submissions suggest not enough has changed in the interim. There is still a call for true partnership within the RSI system that honours Te Tiriti, particularly in terms of co-leadership, co-governance, equal representation and equal benefit.[154] Research institutions were highlighted as having the potential to become trailblazers as Tiriti-led and enabled research organisations. Another strategy could be forming an Independent Commission Mātauranga Māori as outlined within Te Pūtahitanga,[155] "*which states that a meaningful commitment to Te Tiriti would explore ideas in support of a tino rangatiratanga model of governance through the transfer of power, resource, and creative freedom to Māori.*" [156]

It is clear that the aim of full Māori participation remains largely aspirational, however, as this section outlines, SfTI, with the leadership of the Kāhui Māori, has taken steps towards increasing participation, while also supporting Māori to be authentically Māori in their research.

Here we provide insight into the qualitative experiences of Māori in the sector and the corrective power of collectivising, and include quantitative evidence of ongoing underrepresentation of Māori. Finally, ideas for increasing participation are offered, together with SfTI's use of such strategies as advised by the Kāhui Māori.

6.1 QUALITATIVE EXPERIENCES OF THE RSI SYSTEM FOR MĀORI RESEARCHERS

There is a distinctly different experience for Māori working within a system that is so strongly aligned to western philosophies even beyond the bounds of scientific traditions. The blatant mismatch of world views evident within research institutions privilege a particular way of thinking which is very foreign to the Māori scientists and researchers working inside them.

Individual Māori Experiences

Poor experiences begin during student years when few other Māori are present in the country's university science departments as either teachers or learners. Kāhui Māori member Pauline Harris recalls the isolation of that time for her:

"Some Māori I knew didn't really say they were Māori so they weren't singled out. Some of us were the only Māori in the class. And there were no Māori lecturers at all. No Māori engineers lecturing, and definitely no Māori physicists. And there was nothing about mātauranga Māori at all in what we were taught."[157]

Later, once she reached doctoral level, Pauline was able to connect with Ngā Pae o te Māramatanga for mentoring within a more relatable environment. She and others who have been through similar experiences can see that things are changing at universities, however, there is still a way to go before they become comfortable spaces.

> In considering Māori engagement in science and research, there has been an extractive quality to the discourse. In one sense traditional Māori knowledge could not be funded "*because it was too iwi-specific, confidential, or not research producing economic benefits*, [and second,] *discourse suggests that there is a lack of validation for Māori as scientists in their own right and that the value lies in harvesting Māori knowledge for 'mainstream' science.*"[158]

154. Te Ara Paerangi Future Pathways: Wāhanga 2 He Whakarāpopototanga Mō Ngā Toronga Me NgāvTāpaetanga Māori | Part 2 Summary of Māori Engagements and Submissions. 2022.
155. Report recommendation: Establish a Mātauranga Māori Commission/Entity. The Commission would sit outside of the public service, with autonomous governance and baseline funding. It would provide leadership over Mātauranga Māori including Māori knowledge priorities that extend beyond the RSI sector. Kukutai, T., McIntosh, T., Durie, M., Boulton, A., Foster, M., Hutchings, J., Mark-Shadbolt, M., Moewaka Barnes, H., Moko-Mead, TT., Paine, S-J., Pitama, S., & Ruru, J. (2021). *Te Pūtahitanga: a Tiriti-led science-policy approach for Aotearoa New Zealand*. Ngā Pae o te Māramatanga.
156. Te Ara Paerangi Future Pathways: Wāhanga 2 He Whakarāpopototanga Mō Ngā Toronga Me NgāvTāpaetanga Māori | Part 2 Summary of Māori Engagements and Submissions. 2022. (p26)
157. Pauline Harris.
158. Helen Moewaka Barnes (2006). *Transforming Science: How Our Structures Limit Innovation, Social Policy Journal of New Zealand; issue 29*. (p12)

A significant element of the problematic workplace environment is the additional work expected of Māori scholars – the *cultural double-shift* – well recognised by those who have experienced it, but explicitly named through SfTI research as *Aronga Takirua*. This dual workload, which Māori scientists and researchers undertake at the interface between mātauranga Māori and western science, comes from the expectation that they will take on multiple technical and cultural roles, while also managing their own cultural obligations as Māori.[159] Such additional responsibilities are likely to be unrecognised and un-resourced, and can add a significant amount of stress to the experience of Māori researchers.

Aronga Takirua presents itself differently across the career pathway, with early career researchers often being expected to fulfil important connector roles between research teams and Māori communities, which can potentially be beyond their existing abilities. Senior Māori researchers may hold too many roles, meaning they have insufficient dedicated time to contribute meaningfully to any one project. Māori leaders may find themselves leading very complex transdisciplinary projects. But common across all these examples is that Māori are essentially required to take on tasks not expected of non-Māori in order to fulfil the function of "*knowledge and cultural interpreters for both Māori communities and science institutions*."[160]

The Kāhui Māori has been able to take this 'double duty' away from SfTI's Māori researchers, largely through their work lifting the cultural capability of the whole organisation. For Māori researchers, "*It was the relief that there was someone doing all of that, so then they didn't necessarily have to do it on top of their role as researchers. Someone else was giving the resources in terms of that proper process.*"[161]

There are many other examples of what the RSI system can be like for Māori:

At the intersection of racism and sexism, Māori women have the experience of "*consistently having to prove their right to be in the room*" [162]

- This reality has been countered within SfTI's structure: Despite being firmly positioned in the male-dominated physical sciences and engineering space, there are many women working across the Kāhui Māori and the whole SfTI organisation. Both Māori and non-Māori women have occupied respected senior positions such as Director, Theme Leader, Kāhui Kaihautū and Board co-Chair.
- Isolation, already noted as an issue for students, can also be experienced by researchers who decide on a science career. This in turn can lead to a lack of confidence in one's self and the value brought to science and research. Having had this experience herself, Nancy Garrity hoped the Kāhui Māori would contribute to changing the system for the next wave of Māori researchers so they would not experience what she had in the past:

"*When I got to my work door, I took off my Māori hat and put on my science hat, and then went and did my role as a scientist. So there wasn't necessarily the opportunity or the safety to bring myself into the sector as a Māori. But here [within SfTI and the Kāhui] was an opportunity to actually create pathways for our young scientists that they could bring the best, or all, of themselves into their role without fear of cultural misappropriation or ridicule*."[163]

  - In contrast, and through the guidance of the Kāhui Māori, SfTI has been instrumental in increasing the confidence of Māori researchers to be their authentic selves at work: "*I do think in very general but real ways, SfTI has brought the researchers together and [created] formal sharing spaces - you couldn't write that in a program. So, bringing them together and giving them the space to be able to make those connections and sharing, that's probably part of SfTI's secret sauce*."[164] This newfound confidence has helped with researchers' career pathways, including early career researchers, and it has incidentally also been of benefit to non-Māori researchers.

159. Haar, J., & Martin, W. J. (2022). He aronga takirua: Cultural double-shift of Māori scientists. *Human Relations, 75*(6), 1001-1027.
160. Martin, W. (2021). Building Māori Capacity; Accelerating Access to Physical Sciences and Engineering Research. In M. Amoamo, M. Kawharu & K. Ruckstuhl (Eds.), *He Pou Hiringa; Grounding Science and Technology in Te Ao Māori* (pp100-118). BWB Texts. (p118)e
161. Nancy Garrity
162. Te Ara Paerangi Future Pathways: Wāhanga 2 He Whakarāpopototanga Mō Ngā Toronga Me Ngāvītāpaetanga Māori | Part 2 Summary of Māori Engagements and Submissions. 2022. (p46)
163. Nancy Garrity
164. Vanessa Ngaroimata Clark

- Interviews carried out during a recent exploration of RSI funding[165] revealed that Māori researchers were challenged by the process of trying to frame research proposals in ways that accurately reflected relationships within Te Ao Māori and kaupapa Māori approaches, while at the same time meeting funder requirements to prioritise western concepts of research excellence.
  - In order to improve the funding process, the Kāhui Māori developed Te Tihi o te Maunga and Te Aromatawai to ensure that consideration of Māori knowledge, participation and benefit, guided Seed proposal writing and assessment. In fact, by Tranche 2, 25% of Seed funding was ring-fenced for VM-led research. The rōpū also worked to incorporate the same considerations into the development of the larger Spearhead research projects.

The employment precarity, lower system-wide pay rates and a slower route to promotion experienced by Māori researchers, are evidence of the lack of value placed on Māori skills and expertise. Another contributor is the role of publication in pay and promotion, which is not always prioritised by Māori researchers focused on effecting real world benefits from their work.

The question has been asked as to whether SfTI has assisted Māori researchers to reach their full potential in terms of publishing, particularly given its importance for future career opportunities. The answer is that more could potentially have been achieved here: "*We just didn't think that way, but we know that these internal struggles for upward mobility for our researchers is alive and well. Where are those real things that will turn the dial at a career level?*" [166]

While all of these issues are experienced by individual Māori scientists, they are so common that they constitute systemic failures of the RSI system. The Kāhui Māori has shown that by coming together and instituting widespread changes, for example in assessment practices, a more positive space can be founded.

For Kāhui Kaihautū, Nancy Garrity, her professional experience has improved immeasurably since being on the Kāhui as she carries the authority and wisdom of the rōpū with her and is able to more confidently advocate for her ideas:

"*Pre-Kāhui it was me going in and saying, 'This is the work that we need and this is the way that Māori would like to see that.' And then the pushback would be, 'Why would Māori need that?' And then because I didn't have the confidence or the support of anyone else - the organisation pool was small so you were a team of one - I didn't necessarily have the confidence or authority to push back on that. But I knew that it was right… but actually the experts are saying this is the right direction, and so you had the confidence to pull that messaging out into your own role.*"[167]

The undeniable benefit of having a space where Māori can come together to influence the science system, even in small pockets such as SfTI, can also be seen in the wider ecosystem through Nga Pae o Māramatanga and the Rauika Māngai, for example - these are explored below.

Māori Leadership and Collectivisation

One might describe the RSI system as being made up of individual researchers and scientists who come loosely together within individual research and teaching institutions, however, this type of arrangement is not optimal for Māori working in the sector. In this section, two instances of collectivising show the benefits that can be realised by taking a different approach.

Nga Pae o te Maramatanga

Ngā Pae o te Māramatanga (NPM) was founded in 2002 as one of the original Centres of Research Excellence (CoREs).[168] "*Twenty years on, it's a home for Indigenous Knowledge and research to create flourishing futures for Māori communities and Aotearoa*."[169] The name inspires excellence and references the whakataukī:[170]

165. MartinJenkins. (2023). *Exploring the use of government RSI funding for Māori*. https://www.mbie.govt.nz/assets/government-investment-in-Māori-research-science-and-innovation.pdf
166. Vanessa Ngaroimata Clark
167. Nancy Garrity
168. Centres of Research Excellence (CoREs) are inter-organisational research networks, with researchers working together on commonly agreed work programmes. CoREs make a contribution to New Zealand's development and link to user groups. They also build research capacity and capabilities through post-graduate programmes and the training of new researchers. Funding from the CoREs Fund is determined through a fully contestable process. Source: https://www.tec.govt.nz/funding/funding-and-performance/funding/fund-finder/centres-of-research-excellence/
169. Muru-Lanning, C. (2021, 4 December). Ko Ngā Pae o te Māramatanga tēnei: The beating heart of mātauranga Māori. *The Spinoff*. https://thespinoff.co.nz/atea/04-12-2021/ko-nga-pae-o-te-maramatanga-tenei-the-beating-heart-of-mātauranga-Māori
170. https://www.maramatanga.ac.nz/index.php/about

Whāia ngā pae o te māramatanga
Ko te pae tawhiti, whāia kia tata
Ko te pae tata, whakamaua kia tina
E puta ai ki te whaiao, ki te ao mārama!

Pursue the many horizons of insight,
Bring each one closer,
Master them and emerge enlightened!

While NPM has been a driving force in Māori scholarship through to the current time, the environment from which it was born was a different place to what it is now: "*Māori scholars were largely isolated within the world of academia. Isolated within disciplines. Isolated within research projects. Isolated within institutions.*"[171] It would be an overstatement to say this is no longer an issue, but as discussed elsewhere, things are gradually improving, with organisations such as NPM undoubtedly contributing to this evolution. As one interviewee noted, the research system has never been as mature as it is now for important conversations about the relationship between Māori and the RSI system:

"*Fifteen years ago, the Vision Mātauranga policy was developed by the government, rather than a Treaty policy, because politically the science system was not ready to address or consider the Treaty or te Tiriti directly.*"[172]

The founders wanted to build a community of Māori scholars who could apply Indigenous approaches in their research, and who could also incorporate relevant concepts of research and excellence in ways that might realise benefits from research at the interface between mātauranga Māori and western science. This was something not already funded within the RSI system, but it had the potential to add another layer to Māori-led knowledge creation:

"*In the absence of the infrastructure that long-established disciplines such as physics, history or botany enjoy, Māori research and researchers have had to create the lexicon and literature for base theories and methods.*"[173]

The original founders were given no encouragement or support by their university, and as with the NSCs, the CoREs were not created for the benefit of Māori, or even to explicitly enable the extension of mātauranga Māori. So, how did the Centre come to be? It was due to the vision and hard work of a small group of people who saw an opportunity within the system, and were followed by others of a similar calibre who have contributed along the way. The list includes (but is not limited to) Michael Walker, Linda Smith, Tracey McIntosh, Jacinta Ruru, Leonie Pihama, Graeme Smith, Tahu Kukutai, Linda Waimarie Nikora and Charles Royal.

Once funded, NPM was hosted at the University of Auckland, and incorporated the MAI Doctoral Mentoring Programme (MAI) as part of its efforts to reduce participation and success disparities. The Centre has been instrumental in increasing Māori tertiary scholarship: by the end of 2006, NPM already had a database of over 500 Māori PhD candidates and graduates,[174] a significant increase on previous numbers, and has continued to grow this base ever since.

There have been several CoRE funding rounds since 2002, each a precarious time for NPM. As has already been touched on in this document, funding decision-makers with expert knowledge of science domains but minimal understanding of Māori knowledge and processes, may not appreciate the value provided by a Māori-led research organisation such as NPM. In fact, the CoRE was at serious risk of not being funded from 2015, but a great deal of lobbying saw the interim decision overturned.

171. Muru-Lanning, C. (2021, 4 December). Ko Ngā Pae o te Māramatanga tēnei: The beating heart of mātauranga Māori. *The Spinoff*. https://thespinoff.co.nz/atea/04-12-2021/ko-nga-pae-o-te-maramatanga-tenei-the-beating-heart-of-mātauranga-Māori

172. Willy-John Martin

173. Ruru, J., Nikora, L. W., McIntosh, T., Patrick, D., & Kukutai, T. (2019). Whāia ngā pae o te māramatanga: our horizons of pursuit. (p77) https://researchcommons.waikato.ac.nz/server/api/core/bitstreams/5751d0fe-c333-4fc6-8263-4f3dd415a7ee/content

174. News: Producing 500 new Māori PhDs in five years. https://www.maramatanga.ac.nz/news-events/news/producing-500-new-m%C4%81ori-phds-five-years

While the full extent of NPM's achievements is hard to know, as it is for the National Science Challenges and the Kāhui Māori, it can most definitely take credit for several things. It has been a place for Māori researchers to come together to support and collaborate with one another; it has increased the number of successful Māori PhD graduates; it has continued to lobby the Crown on a number of topics; and it has contributed to international Indigenous scholarship and political action. Overall, "*Ngā Pae o te Māramatanga has made vital space for the emergence of Māori knowledge, and its validity and legitimacy within the world of academia*."[175]

The Rauika Māngai

The second example of collectivism is the Rauika Māngai (RM), an assembly of representatives from the 11 NSCs and Ngā Pae o te Māramatanga which, through bringing together a group of talented, committed people, has worked to uplift the "*wellbeing of whanau, hapū, iwi and diverse Māori communities in ways that uphold tikanga and wairuatanga and extends the mātauranga continuum.*"[176]

This initiative was largely driven by researcher Jessica Hutchings (Ngāi Tahu, Ngāti Huirapa, Gujarati) because: "*there was a lack of cohesion and coherence of Māori capability across the National Science Challenges. Many Māori researchers were experiencing things such as isolation and a splintering of capacity through being asked to be on manifold projects at once and '0.1 FTE'd to death'.*"[177] The Challenges presented a unique opportunity for Māori to collectivise, coordinate, and support one another in the science realm.

The Challenges sponsored the RM's establishment, with Willy-John Martin being particularly involved in the early days. As part of their aim of influencing science policy, the rōpū has been integrally involved in organising impactful events and publications including:

- the *Vision Mātauranga Leadership Hui* and subsequent report entitled *A Guide to Vision Mātauranga; Lessons from Māori Voices in the New Zealand Science Sector*;
- advice to government, supported by Dame Juliet Gerrard, the Prime Minister's Chief Science Advisor, entitled *Te Pūtahitanga; A Tiriti-led Science-Policy Approach for Aotearoa New Zealand*;
- the much needed guide, *A WAI 262 Best Practice Guide for Science Partnerships with Kaitiaki for Research Involving Taonga* and accompanying series of webinars; and
- Ko Te Ara, Kia Tika: A Guiding Document for the Consideration of Mātauranga in Contracts.

As the Challenges were coming to a close, the RM organised a national hui, *Te Kura Roa 2024,* to explore plans for the future of mātauranga Māori and science based on learnings from the Challenges over the past decade. A report will be forthcoming.

Each of these clusters has used the power of collectivising to create positive impacts and have supported each other, directly and indirectly, along the way. Actively collaborating to enlarge each other's influence has been an effective strategy:

"*There was an interplay of mana dynamics exerting a growth through collective effects: visibility, reputation, standing, status, understanding, progress. The Kāhui was one of many positive kaupapa happening at the same time, sharing the same key influencers and leaders, and creating a momentum. Sometimes the efforts of the Kāhui's influence merges with the others, for instance, with the Rauika Māngai. It's sometimes hard to see the contribution of the Kāhui as entirely separate rather than a contribution to an overall movement. It certainly played its part as an initiator and amplifier.*" [178]

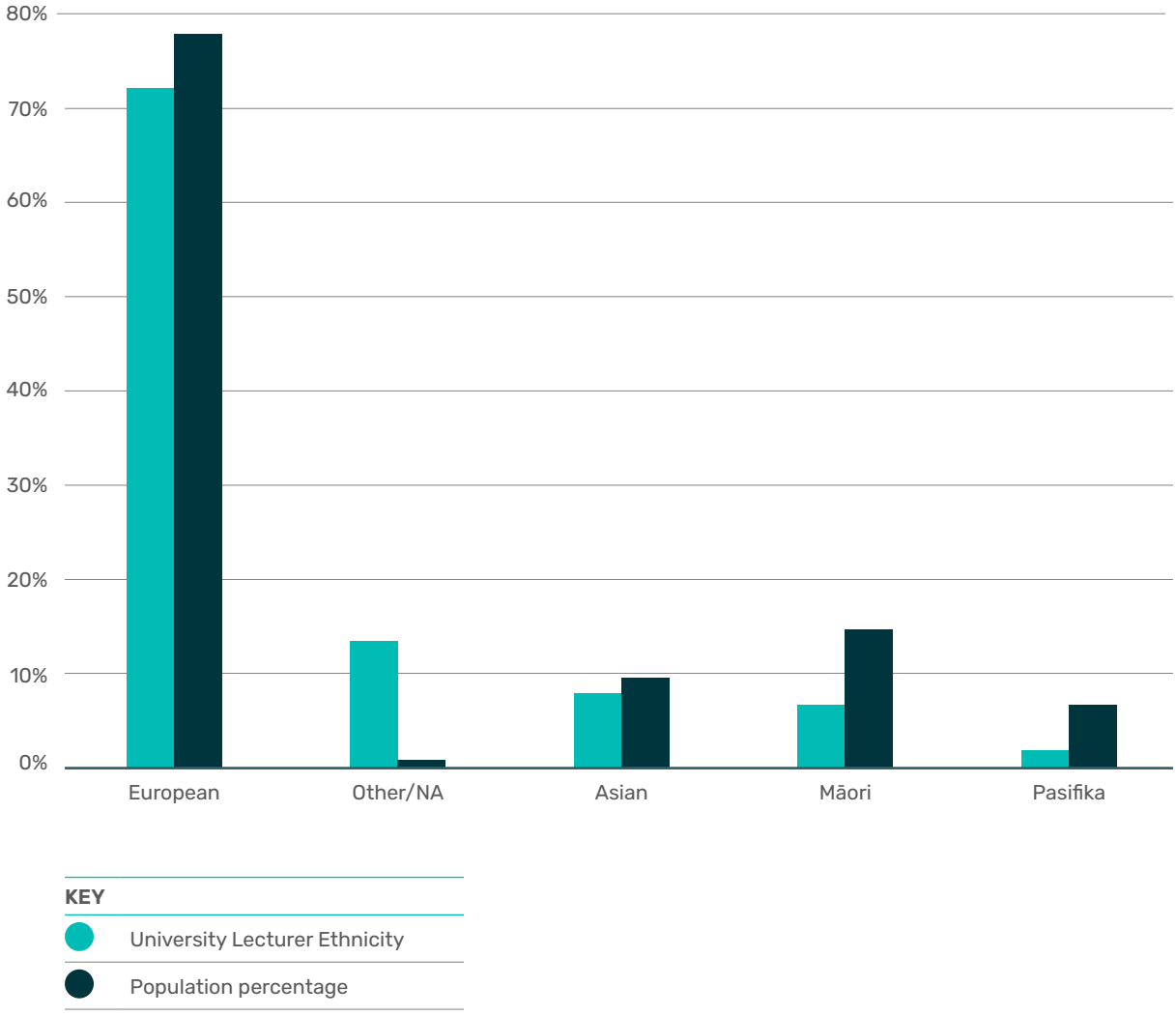
175. Muru-Lanning, C. (2021, 4 December). Ko Ngā Pae o te Māramatanga tēnei: The beating heart of mātauranga Māori. *The Spinoff*. https://thespinoff.co.nz/atea/04-12-2021/ko-nga-pae-o-te-maramatanga-tenei-the-beating-heart-of-mātauranga-Māori
176. http://www.rauikamangai.co.nz/
177. Willy-John Martin
178. Willy-John Martin

6.2. QUANTITATIVE DATA ON MĀORI PARTICIPATION IN THE RSI SYSTEM

Resourcing of Māori in the RSI workforce is held as an area in need of urgent attention, and has been for some time due to the stubbornly static underrepresentation of Māori within universities and other research institutions across the country. The proportion of Māori in the tertiary teaching profession, for example, has remained static since the 1980s[179] and into the current time.

A 2010 BERL study of Aotearoa New Zealand's academic workforce revealed similar participation levels to those identified by other research. Using figures from 2006, this research showed that the largest proportion of University Lecturers identified as European, accounting for 71.2% of the cohort, while 7.9% identified as Asian. Just 6.8% identified as Māori (at that time, Māori made up 14.6% of the population),[180] and 1.8% as Pasifika.[181]Also identified was a relatively large proportion of people choosing not to reveal their ethnicity, making it difficult to know the full extent of disparities.

Ethnicity of University Lecturers in 2006 c.f. Population



179. [BERL] Business and Economic Research Limited. 2010. Report to: Universities NZ Human Resources Committee Steering Group. Academic workforce planning - towards 2020. Berl, Wellington. https://www.universitiesnz.ac.nz/files/Academic_Workforce_Planning_Towards_2020_FINAL.pdf.

180. 2006 Census

181. [BERL] Business and Economic Research Limited. 2010. Report to: Universities NZ Human Resources Committee Steering Group. Academic workforce planning - towards 2020. Berl, Wellington. (p75) https://www.universitiesnz.ac.nz/files/Academic_Workforce_Planning_Towards_2020_FINAL.pdf.

The *Research, Science and Innovation Workforce Survey,* carried for by MBIE in 2022, also showed that Māori are still significantly underrepresented across the sector compared with their numbers in the general population, which now sits at 17.8% according to the 2023 Census. In total, Māori account for 11% of the workforce at Tertiary Education Institutions, although this falls to 6% when considering only universities. Seven per cent of senior leadership and management roles are held by Māori across RSI organisation types, while just 3% of those in research roles are Māori,[182] which is lower than indications from other research.

While these figures are not positive, we cannot be certain of having clear oversight of what is really happening with regard to Māori participation because of poor collection and analysis of ethnicity-related data, as already mentioned.

For example, within research funding proposals, ethnicity data for researchers is limited at the senior level, and even poorer for those occupying other positions. This is due to a variety of reasons including: ethnicity not being uniformly collected across funds, details for a limited number of roles being recorded, and some researchers choosing not to provide their ethnicity information.[183]

So, while a recent study looking at the application of government RSI funding showed that Māori account for 9% of key researchers in the Vision Mātauranga Capability Fund (VMCF), Endeavour and Catalyst funded projects across 2019-2020, it is also noted that 33% of researchers listed in proposals had no ethnicity information recorded.[184] This was more noticeable for VMCF, with 41% of researchers not providing ethnicity information in 2019, and 37% in 2020. And so while there appears to be a higher proportion of Māori researchers being funded via this mechanism - 20% (2019) and 25% (2020) compared with around 9% across the funds,[185] the missing data may tell an alternative story.

Despite the exact nature of the problem being somewhat fuzzy, low participation rates are a source of ongoing frustration for Māori scholars, and as has been stated by one Māori academic:

"It is well past time that our country seriously commits to decolonising the tertiary workforce, curriculum and research agenda."[186]

To counter lower participation rates, a number of National Science Challenges increased their investment in Māori-led research over time. One strategy to achieve this has been to consciously increase the number of Māori researchers participating in and leading research projects, achieved in part through increasing FTE hours available to ensure Māori team members have meaningful availability of time:

"A really important aspect of the Challenge was the opportunity for Māori researchers to lead projects. Before the Challenges, the only time Māori could do this was through Nga Pae [o te Māramatanga] - elsewhere they were highly fractionated. [We] made a firm commitment to enabling Māori researchers to spend chunks of time on projects. Having Māori researchers, leaders and communities at the table enabled research that was important to Māori to be undertaken, an important contributor to achieving the Mission."[187]

182. MBIE. (2022). *Tā te Rangahau, Pūtaiao me te Auahatanga Pūrongo Ohu Mai o ngā Whakahaere | Research, Science and Innovation Workforce Survey of Organisations Report, December 2022.* https://www.mbie.govt.nz/assets/Uploads/Research-Science-and-Innovation-Workforce-Survey-of-Organisations-Report-December-2022-v3.pdf (p17)
183. MartinJenkins. (2023). *Exploring the use of government RSI funding for Māori.* https://www.mbie.govt.nz/assets/government-investment-in-Māori-research-science-and-innovation.pdf
184. MartinJenkins. (2023). *Exploring the use of government RSI funding for Māori.* https://www.mbie.govt.nz/assets/government-investment-in-Māori-research-science-and-innovation.pdf
185. MartinJenkins. (2023). *Exploring the use of government RSI funding for Māori.* https://www.mbie.govt.nz/assets/government-investment-in-Māori-research-science-and-innovation.pdf
186. Ruru, J. (2021). Our Baskets of Knowledge. In J. Ruru, & L. Nikora (Eds.), *Ngā Kete Mātauranga. Māori scholars at the research interface.* Otago University Press. (p12-20) (p16)
187. Science for Technological Innovation National Science Challenge. (2023). *National Science Challenge (NSC) Directors Discuss: The Mission-led Approach to Science and Research*. Wellington: NZ.

6.3. STRATEGIES FOR ENLARGING MĀORI PARTICIPATION

"Our gaze must not only be directed toward Māori, but to the environments and structures that shape engagement."[188]

In addition to collectivising and increasing dedicated funding for Māori-led research, other strategies are available to boost Māori participation in research, science, technology and innovation.

Some research organisations are endeavouring to enlarge Māori participation. Respondent organisations in the MBIE's 2022 RSI Workforce Survey reported a number of strategies such as summer programmes for Māori students, recruitment of Māori graduates, and increasing the cultural capability of non-Māori staff. In the same survey, respondents also reported supporting the VM policy by: supporting engagement, collaborations and partnership with Māori in research; providing workshops and training on both VM and mātauranga Māori; establishing Māori-specific roles focussed on developing Māori capability; and instituting policies and practices that help give effect to VM.[189] And yet, participation disparities persist.

One specific practice that has been promoted across a range of literature is the more purposeful **funding of relationship-building and collaboration** in research, including funding for Māori who are not based within research institutions. Such an approach applied across the sector would facilitate Aotearoa New Zealand's two knowledge systems to function in tandem to create benefit for Māori and for the nation as a whole.

Formally enabling hapori Māori to participate in research, for example, through targeted funding or contracting arrangement, is an important aspect of collaborative research. Positive change cannot be realised within the constraints of existing colonial foundations, rather, building Māori talent within the system should be "*collective in orientation.*"[190] Of course, in order for collaborative research to be a genuine undertaking on the part of (non-Māori) scientists, hapori Māori must be involved as early as possible to facilitate meaningful input into defining desired impact, project planning and including Māori knowledge.

Guided by the Kāhui Māori, SfTI has formalised a number of partnerships with Māori organisations including Te Hiku Media (who partnered in hosting the second Māori Data Futures Hui), FOMA, and the Data Iwi Leaders Group (who also partnered in the Māori Data Futures Hui and have gone on to establish one of SfTI's Ending with Impact Projects, *Te Pā Tūwatawata*, an Indigenous Māori data sovereignty repository). Ātea is a Spearhead project that has been carried out in partnership with Te Rūnaka o Awarua based at Te Rau Aroha Marae in Bluff. This is the marae of research leader, Hēmi Whaanga, but rather than this being considered a 'conflict of interest', it was welcomed as a 'relationship of interest'.

"*Having Māori researchers in the community who get the opportunity to engage and have technology being developed with them and for a specific purpose or kaupapa important to them, like Te Tātari Raraunga, Finding the Missing Shareholders project or* Ātea *is absolutely awesome! These are really major projects that would never have happened without SfTI.*"[191]

188. Te Ara Paerangi Future Pathways: Wāhanga 2 He Whakarāpopototanga Mō Ngā Toronga Me NgāvTāpaetanga Māori | Part 2 Summary of Māori Engagements and Submissions. 2022. (p10)
189. MBIE. (2022). *Tā te Rangahau, Pūtaiao me te Auahatanga Pūrongo Ohu Mai o ngā Whakahaere | Research, Science and Innovation Workforce Survey of Organisations Report, December 2022.* https://www.mbie.govt.nz/assets/Uploads/Research-Science-and-Innovation-Workforce-Survey-of-Organisations-Report-December-2022-v3.pdf
190. Kukutai, T., Parr-Brownlie, L., & Pitama, S. (2022). A bridge between: Te Ao Māori and Te Ara Paerangi. New Zealand Science Review, 78(1-4), 12-20. (p15)
191. Pauline Harris

There was shared acknowledgement in Te Ara Paerangi submissions that **workforce management** is an area requiring urgent attention. For example, "*an onboarding pathway and process that is Māori epistemology-based to attract and retain more Māori to the sector [would be] an enabler for connecting Māori science leadership with Māori communities to support wellbeing to thrive.*"[192] Other recommendations included preferential employment, scholarships, internships, and partnering with Pūhoro STEM Academy.

While SfTI did not have a workforce per se, the Kāhui Māori were active in providing mentoring and advice to Māori researchers, taking on the burden of aronga takirua, ensuring that tikanga was enacted throughout the organisation, and elevating the respect of mātauranga Māori; all of these actions served to create a more comfortable working environment and experience for Māori researchers.

The need for **Māori leadership** has been highlighted, although expectations must be moderated due to the shortage of leaders and scientists within the sector, particularly in physical sciences and engineering. Instituting co-leadership and co-governance are obvious ways to lend internal expertise for organisations wanting to increase Māori participation in research. This would require a purposeful rebalancing by existing leadership, but is crucial if Te Tiriti o Waitangi is to be honoured in this space:

"A sector that truly valued te Tiriti o Waitangi would nurture Māori leadership."[193]

SfTI consciously made space for Māori in leadership roles as part of business-as-usual. Māori took on roles including Board co-Chair, Theme Leader, Programme Office Manager, principle researcher, and, of course, sitting on the influential Kāhui Māori advisory group.

The Royal Society Te Apārangi

Who is responsible for reinforcing the place of mātauranga Māori and increasing participation of Māori within the RSI system? While Māori collectives, the government and research institutions, certainly have a role, so too can organisations such as Royal Society Te Apārangi, which is charged with encouraging the exploration, discovery and sharing of knowledge, in part, through public outreach and supporting the research community.

A 2023 Engagement Report commissioned by the Society noted that in terms of the organisation's scope and focus, some members are still debating "*whether the Society's remit should extend beyond the classical sciences to other disciplines … most members see the importance of the new fields which are emerging at the intersection of traditional sciences, as well as knowledge systems such as mātauranga* Māori."[194] Others consider that when it comes to its Bicultural Commitment, the Society is yet to "*actively embrace Te Tiriti o Waitangi and indigenous Māori perspectives and knowledge systems*."[195] There were different understandings amongst the membership of what bicultural commitment actually entailed, and some wondered if multicultural was more appropriate than biculturalism.

The message from Māori members and stakeholders was that the Society should define its position on biculturalism, rangatiratanga and Te Tiriti, and then take a leadership role here, and in fact, "*Participants saw opportunity for the Society to use its purpose and role to have a transformational impact on the Māori science and research community, as well as take a leadership role in Aotearoa New Zealand and internationally in the space of indigenous knowledge systems*."[196] However, at the current time, the Society is some distance away from meeting this potential.

192. Te Ara Paerangi Future Pathways: Wāhanga 2 He Whakarāpopototanga Mō Ngā Toronga Me NgāvTāpaetanga Māori | Part 2 Summary of Māori Engagements and Submissions. 2022. (p44)
193. Te Ara Paerangi Future Pathways: Wāhanga 2 He Whakarāpopototanga Mō Ngā Toronga Me NgāvTāpaetanga Māori | Part 2 Summary of Māori Engagements and Submissions. 2022.
194. MartinJenkins. (2023). Report on engagement on behalf of Royal Society Te Apārangi. (p7). https://www.royalsociety.org.nz/assets/MartinJenkins-Engagement-Report-180823.pdf
195. ibid. (p7)
196. Ibid. (p9).

6.4 THE ROLE OF NON-MĀORI

As Helen Moewaka-Barnes noted twenty years ago, it will be necessary to increase the capability of non-Māori in order to realise the VM policy's potential benefits. Specifically, this would entail building their support for, and understanding of, different approaches to science and research.[197] Almost twenty years later, there are still calls for non-Māori who lead Crown-funded research agencies, as well as their researcher workforces, to engage in cultural upskilling as a basis for partnership with Māori that honours te Tiriti.[198]

Non-Māori researchers across the sector still have a lot to learn about the proper processes involved in working with Māori. Recognising and acknowledging valuable input from Māori, and in particular, the need to engage with such expertise early in a project's life, is a basic level of knowledge required. Unfortunately, outside of the Challenges, a lot of research-related connection between researchers and Māori has tended to happen late in the project, or after research has been completed, meaning Māori have had no input into the whole project:

"Building capacity within our researchers to have those examples of working with Māori in a more genuine way. And I think outside the organization, that never happened, but we're beginning to see it overflow."[199]

In contrast, and with the leadership of the Kāhui Māori, SfTI has consciously invested in improving non-Māori capability and confidence to engage with hapori Māori and mātauranga Māori. This has changed the research culture to the point where non-Māori began to want to use their scientific skills to contribute towards Māori development and achieving Māori aspirations. This proved to be an efficacious approach with many non-Māori researchers becoming 'allies'.

Learning opportunities with a high cultural element provided by SfTI were well attended by non-Māori leaders and researchers, who tended to be unfamiliar with Te Ao Māori, and feedback showed that the offerings did indeed give attendees new knowledge and skills, and higher confidence in applying their learnings when collaborating with Māori (and industry) partners.[200]

Other tactics included running courses on the Māori economy, and supporting researchers to attend external Māori events. SfTI's annual All of Researchers Workshop brought together researchers and Māori leaders, and also integrated Māori practices such as pōwhiri, karakia and waiata, so that researchers were not only learning 'about' cultural practices, they were actively participating in them.[201]

Whakawhanaungatanga was practiced to help people introduce themselves as people first, rather than via their academic credentials, which "*created a safe, level playing field for everyone sitting at the table. Whether you were Māori or non-Māori, your degree didn't necessarily play a part in who you were at the time.*"[202]

Significant changes in SfTI's non-Māori personnel have been observed, and some of those individuals say the journey has been life-changing. Such examples of professional development tend to happen over time and constitute one of the most positive aspects of the Challenge's legacy: "*The influence of people who absorb the capacity and advance to be successful, continuing to amplify their influence through continued exercising of the skills that they learned through SfTI and leveraging their growing networks.*"[203]

197. Helen Moewaka Barnes (2006). Transforming Science: How Our Structures Limit Innovation, Social Policy Journal of New Zealand; issue 29
198. Te Ara Paerangi Future Pathways: Wāhanga 2 He Whakarāpopototanga Mō Ngā Toronga Me NgāvTāpaetanga Māori | Part 2 Summary of Māori Engagements and Submissions. 2022.
199. Nancy Garrity
200. Science for Technological Innovation. (2022). *Interim Capacity Development Report; Accelerating Science Innovation Through Human and Relational Skills Development.* Wellington: NZ.
201. Martin, W. (2021). Building Māori Capacity; Accelerating Access to Physical Sciences and Engineering Research. In M. Amoamo, M. Kawharu & K. Ruckstuhl (Eds.), *He Pou Hiringa; Grounding Science and Technology in Te Ao Māori* (pp100-118). BWB Texts.
202. Nancy Garrity
203. Willy-John Martin

Two members of SfTI's Leadership Team made considerable gains in this area. For example, Professor Stephen MacDonell, who began his Vision Mātauranga learning journey when he attended a 2016 workshop entitled Bringing Vision Mātauranga to Life. As he recalls, "*This was my first exposure to anything to do with Vision Mātauranga and it was totally eye opening. Getting an understanding of the Māori economy, the scale of it, the fact that Māori had been doing business for centuries – I just wasn't aware of it.*"

As a result of his experiences, Stephen is approaching his professional activities differently: "*I do think more about not just the economic impact of our research, but I think about the social and the environmental and the cultural impact of our research and what it might mean beyond our generation through to our tamariki and our mokopuna, our children and our grandchildren. I know this has made me a better researcher and a better engager with industry and with Māori.*"[204]

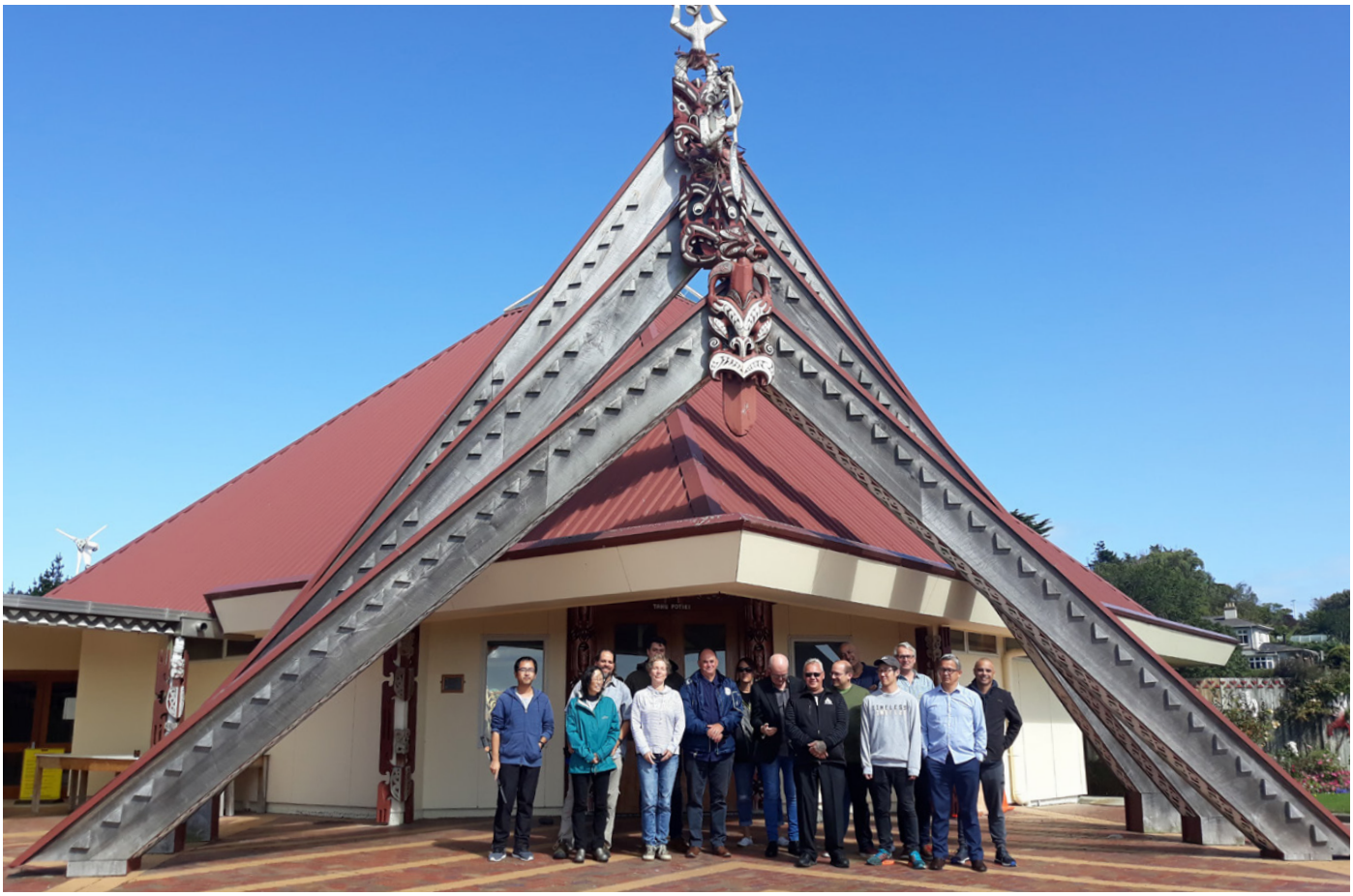
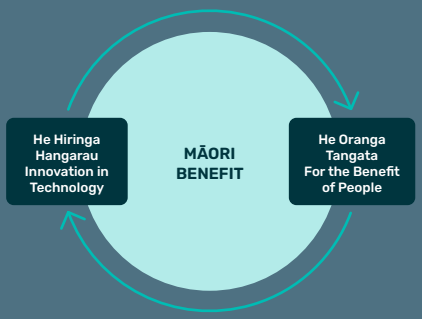


Image: SfTI's Ātea Spearhead research team outside Te Rau Aroha Marae

204. Stephen MacDonnell



Creating Benefit with and for Māori is a Vital Element of Generating Innovation in Technology for the Benefit of All People

7. Māori Benefit

"One thing has been to reintroduce the importance of having people at the center of the work we do. And at times that was lost in science - it potentially wasn't about how we made the world better, it was just about how we produce great science, great results, great numbers. The opportunity is to remind our researchers that their science has implications and impacts."

Ensuring that SfTI's work programme created benefits with and for Māori has been a top priority for the Kāhui Māori. Within Te Tihi o te Maunga, Māori Benefit (Pou 3) draws attention to the potential for a project to deliver benefit for Māori, particularly in priority areas identified by Māori. Benefits may take the form of new products, increased efficiencies, positive impacts, and training and capability gains.[205]

In practice, Seed research proposal assessors have considered a number of questions focused on how Māori could benefit from a project, for example:[206]

- Will products or services be developed that will be of particular benefit to Māori? Will Māori be able to access these products or services easily?
- Will the proposal enhance Māori quadruple bottom lines (i.e., economic, social, environmental, cultural)?
- Will the proposal have intergenerational impacts (i.e. benefits and risks) for Māori beyond the life of SfTI and are these acknowledged?
- Will the project develop Māori capability in some way? How will the findings be communicated to Māori?

This approach of consciously considering Māori Benefit, alongside Māori Knowledge and Māori Participation, has shaped how the totality of SfTI research funding has been allocated, and made it possible for positive impacts to be distributed more fairly for all peoples who call Aotearoa New Zealand home.

In addition to guiding funding decisions (to increase supply), the Kāhui Māori have also focused on raising the demand from Māori communities and businesses for science and research. As already noted, the Vision Mātauranga policy aim of unlocking the innovation potential of Māori knowledge, people and resources *"to come together to create knowledge that is positive both for Māori and the nation,"*[207] is only possible if Māori are actively participating… whether they are based inside or outside the RSI system.

7.1 MĀORI DEMAND FOR SCIENCE AND RESEARCH

While the existing low level of demand from hapori Māori for physical science and engineering input has reduced the pressure on SfTI and the Kāhui, it is something that needs to change if the full potential at the interface of mātauranga Māori and western science is to be realised.

SfTI has networks that extend deeply into Te Ao Māori, with strategic partnerships with the Federation of Māori Authorities (FoMA), for example, and the Ātea Te Taumata (a distinguished council of Māori Leaders) which provides guidance and serves as kaitiaki for matters relating to tikanga and mātauranga Māori for the Ātea project.

These relationships notwithstanding, the challenge has been how to progress the dialogue around what Māori communities want, how they want it, and what might be possible through collaboration with the RSI system. This conversation has to be handled carefully because in the past, the science system approach to engagement has been less than ideal.

There is a whole field of inquiry around the *absorptive capacity* of organisations external to research institutions in terms of their ability to recognise, value and apply new knowledge, in this case, science and technology. Unfortunately, the basic tenets of building such capacity are usually relevant to large firms but not necessarily to Indigenous communities.

Introducing new knowledge and ideas that are based on third party agendas may not align with Māori aspirations, and may, for example, focus on individual recipient organisations, thereby bypassing contextual histories of colonisation, culture, or existing capabilities.[208]

205. Ruckstuhl, K., & Martin, W. (2019). Mātauranga Māori and the high-tech interface. *New Zealand Science Review*, *75*(4), 87-91. (p89)

206. Science for Technological Innovation: Kaupapa kākano Seed Project Fund 2021 Call for Proposals.

207. Amoamo, M., & Ruckstuhl, K. (2021). Kāhui Māori; Distinctive Leadership in Science and Technology. In M. Amoamo, M. Kawharu, & K. Ruckstuhl (Eds.), *He Pou Hiringa; Grounding Science and Technology in Te Ao Māori* (pp35-54). BWB Texts. (p39)

208. Ruckstuhl, K., Amoamo, M., Hart, N. H., Martin, W. J., Keegan, T. T., & Pollock, R. (2019). Research and development absorptive capacity: a Māori perspective. *Kōtuitui: New Zealand Journal of Social Sciences Online*, *14*(1), 177-197.

Further, historical science system approaches to engagement have had an extractive quality. For example, traditional Māori knowledge may not have been considered suitable for public funding "*because it was too iwi-specific, confidential, or not research producing economic benefits,… [and there was] a lack of validation for Māori as scientists in their own right and [a view] that the value lies in harvesting Māori knowledge for 'mainstream' science.*"[209] It is hard to see how benefit for Māori could be realised in such circumstances.

Additionally, efforts to support Indigenous development through application of science and technology can tend to apply deficit thinking to Indigeneity while failing to recognise "*that capacity developers themselves may have much to learn [and in fact] Indigenous peoples are not just recipients of development, but agents contributing to transformational change through traditional knowledge systems and innovations developed over generations.*"[210]

It is difficult to establish the trusting connections required for beneficial research in this context, so on the basis of such history, the guidance of the Kāhui Māori has been vital.

For example, one of the most notable benefits of having Mānuka Henare on the Kāhui was that he attracted Māori researchers to SfTI because they could see good people were involved in setting a positive environment, and so too with hapori Māori:

"It was comfort for them as well as protection for those people around that table who at times were probably feeling they were doing stuff that was really, really quite edgy, and didn't know where it was going to go."[211]

Most importantly, SfTI has recognised that as the world faces more complex challenges, scientists need to work across multiple borders, in order to be most effective. These borders include "*geographic, disciplinary, social and cultural*,"[212] and this requires abilities beyond the purely technical. Because of this, SfTI has focused its absorptive capacity building efforts at the level of researchers and research teams - a continuation of the capacity development activities already discussed in this document. Further, given the lower numbers of Māori technical experts in physical sciences and engineering, a result of longstanding colonisation dynamics, the ability of non-Māori scientists to work with Māori communities is vital and has been factored into capability development initiatives.

7.2 FRAMING PHYSICAL SCIENCES AND ENGINEERING IN RELATION TO TE AO MĀORI

A key cause of the disconnect between hapori Māori and the RSI system from the demand side is that Māori have not seen themselves or their ideas reflected in the creation of Western science and technology,"[213] making it unfamiliar and unappealing. Reframing science in relation to Te Ao Māori to demonstrate connections is a useful approach.

Ātea Spearhead[214]

The Covid experience, and its requirement for people to communicate virtually rather than in person, elevated the question of online safety for Māori, including how to stay grounded in virtual spaces, and how young people can be kept safe while interacting in alternative realities?

This prompted critical thinking about establishing protocols and tikanga, and how this could be informed by cultural experts and technology experts. An important aim of the Ātea Spearhead has been to ensure Māori can interact safely and meaningfully in the online space, particularly when sharing knowledge.

209. Helen Moewaka Barnes (2006). *Transforming Science: How Our Structures Limit Innovation, Social Policy Journal of New Zealand; issue 29*. (p12)
210. Ruckstuhl, K., Amoamo, M., Hart, N. H., Martin, W. J., Keegan, T. T., & Pollock, R. (2019). Research and development absorptive capacity: a Māori perspective. *Kōtuitui: New Zealand Journal of Social Sciences Online*, *14*(1), 177-197. (p179)
211. Reece Moors
212. Ruckstuhl, K., Amoamo, M., Hart, N. H., Martin, W. J., Keegan, T. T., & Pollock, R. (2019). Research and development absorptive capacity: a Māori perspective. *Kōtuitui: New Zealand Journal of Social Sciences Online*, *14*(1), 177-197. (p179)
213. Amoamo, M., & Ruckstuhl, K. (2021). Kāhui Māori; Distinctive Leadership in Science and Technology. In M. Amoamo, M. Kawharu, & K. Ruckstuhl (Eds.), *He Pou Hiringa; Grounding Science and Technology in Te Ao Māori* (pp35-54). BWB Texts. (p46)
214. Interview with Hēmi Whaanga at SfTI's All of Researcher Workshop 2024.

Hui such as the Māori Data Sovereignty (MDS) events were supported by Kāhui Māori members as a way of introducing both the challenges and opportunities inherent in MDS to Māori communities. One example of communicating relevance is using the metaphor of the wharenui as a type of data repository akin to modern data centres.

Following on from the MDS Hui, in addition to the greater interest from Māori communities and organisations, a number of publications have been written, and SfTI has been able to part-fund a significant digital project, Te Pā Tūwatawata. This project is in the process of creating an iwi-Māori designed, owned, and operated repository network. One of the most important aspects of the initiative is that it will "*enable iwi, hapū and whānau Māori to collect, store, protect, access and control their own data,*"[215] all foundational tasks for Indigenous Data Sovereignty. Further, the physical servers will reside on Marae and other appropriate locations around the country, rather than in larger data centres in Aotearoa New Zealand or overseas.

There has already been interest from some large New Zealand-based organisations, including the National Archives (with seven trillion bytes of data to house) who want to onshore their data storage; this infrastructure has the potential to be self-funding in the longer term.

As Erena Mikaere, Principal Advisor (Digital) has described it, the network "*has layers of safety, security, functionality and protection structurally informed by kawa and tikanga; that means hapū and iwi can make their own calls about the access and sharing of their own information in ways that honour their kawa and tikanga at place*."[216] The ability of Māori to take ownership of their digital information will only become more important over time as the world moves more functions online.

An additional benefit of this project has been the involvement of two Rangatahi who are learning from experts in this field, an approach to learning that SfTI has been keen to support.

Te Taka Keegan has high praise for this project, saying, "*Out of all of the projects I've seen, it's got the potential to really change the data network throughout New Zealand. It won't be completely SfTI's doing, but SfTI has had a big part of kicking it off.*"[217]

"I'm really looking forward to sharing Te Pā Tūwatawata with the rest of Aotearoa and seeing the benefits it will bring to not just the Māori economy, but for New Zealand's economy, showing Aotearoa and the world, what Iwi Māori can achieve."[218]

7.3 INTERMEDIARIES

While Māori technical experts are vital for creating positive initiatives such as Te Pā Tūwatawata, equally important are those who can take science and technology into the real world. These people, such as social scientists, business people and those working in the community, can sit alongside researchers to help identify areas of greatest potential and priority.

Engaging specialists to support collaboration between researchers and hapori Māori was a strategy used by a number of National Science Challenges; these experts took on the role of conduit and translator between the two groups:

"*In the case of Māori communities we try to bring in the appropriate Māori resource to build those connections rather than trying to do it as non-Māori, that's been a really big part of the success there. Also taking the burden off Māori researchers to do all that cultural labour. So resourcing things appropriately*."[219]

215. Waatea News. (2024, 4 June). World-first data storage infrastructure solution built by Iwi Māori, for Iwi Māori. WaateaNews.com. https://waateanews.com/2024/06/04/world-first-data-storage-infrastructure-solution-built-by-iwi-Māori-for-iwi-Māori/
216. Waatea News. (2024, 4 June). World-first data storage infrastructure solution built by Iwi Māori, for Iwi Māori. WaateaNews.com. https://waateanews.com/2024/06/04/world-first-data-storage-infrastructure-solution-built-by-iwi-Māori-for-iwi-Māori/
217. Te Taka Keegan.
218. Erena Mikaere in Waatea News. (2024, 4 June). World-first data storage infrastructure solution built by Iwi Māori, for Iwi Māori. WaateaNews.com. https://waateanews.com/2024/06/04/world-first-data-storage-infrastructure-solution-built-by-iwi-Māori-for-iwi-Māori/
219. Science for Technological Innovation National Science Challenge. (2023).*National Science Challenge (NSC) Directors Discuss: The Mission-led Approach to Science and Research*. Wellington: NZ. (NSC Director quote;p29)

The WAI 262 Best Practice Guide produced by the Rauika Māngai is another resource that supports collaboration between (non-Māori) researchers and communities. It provides excellent advice on how researchers can take a partnership approach to ensuring research is reciprocal and results in benefits being shared with Kaitiaki.

Best practice includes:[220]

- Kaitiaki determining for themselves what benefits they want to see out of the research;
- Ensuring that benefits for kaitiaki are the research project's primary goal(s);
- Developing benefit-sharing agreements and protocols to ensure the benefits to kaitiaki are delivered; and
- Being clear and being honest about the expertise you bring to the table and what benefits you can help kaitiaki to achieve.

An additional approach has been to invite community experts in mātauranga into the research process; these are people who may have no formal science or research training, but who possess specific knowledge and are heavily invested in impact-making. "*We have had some big projects that have been Māori led, of importance to Māori, and using kaupapa Māori approaches… so this is heartfelt for us even though most non-Māori don't understand why it's so important.*"[221]

The Ātea Spearhead project has used a mix of strategies to bring together a team of researchers and community experts, with project leader, Hēmi Whaanga, performing the role of facilitator in making this happen:

"*It was decided that his most pressing task as leader was to help team members understand the context of material they would be working with: stories of and from Ngāi Tahu. This seemed the best way to meet a common tech challenge that Hēmi had been pondering: "When you're working in a digital space, it's the cultural element that's often missing. How do you actually make your colleagues connect to the stories that you're talking about? You need to take them to where those stories were actually created. You need to go out and feel the wind down at* Ōreti*…" A trip to Te Rau Aroha Marae was planned for all researchers and their families. Hēmi wanted everyone to experience a powhiri, participate in whakawhanaungatanga, and meet with the haukainga who would ultimately be sharing their knowledge.*

In the event, says Hēmi, the trip worked as intended, with stakeholders from Awarua Rūnanga, University of Otago and University of Canterbury, able to share their aspirations for the project, respective roles, and the practical actions they would take. Ultimately, "finding common agreement on how we were going to do things really saved me time," he explains. But it was more than that; Hēmi wanted to ensure that when team members spoke on behalf of the rūnanga, they had "seen our carvings, slept in our Marae, and spoken with the locals," and from this foundation, could take context into account when making decisions."[222]

7.4 EXAMPLES OF BENEFICIAL RESEARCH

Below we present details from a small selection of SfTI-supported research, which offer great potential for providing benefit to Māori. These projects are:

- Veracity Spearhead
- Ātea Spearhead
- Early Career Researcher Bolt-On project that focuses on turning phones into mixed reality devices for Matariki[223]
- Ending with Impact project entitled 'Intelligent Oceans'[224]

220. Potter, H., & Rauika Māngai. (2022). *A WAI 262 Best Practice Guide for Science Partnerships with Kaitiaki for Research Involving Taonga: Lessons from Māori voices in the New Zealand Science Sector*. Dunedin, NZ: Rauika Māngai. (p34)
221. Science for Technological Innovation National Science Challenge. (2023).*National Science Challenge (NSC) Directors Discuss: The Mission-led Approach to Science and Research*. Wellington: NZ. (p29)
222. Science for Technological Innovation. (2022). Accelerating Science Innovation Through Human and Relational Skills Development; Interim Capacity Development Report. Wellington: NZ. (p34)
223. This project emerged from the Ātea Spearhead.
224. This project emerged from the Precision Farming Technologies for Aquaculture Spearhead.

CASE STUDY

Developing the Ātea Spearhead Project[225]

How can the feeling of being kanohi ki te kanohi be created when people are geographically dispersed and in a virtual environment? SfTI researchers have designed and built Ātea, an immersive experience that draws on Māori protocol and world views as well as new technologies.

Through incorporating mātauranga Māori, artificial intelligence (AI), virtual and augmented realities and machine learning (ML), the Ātea project aimed to create a virtual, digital space in which Māori knowledge could be created, articulated, interpreted, interrogated and built. This spearhead has focused on supporting Māori, iwi and communities to connect their increasingly globally tribal members to their Mātauranga-ā-iwi, reo, tikanga, histories and knowledge.

The project has been unique in placing Māori front and centre in the scientific research development process.

Reece Moors developed the project formation process - he did not want to tell Māori what technology could do for them, but rather, asked them what they would like to do with technology, however, as one interviewee noted, "*it wasn't that easy to do because Māori don't really know what they want to do with technology*."[226] There were additional hui and a call for proposals, which elicited many, many ideas. At this point, the Challenge engaged Assoc. Professor Hēmi Whaanga to work through the proposals and try to formulate a project.

The Covid experience, and its requirement for people to communicate virtually rather than in person, elevated questions around online safety for Māori, including how to stay grounded in virtual spaces, and how can young people be kept safe while interacting in alternative realities?

This has allowed the research team to think critically about establishing some protocols and tikanga, and be informed by cultural experts and technology experts around that. Making sure it is possible to interact in a safe and meaningful way with cultural knowledge in that space.

While Hēmi does not have a background in technology, he was open minded and, more importantly, he was able to bring his own iwi into the project: "*If you wanted to get Iwi involved, then your key driver, your key researcher has to be your own iwi because why would they go and do it with somebody else's iwi? It's not a believable thing.*"[227] This was absolutely critical to the project's success.

The Ātea project was in a sense, technically and culturally risky, making the process of establishing trustful relationships even more important and worthy of moving at the right pace. However, this example illustrates considerations and a process that would also be useful for many other hi-tech projects with iwi:

"*If you're doing any kind of research project, you've got to go out to the Marae, go out to the places, meet the people, sit down. Quite often that's all you've got to do on the first one, just meet*

225. Excerpt from SfTI Media article: https://www.sftichallenge.govt.nz/news/veracity-mission-update-aotearoa-new-zealands-opportunity-to-trade-in-trust/

226. This case study draws on interviews, and SfTI's internal and published documents, including: https://www.sftichallenge.govt.nz/our-research/projects/spearhead/atea/ https://www.sftichallenge.govt.nz/our-research/projects/spearhead/atea/creating-new-mātauranga-with-virtual-immersive-wananga/ https://www.sftichallenge.govt.nz/our-research/projects/spearhead/atea/ending-with-impact/ https://www.sftichallenge.govt.nz/our-research/projects/spearhead/atea/ecr-bolt-on/

227. Te Taka

CASE STUDY

Developing the Ātea Spearhead Project (Continued)

everybody, and then you've got to come back the second and maybe the third, and then start talking about what you want to do. No point talking about it in the beginning. They don't trust you. You haven't built up a relationship, you have to build trust. Why should I trust all of my ancestral knowledge with someone I haven't even met? So yeah, so that's why Hemi was key and that's why that's such an important project because it wasn't the government's idea, it wasn't any smart professional, any university's idea. It was Māori, Māori led from the ground up."[228]

Ātea has been successful in creating an open-source digital library architecture with user authentication and access that supports multiple membership of iwi/hapū/whānau, and in building software tools that can refine and store Māori medium knowledge from video, sound recordings and written text in digital format. It has also built an integrated tele-co-presence system which allows two remote parties to meet in the virtually reconstructed wharenui, and includes experiences. Additionally, a framework of guiding principles for future generations to interact safely in these developing technologies has been constructed.

And there is more to come. In SfTI's final funding round, further resourcing was allocated for two Ending with Impact projects.

The first, *Your* Ātea *Natural language processing Platform*, uses machine learning to create a digital platform that allows whānau, hapū and iwi to interact with their data in their language and on their own terms. Some improvements had already been made by the original Ātea Spearhead to solve the clunkiness of existing NLP Tools for te reo Māori content, but further development is needed to realise the full potential offered by the online environment.

The second, *Virtual Wānanga*, builds on the strong relationships built during the Ātea Spearhead to incorporate cultural practices into virtual tools so that the concept of wānanga is not diluted by technology, and in fact, can be enhanced by it.

A Rangatahi Bolt-on, Matariki Ahunga Nui (see below), was also funded to extend the Ātea Tele-co-presence system. The project has focused on building a mobile phone-compatible Mixed Reality (MR) based tātai arorangi (Māori astronomy) experience with immersive content about Matariki provided by Matariki experts.

228. Te Taka Keegan.

CASE STUDY

ECR Bolt-On: Turning phones into mixed reality devices for Matariki[229]

SfTI researchers recently designed and built the Ātea Tele-co-presence (3D Video calling) system that adheres to Māori customs and values. While wearing an immersive VR headset, users can virtually explore a 3D replication of Te Rau Aroha Marae in Bluff. Through this system, users can virtually access the stories embedded within the tukutuku and whakairo panels of the wharenui, which is told in the presence of the kaumatua in the manner that is kanohi ki te kanohi. More importantly, live users can have a "face-to-face" conversation despite being physically located in different places.

Now, as part of SfTI's 'bolt-on' projects, early career researchers from Ātea have successfully been funded to extend this work and build a mobile phone-compatible Mixed Reality (MR) based tātai arorangi (Māori astronomy) experience with immersive content about Matariki. The Early Career Researcher 'bolt-on' projects are designed to further the work of existing SfTI projects whilst giving leadership opportunities to young researchers.

With the recent introduction of the Matariki public holiday, there has been increasing interest around the country in learning about the science and the story of Matariki, and this project will enable an astronomy experience independent of time, weather, and location.

The Matariki Hunga nui project is co-led by PhD students Kris Tong (University of Canterbury) and Noel Park (University of Otago). Stu Duncan of the University of Otago will continue to advance the voxel capture technology used in Ātea. Tiriana Anderson (He Kura Tūī He Kura Ika) will join as a tikanga advisor. Postdoctoral Research Fellow Dr Rory Clifford (Kāi Tahu, Kāti Māmoe) will also be an advisor on this project.

The project will use mahi ngātahi (co-design approach with end-users) and kaupapa Māori guidelines. Once complete, the system has the potential to provide several experiences such as enabling celestial observations, teaching, sharing of mātauranga and educational materials; but most importantly access to everyone in both non-immersive and immersive mediums. During the Ātea project, the project team developed a strong relationship with Te Rūnanga o Awarua and with the kaikōrero and tohunga. The team will again work with these key-knowledge holders to collect targeted kōrero about Matariki to inform the tātai arorangi MR experience.

"*The Matariki MR experience will be built primarily for mobile devices, so that we can capture as wide as possible segment of the public, and enable easy access to the experience*," said Kris Tong, one of the co-leaders of the project.

The initial stage of the project will use an existing voxel-based tātai arorangi kōrero (from Ātea) and make it portable on mobile devices. In the second stage, the researchers will combine 360-degree videos and volumetric technologies to capture kōrero on Matariki. They will work with key knowledge holders and practitioners from Te Rūnanga o Awarua and Massey University. These kaikōrero will explain the mātauranga and activities and ceremonies involved in the celebration on Matariki in 360-degree videos and volumetric videos. This content will be merged and loaded into the prototype from the first stage as an updated experience. The final stage of the project will finalize the MR experience with appropriate user interface and more extendibility to future content.

"*The aim is for people to either watch this on their regular mobile phone screens or use a virtual reality headset if they have one, so they can experience Matariki in mixed reality*," said Kris Tong.

229. https://www.sftichallenge.govt.nz/our-research/projects/spearhead/atea/ecr-bolt-on/

CASE STUDY

Connect farm to desk: using data to bring iwi, scientists and marine farmers together[230]

The 24th November 2023 was an important date for research analyst Thomas Shorrock. It marked the culmination of a SfTI 'ending with impact' (EWIP) project called Ocean Intelligence that he's been heavily involved with. On that day, the project team were deploying a novel environmental sensor technology (NEST) float to a Ngāti Rārua-owned marine mussel farm at Admiralty Bay in the Marlborough Sounds.

"The data gathered from the NEST float will be used to remotely monitor the health of the water, to inform decisions about our mussel farming operations," explains Shorrock. "*The launch was a great day. Karakia was observed throughout the process by our cultural Pou 'Reo Mauri Ora' Pohe Stephens, with support from one of our NMIT Aquaculture students Te Rito Hughes. The team were very respectful, including our mussel farmer. This project is a combination of our mātauranga* Māori and scientific research."

Ocean Intelligence is a partnership between the Tokomaru Research Centre – a new institute established by Te Rūnanga o Ngāti Rārua – Clearwater Mussels who operate the farm for the iwi, the Cawthron Institute, and data science specialists, Oceanum. A spinout from the Precision Farming Technologies for Aquaculture Spearhead, the project is utilising a suite of proven sensors and bespoke software to create data-heavy digital dashboards for marine farmers.

"*The goal is to transition the aquaculture industry from one that's largely based on experience, into something more data-driven and technology based*," says Cawthron's Dr Chris Cornelisen. "*For a mussel farmer working in a dynamic, super high-energy environment like the ocean, it's not possible for them to just walk out to the paddock to check things. This project's been about bringing the farm to the desk; turning the lights on for the farmers, so they can manage their farms much more effectively and efficiently*."

At Admiralty Bay, the mussels grow on lines that stretch from the surface down to 20 m. The Ocean Intelligence sensors continuously monitor the water temperature at different depths, to ensure conditions are suitable for mussel growth. Precise location data is also collected for each line by the NEST float, and lights and the batteries needed to power them are monitored too. Longer-term, additional sensors could be added, including those that measure ocean acidity and water turbidity (or clarity). The float housings are 3-D printed at Cawthron, which significantly reduces the cost of materials, making the platforms cheaper than those available from commercial suppliers. The data collected from all of the sensors in the NEST float is collated into a single online dashboard, providing farmers with data even when they are far from their mussel farm.

This is a valuable new tool for Ngāti Rārua, and Shorrock, who joined Tokomaru specifically to work on the Ocean Intelligence project, says the experience of deploying the float has been very positive, "*I had a lot of learning to do from the start, but what's helped is that everyone involved has been very open-armed and keen to be collaborating with us. We have monthly hui with them, and I visit the team at the Cawthron boatshed – their innovation hub – regularly. They've always responded to my requests, and helped us solve issues. It's been fabulous*."

Since its earliest inception, the goal of the Ocean Intelligence (OI) project was to turn great research into a commercial enterprise, for the benefit of

230. https://www.sftichallenge.govt.nz/news/connect-farm-to-desk-using-data-to-bring-iwi-scientists-and-marine-farmers-together/

CASE STUDY

Connect farm to desk: using data to bring iwi, scientists and marine farmers together (Continued)

New Zealand, as Cornelisen explains, "*From day one, we've treated OI as a new company. It wasn't about scientific papers. It was about building real solutions that can be commercialised and scaled*." The Spearhead project demonstrated to Cornelisen that it was the data itself – rather than the hardware used to collect it – that was particularly valuable. "*The information we're providing helps farmers to make decisions. Bringing in ocean data engineers from Oceanum was a step change for this. We now use a 'data mesh' that allows you to bring in lots of different data sets, whether it's forecasts or measurements, satellite imagery, whatever, and do your analytics on it in one place*."

Shorrock says that following on from the project, Te Rūnanga o Ngāti Rārua have expressed interest in rolling out the technology further. "We have a shared interest, with another Tainui iwi, in a mussel farm at Snapper Point. That'll be our next go-to – we'd like to put a NEST float there." The iwi is also in conversation with several universities, and was recently awarded funding from the Vision Mātauranga Capability Fund. The aim of that work is to investigate the impact of climate change on Ngāti Rārua land and water, and to establish environmental management responses supported by scientific research, data from the data mesh platform, and traditional knowledge.

For Cornelisen, the long-term implications of their data mesh could be significant. "*Ultimately there's a much wider need out there for data-driven solutions. New Zealand has the fifth largest ocean marine economic zone and yet we're one of the few maritime OECD countries without a dedicated ocean observing system. The work we've been doing with SfTI is basically our way of bootstrapping tech innovation for that system, so that it can ultimately be used by everyone*."

8. Conclusions

What is the legacy the Kāhui Māori leaves behind? Many people have said that the legacy is in the people, and that this equally applies for SfTI and the other ten National Science Challenges too. Behaviour makes things happen, despite the influence of policy or institutional expectations, and it is reasonable to assume that a 'slow flow' of influence may result in more permanent behaviour change. In this case, the Kāhui has helped people to think differently about relationships, including with Māori, and to think about Māori as part of the science sector.

The full impact of the Kāhui Māori is not easy to grasp at this early stage, so we must look for evidence of a movement or journey from a place where Māori Knowledge is undervalued, where Māori Participation is underrepresented, and Māori Benefit is under-realised, towards an RSI system that is genuinely te Tiriti-honouring and that produces tangible benefits with and for Māori. Let's take a closer look at how things have changed with regard to seven specific areas:

What should we expect from an RSI system that is genuinely honouring te Tiriti, and that produces tangible benefits with and for Māori? What would it look like?

- Māori activity would not be seen as unusual - it would be seen as entirely normal and 'no big deal'.
- Te Tiriti would be seen in action consistently, rather than being a topic of discussion.
- There would be a diversity of institution types across the sector, with some remaining similar to what they are today, and others being more integrated with the interests of Māori people. Māori leadership and governance would be a normal part of these organisations, ensuring that particular values, skills and perspectives were brought to bear.
- A diversity of research activities would be taking place, with a significant portion generated by Māori aspirations and priorities, and including Māori knowledge, researchers, communities, with benefits flowing to iwi Māori.
- Communities would be embedded across research institutions to different degrees and at different levels based on the interests of Māori.
- There would be a diversity of people across the RSI system, including more Māori researchers and more Māori women with the right skills in the science system.
- Funding would be applied across a portfolio of research, including research involving mātauranga Māori. Some mātauranga would be very focused, in other instances more generalised, and in some cases, funded projects may not contain any mātauranga. However, its presence would be included at a system level, and distributive funding mechanisms would be fairer.
- Aotearoa New Zealand as a whole would understand the value of science, research, and mātauranga, and there would be a focus on creating positive impacts for communities and the way they work and live, and on businesses and the way that they operate. For the science, innovation and technology system and the aspirations of te Tiriti to be fully realised, the impact must be felt not only by researchers and science organisations, but also by communities who are end-users. This would be evidence of RSI system maturity: a move from being only about the research, to also being about its value.

There is evidence that behaviours practiced by the NSCs have indeed made their way into other research institutions, resulting in such changes as public statements of te Tiriti commitment, better contracting practices, employment of people skilled in community collaboration, and allocation of more equitable funds for Māori-focused research.

As already discussed in this document, some Māori scholars are observing a general uptick in acceptance of mātauranga Māori as a valid knowledge system across the RSI system, while the National Science Challenges have arguably been the site of greatest increases in participation by Māori compared with glacial change still seen elsewhere in the sector.

The professional experience of one of the Kāhui members suggests that the RSI system is indeed changing:

"I am hopeful by what I'm hearing from some at a leadership level who are non-Māori that I'm working with now. And that they're vocal, they're committed and they're supportive of kaupapa Māori. They see the value of working with Māori and it's not lip service. And they ask questions, check in and will fight alongside us. I am happy that not only do I have the support from our Māori, but also from our non-Māori colleagues. There has been much progress made, the question remains how much of this shift in behaviour is actually embedded and how much sits at face value readily lost."[231]

Movement towards a more ideal RSI system might be described as 'mixed', however, with the guidance of the Kāhui Māori, SfTI has made gains. For example, it has widened researchers' understanding of respectful and effective ways of working with partners, including but not limited to Māori. Resourcing the act of relationship-building and collaboration, and capitalising on the longer funding timeframes to support deeper relationships to be formed has helped with this. SfTI has appropriately resourced a range of expertise, including that coming from Māori communities, as a way of supporting Māori participation.

Involving Māori at the beginning of research, rather than at the end, has been an important step towards ensuring projects genuinely include Māori priorities and aspirations. Crucially, SfTI prevented researchers from sidestepping this issue during the funding process, requiring researchers to be clear about why and how their research is of relevance and benefit to Māori.

Creating an atmosphere of collaboration rather than competition has also been a departure from typical operations in some other parts of the RSI system. In part this has been because Mission-led research requires cross-discipline teams to be formed so that everyone can work together to meet the Mission-led problems and opportunities.

231. Nancy Garrity

Issue	Wider RSI System	SfTI
1. How mātauranga Māori, Te Ao Māori, and kaupapa Māori approaches are valued within the mainstream RSI system	Historically, the system has been somewhat dismissive, however, Māori working in the sector have observed a recent improvement here, with more interest being expressed in the potential for incorporating mātauranga Māori into research. However, the capability of non-Māori to work genuinely with Māori researchers and communities remains lower than it needs to be.	The Kāhui Māori has taken on some of the cultural double duty expected of Māori researchers, leaving them freer to focus on their research. The rōpū has also supported the upskilling of non-Māori (leaders and researchers) working in the Challenge to help them become more familiar with these concepts, and how they constitute a valid component of the research.
2. Māori data sovereignty	Māori are taking the lead on Māori Data Sovereignty. For example, the Māori Data Governance (MDG) Model is being co-designed by the Data Iwi Leaders Group and Stats NZ, and aims to bring Māori input into the government data ecosystem for mutual benefit. While it may take some time for MDS considerations to be influential on researcher behaviour, the supportive infrastructure is beginning to be put in place.	SfTI supported the Māori Data Sovereignty Hui x2, and has co-funded the Te Pā Tūwatawata project, which is well advanced in establishing a Māori data repository.
3. Māori IP protection	There is some observable change in protection for Māori knowledge and taonga species, with the government releasing Te Pae Tawhiti in 2019 and subsequently developing a whole-of-government work programme to respond to the concerns outlined in WAI 262. There is also evidence that a number of research institutions are following the lead of the NSCs to develop appropriate clauses within their research partner contracts. Nevertheless, underlying intellectual property laws are problematic in this space.	SfTI engaged with two Māori IP lawyers to integrate protection of Māori knowledge and taonga into its contracting processes. In addition to rewriting its IP contract, it also developed a separate guide to inform research leaders of their responsibilities. The process was overseen by the Kāhui.
4. Culturally relevant evaluation and assessment practices	Māori researchers have reported the difficulty involved in writing funding proposals that meet both RSI concepts of science excellence and Māori cultural obligations. Additionally, some funders and research institutions are slow to ensure that Māori expertise is in place for assessment and evaluation.	Te Tihi o te Maunga and Te Aromatawai are two foundational tools that have guided researchers in forming research projects, and have been used by the expert Māori Panel of assessors in their funding decisions.

Issue	Wider RSI System	SfTI
5. Māori participation in the RSI system, including: students, researchers and leadership	Māori representation within the RSI workforce remains low and stubbornly static, particularly for universities and within certain science domains.	Māori have been appointed to leadership roles across the SfTI organisation, including at governance, advisory and management levels. Māori representation within SfTI's research community did remain below national population rate at 12.4% (c.f. 17.8%), however, physical sciences and engineering have one of the lowest Māori participation rates across disciplines, so this is not surprising.
6. Funding levels (practice and policy) for Māori research	Research shows it is difficult to define exactly how much funding is being awarded to Māori-led research due to variability in application processes, poor data capture during the proposal process, and unknown expertise of proposal assessors to identify high-quality Māori-centered research. Nevertheless, inequitable funding for Māori research remains an issue.	SfTI ring-fenced a proportion of funding for Māori-led research. For example, for Seed funding rounds this was set at 25%, but the fourth round actually reached 34% due to the high quality of VM proposals received.
7. Māori community and business involvement in RSI, and incorporating Māori aspirations and priorities	A mixed incidence of collaboration is seen across the sector. Māori are still often 'consulted' late in the proposal writing stage, and/or at the end of research project.	SfTI put in place formal processes for involving Māori in the research process, for example, holding Mission Labs involving Māori and industry participation, running researcher workshops that included hapori Māori who had already expressed interest in the research topic area, and funding relationship-building within specific research projects.

There is no doubt that Māori are becoming more involved in research, science, innovation and technology, and the Kāhui Māori can take some credit for this, perhaps even beyond the boundaries of SfTI.

This year's Hi-Tech Awards showcased a number of trailblazing Māori hi-tech companies who are leaping to the fore: Envico (winner of the Hi-Tech Kamupene Māori o te Tau – Māori Company of the Year); Toku Eyes (runner up Most Innovative Hi-Tech Software Solution, and an early SfTI-funded Seed research project); and Elle Archer (winner of Hi-Tech Inspiring Individual).

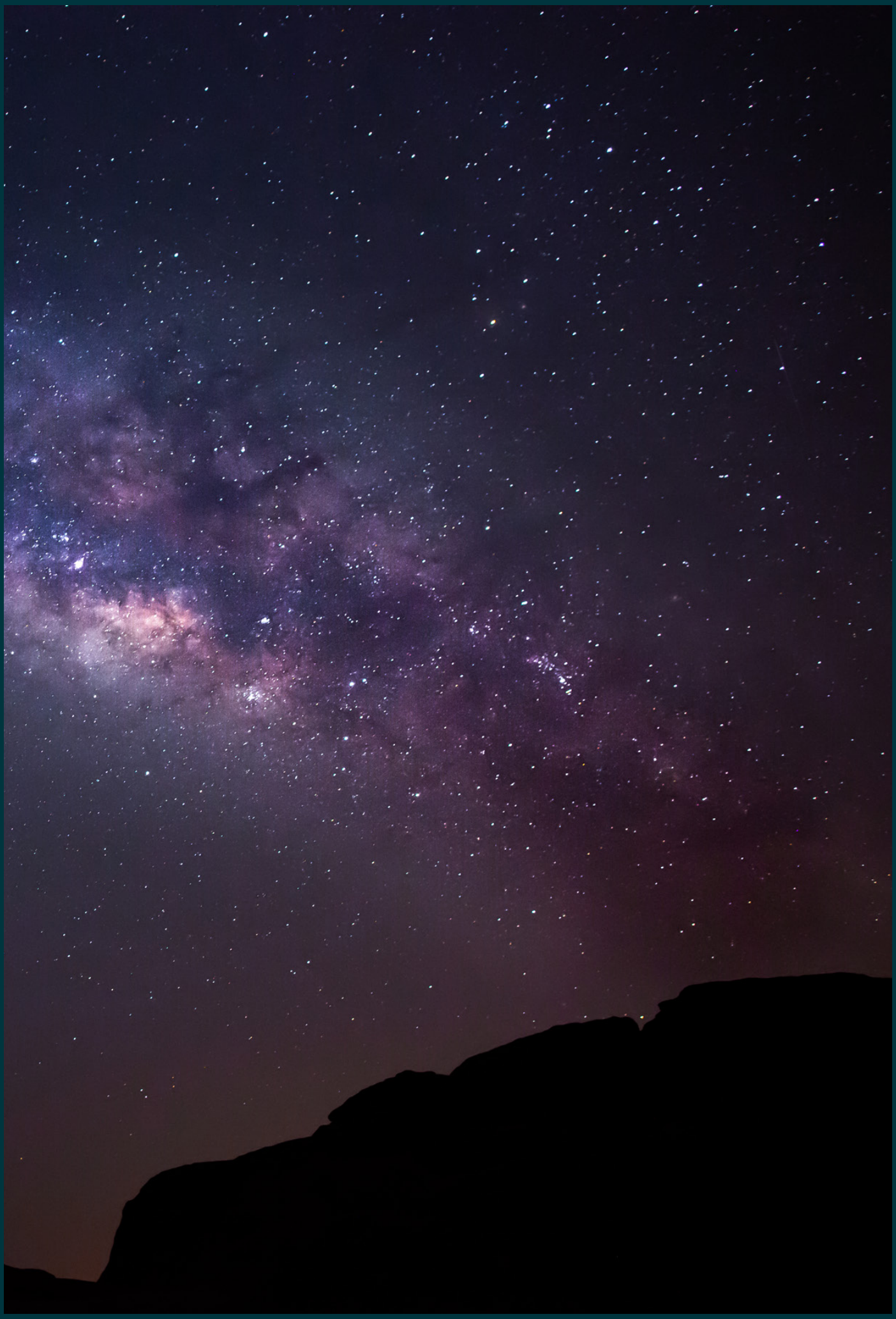
Just like their Māori forebears who journeyed to Aotearoa hundreds of years ago, enabled by their superior navigational and boat-building skills, these tech entrepreneurs are already leading at home and internationally. Hapori Māori around the country are also going on their own technology journeys and are proving ever more ready for this new direction.

Being integrally involved at the frontier of technological innovation should not be considered an irrelevant or unattainable dream for Māori, it is actually a continuation of how they have always operated, in a way, it's just business as usual.

Appendix

Aotearoa	Now used as the Māori name for New Zealand, it was originally referred to the North Island of New Zealand.
Data ILG	Data Iwi Leaders Group was established in 2016 to advance Māori Data Sovereignty in Aotearoa New Zealand.
Hapori Māori	Māori communities.
Kaihautū	Leader or Chair.
Kaupapa Māori	A Māori approach or customary practice. In the context of the RSI system, Linda Smith defines Kaupapa Māori researchers as "Research by Māori, for Māori and with Māori."[232]
Mātauranga	Knowledge
Māori	Māori
NSC	National Science Challenge. Eleven Challenges operated from 2014 to 2024, and aimed to tackle the biggest science-based issues and opportunities facing New Zealand.
Pou	Pillar or support
Rohe	District or region
Rōpū	Group or management committee.
RSI	Research, Science and Innovation
RS&T	Research, Science and Technology
Seed Research Projects	Small, risky and complex researcher-led projects, funded $200k for up to two years.
Spearhead Research Projects	Large multidisciplinary research projects spanning three-plus years, funded up to $1million per annum.
Tauiwi	Non-Māori person.
Te Ao Māori	The Māori world.
Te Wai Pounamu	South Island of New Zealand
Whakatauākī	Proverb or significant saying
VM	Vision Mātauranga Policy aims to unlock the science and innovation potential of Māori knowledge, people and resources to benefit New Zealand.

232. Smith, L. T. (2015). *Kaupapa Māori research-some kaupapa Māori principles*, 46-52. (p47) https://researchcommons.waikato.ac.nz/server/api/core/bitstreams/c3eb833e-73ff-4239-a595-f64b4a00a36b/content



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