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Mission-led science communication and engagement

May 2024

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Contents

Glossary

Mission-led science	Mission-led science is a collaborative, transdisciplinary, multi-organisational approach to solving 'big picture' problems and creating impact.
Science communication	Science communication is using appropriate communication and translation to produce a desired response to research.
Engagement	Engagement is relationship building through connection with individuals or communities (including industry, business, iwi and hapū) that seeks to improve both the quality of the research output and the situation and empowerment of the community.
Misinformation	Misinformation is information that is false or misleading, though not created or shared with the direct intention of causing harm.
Disinformation	Disinformation is false or modified information knowingly and deliberately shared to cause harm or achieve a broader aim.[1]

Executive summary

This report defines mission-led science communication and engagement (MLSCE) as meaningful translation of science findings that lead to impact. The key characteristic of MLSCE is that it goes beyond explaining research, instead aiming to help people respond to science with meaningful action. This report aims to explore how MLSCE can be better used to improve science impact in all its different guises.

The impact of MLSCE varies and does not always fit well within discrete silos, however, for the purposes of this report impact is described as:

- Building social license
- Growing community for applied research
- Informed decision-making
- Behavioural change
- Economic growth
- Capability building

Translation of research

Traditionally science communication is seen as translation that explains science to non-scientists, for example, through media articles, videos, or websites, often with the aim of producing a desired response to research. Taking a MLSCE approach, the mission-led element requires multi-directional translation between researchers in different institutions and disciplines, as well as between a variety of audiences and researchers. This kind of translation assists in establishing equity as it allows all participants, including scientists, to engage on both intellectual and values-based levels. Often this multi-directional translation work does not fit within the remit of an institution's communications staff who are generally incentivised to promote only their own institution's research.

Measurement

The impact of mission-led science is not well-captured in traditional science measurement. More discussion is needed about how to better measure the impact of MLSCE beyond narrow quantitative measures.

Suggestions for improvement

Several areas for improvement were identified that would better enable MLSCE to improve science impact. These include:

- recognising MLSCE professionals as specialists in their own right and providing researchers with access to their skills;
- involving MLSCE throughout the duration of science project funding, from application through to wrap up;
- incorporating specific planning for MLSCE professionals, and impact activities, into funding application budgets;
- creating project structures that allow MLSCE professionals to operate in collaboration, such as including MLSCE in project leadership and decision making; and
- working on establishing methods to measure both project and MLSCE impact.

A science communication and engagement exemplar: Lakes380

Mission: To understand the past and present health of lakes in Aotearoa, to better plan for their future

Project: Endeavour Fund: Lakes380 - Our Lakes' Health: Past, present and future[2]

Organisations involved: Cawthron Institute, GNS Science, and others

Audience: Iwi/hapū, young people, landowners, neighbouring residents, community restoration groups, environmentalists, teachers, and others with connections to the sampled lakes, regional councils, Department of Conservation (DOC) and Ministry for the Environment (MfE)

What: Lake sediments are natural archives that record environmental history, providing insights into current and historic aquatic communities and water quality. For this project a team of over 50 researchers undertook the most ambitious lake sampling programme in the history of Aotearoa, collecting samples from over 300 lakes. Researchers would only sample from a lake with approval from local iwi, community, and landowners. The samples revealed contemporary lake health, and the sediment cores taken enabled researchers to further understand the histories of each lake. In-depth engagement with iwi across the motu and weaving of mātauranga Māori alongside western science was a priority.

By traditional metrics, the impact of the project was high, with 50 publications in scientific journals, 26 technical reports, and over 130 conference or workshop presentations.

The Ministry for Business, Innovation and Employment (MBIE) awarded the Lakes380 research programme Gold Status, in recognition of its 'excellence and impact'.[3] The project also won the 2023 SCANZ Excellence in Science Communication Award.[4]

Communications and engagement: Lakes380 included their science communications and engagement staff from the outset, helping to shape the research process from start to finish. The cost of implementing MLSCE over the five-year course of the programme is estimated to be between $500,000 to $1 million, from a total project grant of $12 million.

Lakes380 team and community members sampling Upper Duncan Stream Tarn, Ruataniwha Conservation Park. Photo by McKayla Holloway

Building social license

The Lakes380 website allows users access to infographics describing key concepts related to lake health, and access to information where they can learn learn about 302 of the lakes sampled in the research programme.[5] The website was visited 90,500 times between 2020 and mid-2023.

The Land Air and Water Aotearoa website (LAWA) links to the Lakes380 website on their lake quality pages.[6]

The team also created an app that allows users to search for their favourite lakes, either by name or geographically using an interactive map, to check on its water quality.[7] Water quality information has been looked up on the app 16,000 times between 2020 and mid-2023.

Over the course of the programme there were more than 70 media articles, ending in a media campaign, which included feature stories over two nights on 1News[8] and a live interview on Breakfast. This campaign resulted in over 16 million views. RNZ also produced a two-part 'Our Changing World story'.[9]

Growing community for applied research

From the outset Lakes380's primary focus was fostering community engagement. In the first year, over 60 tailored presentations were delivered nationwide to seek approval from iwi/hapū to sample their lakes and to forge relationships to ensure ongoing participation. This initial engagement informed the preferred style of ongoing communication with that particular community. Iwi/hapū input was sought each time a lake information sheet was produced.

The team continued to grow relationships through regional lakeside knowledge-sharing events facilitating dialogue between iwi/hapū, the community, and the research team. These events served as platforms for locals to share their knowledge of the lake's history. They allowed the research team to communicate the science behind the programme by giving participants the chance to examine a sediment core retrieved from the lake, accompanied by 3D-printed pollen grains, offering a tactile understanding of the science and insight into the sediment's whakapapa.

At the end of the project regional councils and iwi were offered a hui or zui to share results on the lake/s of significance to them. Most regional councils and around 70 percent of iwi participated.

Informed decision-making

Tools developed by Lakes380 to estimate lake trophic status are being used by regional councils to plan their management effort as required under the National Policy Statement for Freshwater Management.[10] Surface sediment geochemistry datasets are helping lake managers control nutrient fluxes, and with the management of pest fish.

In partnership with Ngāti Koata and DOC Lakes380 developed and launched a virtual reality (VR) platform for Lake Moawhitu.[11] Informed by mātauranga Māori and biophysical data, viewers can travel backward and forward through time to gain a deeper appreciation of how lake, landscape and human interactions have changed over 1,000 years.

Ngāti Koata whanau engaging with Lake Moawhitu through the VR experience. Photo by Tim Cuff

Over 100 whānau attended the launch. Although the original target audience for the VR platform was Ngāti Koata whānau, it has proved popular across the wider population of New Zealand and has now been viewed nearly 3,300 times.[12]

Lake Stories Aotearoa New Zealand captures 24 video documentaries and nine audio stories that share the knowledge of mana whenua from three rohe (Wairarapa Moana, Rangitīkei and Otago) and insights from lake scientists.[13] It also ensures that 'shifting environmental norms' are not lost to future generations by preserving the memories of multiple storytellers.

Behavioural change

Data generated from sediment cores resulted in a transformational shift in how restoration plans are being developed - lake managers are now using the past to guide the future.[14]

Whānau who whakapapa to rohe in the Lake Stories documentaries can now connect with their lakes, their mātauranga-ā-iwi, and their history digitally, making it more accessible.

The true impact of the research findings and of the engagement with communities may not be felt for many years. The Lakes380 team believe their work is already shifting conversations about the value of lakes and their importance in the ecosystem of Aotearoa New Zealand. Communities are using Lakes380 information to advocate for the restoration of specific lakes, and regional councils are using the information to prioritise lakes with the most urgent need for protection and restoration.

Economic growth

Lakes380 scientists continue to develop fit-for-purpose eDNA tools for end-users, which are commercially available through Cawthron.

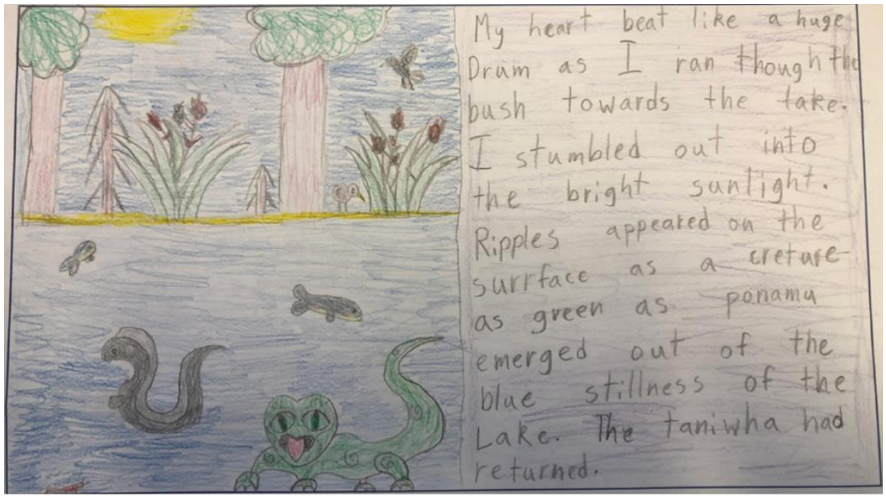
In its final years, the Lakes380 team made nearly $890,000 in revenue (mostly from consulting to regional councils) as a direct result of the programme.[15]

Capability building

Thanks to the community building efforts at the outset, scientists involved in the Lakes380 programme developed their engagement skills enabling them to 'push the limits in presenting science better'. Feedback from the researchers highlighted the positive impact created by seeing how their science affected communities.[16]

Science education outreach workshops were delivered to over 300 primary and intermediate aged school children (Years 5–8) in the Nelson/Tasman region. Workshops explored how researchers can use molecular biology and paleolimnology to understand the health and history of a lake, and then use the information to improve lake health and adopt better decision making for the future. This kaupapa was scaled nationally through the Science Learning Hub, with 12 Aotearoa-specific lake science units freely available to all.[17] These units have been used by more than 1,500 teachers in Aotearoa New Zealand.

The outcome of the outreach works included kids producing visualisations of future lakes. Their drawings had lakes surrounded by more native trees, with less algae, nutrients and pollution, no wastewater leaks, more fish, better swimming, and even a story where a taniwha returned to their lake.



One child's independent visualisation after a Lakes380 science outreach workshop. Photo with permission of Lakes380.

For an explanation of the following impact matrix, please see page 13.

Table 1: Impact matrix for Lakes380

	Business & industry	Local & Central Government	Specific communities	Wider science sector	Educators & students	General public
Building social license	■		■	■	■	■
Growing community	■		■		■	■
Informed decision making	■	■	■		■	■
Behavioural change			■	■	■	
Economic growth		■		■		
Capability building			■	■	■	■

Introduction

As this report is written in May 2024, the science system in Aotearoa New Zealand is in flux. While stressful for those involved, this instability also provides an opportunity to consider new structures aimed at improving science impact and collaboration. In particular, the formal recognition of mission-led science communication and engagement (MLSCE) has the potential to be incorporated into new structures.

Background

In early 2024, the Science Communicator's Association of New Zealand produced a brief on MLSCE for the incoming minister.[18] The briefing was written by Annabel McAleer (Our Land and Water National Science Challenge), Kati Doehring (Cawthron Institute) and myself, Ceridwyn Roberts. I am a freelance science communication consultant with experience across a wide variety of mission-led science programmes.

The Prime Minister's Chief Science Advisor (PMCSA) offered me a fellowship with the office to explore best practice of communication and engagement involved in mission-led science across the current New Zealand science system. In compiling this report and the case studies illustrating elements of MLSCE, I interviewed directors and communications and engagement staff across the National Science Challenges, Centres of Research Excellence (CoREs), Endeavour Projects and other mission-led, science focused organisations and programmes in New Zealand.

This report does not claim to be an examination of Kaupapa Māori led research and the engagement and translation work that happens within this context. There are many phenomenal examples of excellence in MLSCE within mātauranga Māori and community-led research that I am ill-equipped to narrate. I hope that an examination of this work can occur in the future as there is huge benefit to everyone involved and to New Zealand as a whole.

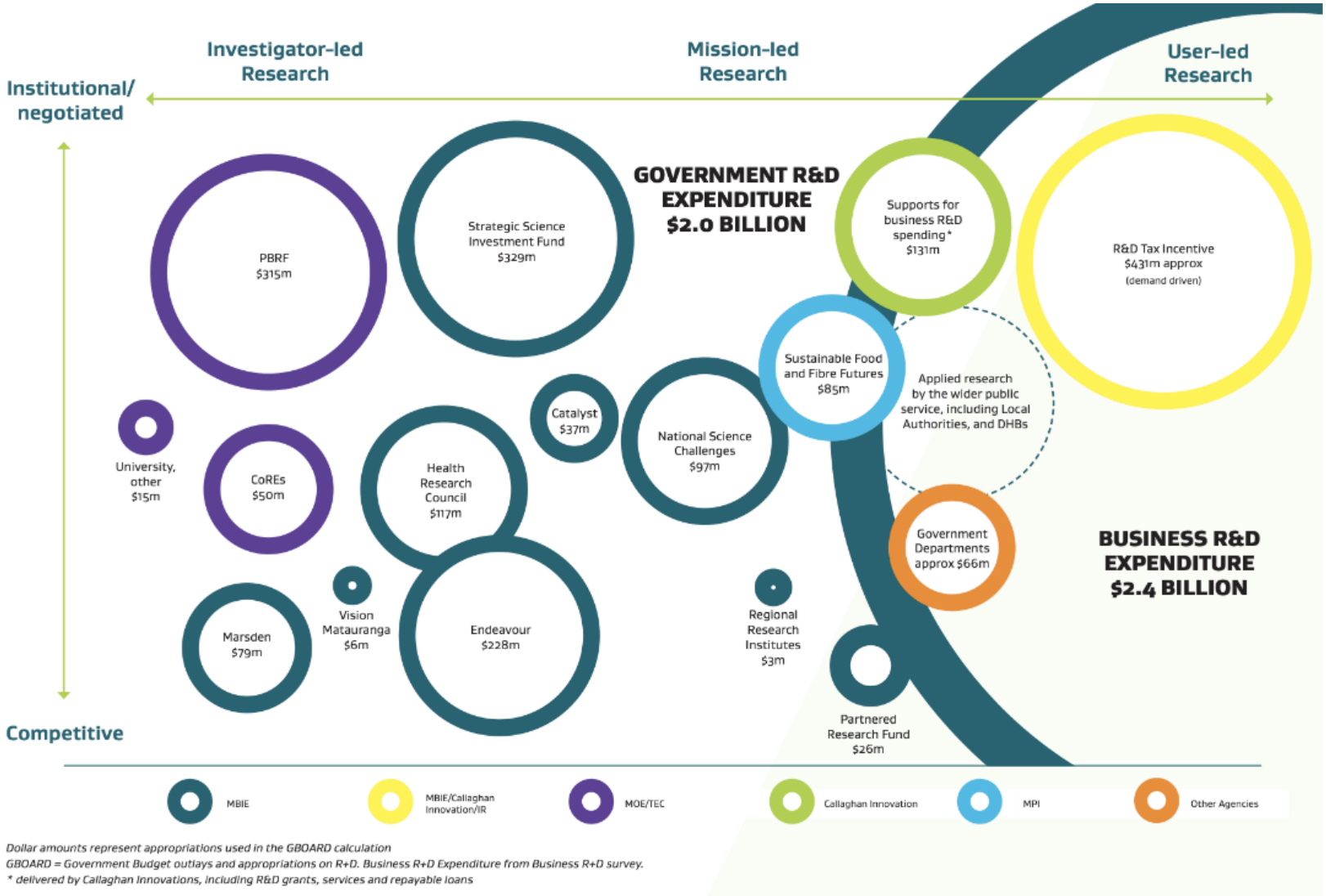
What is mission-led?

This report defines mission-led science as a collaborative, transdisciplinary, multi-organisational approach to solving 'big picture' problems and creating impact. Figure 1 details the science funding 'buckets' as at July 2021.

While the CoREs are not defined as mission-led in this figure, during interviews, I identified projects from some CoREs that fit the definition. The report therefore provides case studies funded through the following 'buckets':

- National Science Challenges
- Endeavour Fund
- Strategic Science Investment Fund
- Health Research Council (HRC)
- CoREs

Figure 1: New Zealand's Science Funding System (2021) Image credit: Ministry of Business, Innovations and Employment[19]



The value of science communication and engagement

There is a common belief that if someone truly understands the scientific findings and the impact on humanity, they will immediately change their behaviour. Unfortunately, this is rarely the case. Part of the role of science communicators and engagement specialists is to understand, engage with, and then address pre-existing beliefs, concerns, values, and emotions of a target audience. Creating impact is impossible without trust in the science, the researcher, and the process. This trust is only possible when research is relevant and accessible.

Traditionally, science communication is seen as translation that explains science to non-scientists.[20] This one-way translation encompasses communications work such as media releases, social media, education and outreach materials, and other material that raises general public awareness.

Figure 2 shows how a broader participatory approach to science and its communication began in the mid-1980s.[21] From this point science communication academics began to stress the importance of dialogue with the public.[22] With the incorporation of Vision Mātauranga into science funding, a further shift occurred away from one-way translation.

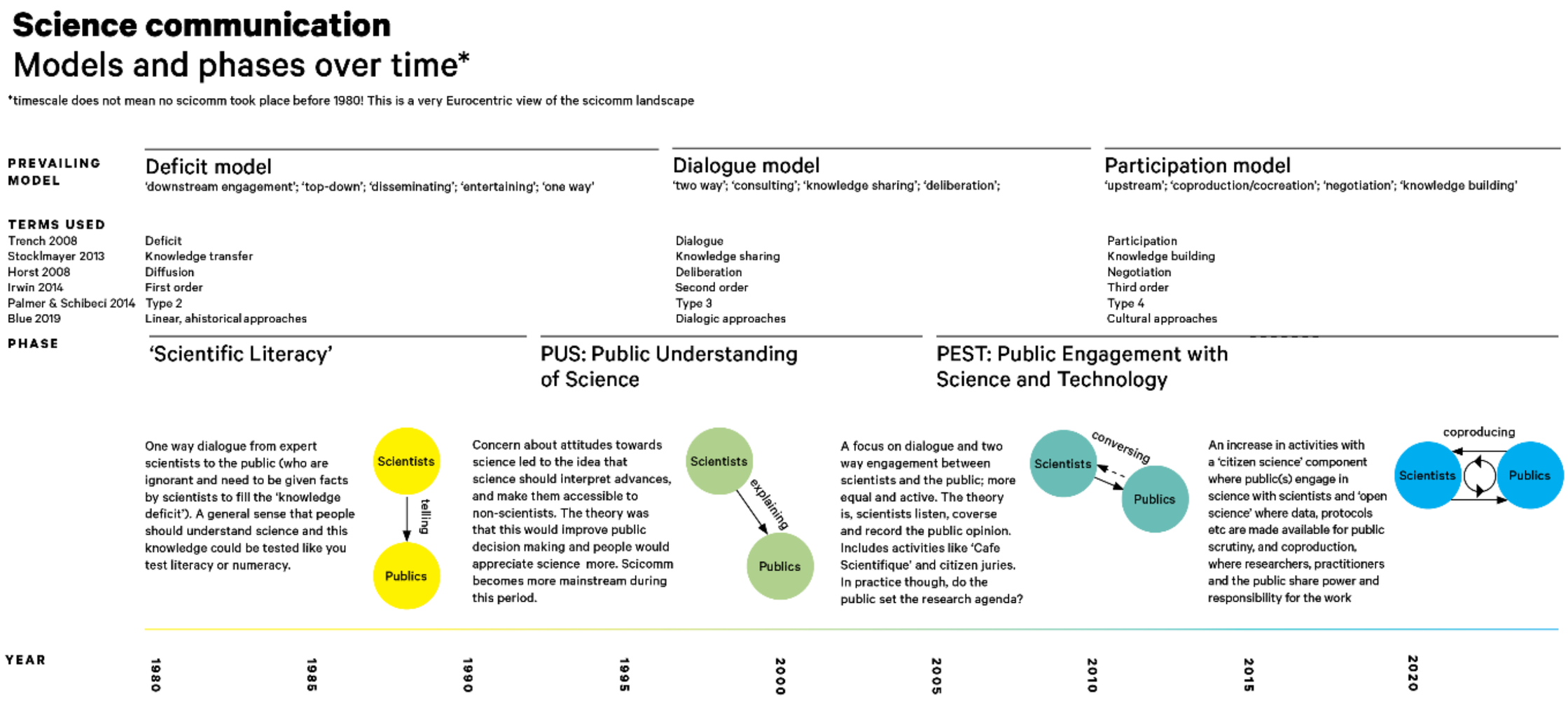
"Vision Mātauranga thus allowed communities, and the knowledge and potential therein previously disconnected from the science sector, to become fully engaged in science and technology." – Fleming et al (2020)[23]

The mission-led element of MLSCE requires the use of these traditional channels in combination with two-way or multi-directional translation between researchers in different disciplines and institutions and diverse audiences. This kind of translation is designed to assist equity as it allows all participants, including scientists, to cognitively engage.[24]

Audiences for this multi-directional translation include:

- communities and individuals affected by the issues being researched;
- those able to implement research findings in policy;
- businesses or industries able to apply or wishing to buy research outputs;
- potential funding or investment partners;
- researchers in different disciplines within the programme; and
- other researchers working externally to the project on related research.

Figure 2: Participatory approach to science communication Image credit: Jo Bailey[25]



The role of science communicators and engagement specialists

The impact of MLSCE is multifaceted and does not always fit well within discrete silos. For the purposes of this report, I have defined impact across six specific outputs. These outputs are based on the foundation of Bloom's taxonomy of educational learning objectives[26] and have been refined within the context of MLSCE through contributions from Dacia Herbulock, Director of the Science Media Centre and Nicola Gaston, Co-Director of the MacDiarmid Institute.

- Building social license (includes branding, awareness, community acceptance and trust).
- Growing community for applied research (includes relationship building, community participation and responsiveness to community/industry needs).
- Informed decision-making (personal, local, regional, national, international).
- Behavioural change.
- Economic growth (commercialisation of new products, aiding industry by solving problems, improving productivity, safeguarding reputation).
- Capability building (education in schools and universities, as well as within the science community, the impacted community, and project team).

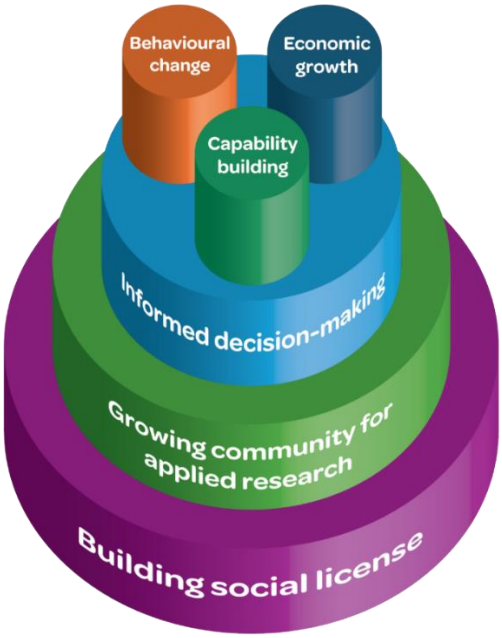


Figure 3: Impact outputs: Graphic by Stephen Reid, Ramp

The first three impact outputs build upon each other; without social license it is difficult to make connections with any specified community, without trust built through relationships it is difficult to create a platform for informed decision-making that will lead to behavioural change, economic growth and building capacity.

The last three impacts take the most time to achieve and are long-term investments. Each of the impact outputs require specific and specialised communications and engagement skills. Some of the skills are ubiquitous, extending across all six outputs, and some are applicable to just one or two outputs.

Impact matrix

In the case studies provided in this report I have used a matrix to show where the programme discussed has had impact for specific audiences. The filled in squares in the matrix are an indicator that that case study has had an impact for that audience in that output. It is unlikely that any project would produce a full matrix, as audiences for research differs along with the desired impact.

Table 2: Sample impact matrix

	Business & industry	Local & Central Government	Specific communities	Wider science sector	Educators & students	General public
Building social license						
Growing community						
Informed decision making						
Behavioural change						
Economic growth						
Capability building						

Why science needs dedicated mission-led science communicators and engagement specialists

Māori communications and engagement

Mātauranga Māori acknowledges that power dynamics change when collaborations are formed between researchers and indigenous peoples that involve sharing with and learning from each other. This style of collaborative learning is known as 'Ako', meaning two-way learning relationships. [27]

"Ako processes place at the forefront the guiding principles of dignity and mana (prestige) of all those engaging in the collaboration process. The key principles of Ako emphasise the learning environment via maintaining the mana of all participants." – Perrot (2016)[28]

There is much for MLSCE specialists to learn from mātauranga Māori in growing the impact of science.

"Putting Māori values at the core of the Challenge was good for supporting inclusive, interdisciplinary, collaborative research. This is exactly the sort of research that mission-oriented innovation systems are expected to support, and that are expected to be good for producing science with impact." – Hazel (2024)[29]

Mission focus

General communications staff (not attached to specific research projects) are budgeted as 'overhead' within institutes. They have many demands on their capacity and must prioritise the needs of their organisation first. Often, they have no resource or incentive to promote research that occurs across institutions and their performance is assessed against organisational priorities (e.g. attracting students or building their institute's profile) rather than their contribution to research outcomes and impact. Multi-directional translation work for science across multiple institutions does not fit easily within the remit of organisational communications staff.

MLSCE specialists can act with more autonomy than institutional communication teams, as they do not report to boards focused on reducing corporate and reputational risk. This enables MLSCE specialists to help scientists with advocacy. This might look like advocating for policy changes, or advocating for behavioural change at an individual or industry level.

MLSCE specialists can work with researchers who don't have access to institutional communication teams, e.g. independent or community-based researchers, iwi and hapū mātauranga experts, or researchers based at small whare wānanga.

Finally, MLSCE specialists are in a unique position to develop a broad picture of research taking place across programmes and institutions and how this research fits together. This contextualised view may not be available to institutional communications, who are accustomed to prioritising the role of their own institution in the research landscape. MLSCE specialists can therefore help institutional communications by 'joining the dots' with other research taking place in the sector and help create synthesis in both reports and collaboration.

Specialisation

Communicating effectively and efficiently is hard. The conceptual and technical skills needed to plan, develop, implement, and evaluate MLSCE activities are different from those needed to succeed in science. To use a basic example, many researchers would struggle to write a media release that was appealing and useful to journalists and many science communicators would find writing and appropriately referencing a journal article difficult.

It is important to build the communication and engagement skills of researchers. However, just as science communicators and engagement specialists are not trained scientists, the majority of researchers do not have the specialised skills or time to take on audience research, multi-directional translation across a variety of disciplinary outputs, or strategic communications and engagement planning and delivery. The contributions of science communicators and engagement specialists are a unique and important value-add to mission-led science.

What mission-led science communicators and engagement specialists do

Science communicators and engagement specialists are representatives and advocates for the end-users of the research. Their specialist expertise stems from their ability to bring a wider perspective, one that is not captured by any specific organisation or discipline involved in the project and one that is often not well understood by the researchers.

In the absence of a simple explanation for researchers of what MLSCE provides, I constructed a list of the work done by MLSCE specialists. This was refined by input from Allanah Robinson (GoodSense), Annabel McAleer (Our Land and Water National Science Challenge), Catherine Kirby (Eco-index), McKayla Holloway (Cawthron Institute), and Caitlin Carew (Resilience to Nature's Challenges National Science Challenge).

MLSCE work can be split into four different areas:

- Strategy
- Translation and engagement
- Support and administration
- Measurement

Strategy

Specialists working in communications and engagement can be vital in elevating uptake and impact of research when they are included at a strategic level. At the beginning of project planning, MLSCE specialists can work with scientists to understand what outcomes and impact are intended, including working to craft and hone the mission and values of the project. It is also at this point that they identify the end user of the research and to plan for how they can best be engaged.

MLSCE specialists bring an understanding of the systems in which end-users work to this audience identification. This includes identifying who has the power to make a change with the science, who needs this information to make better decisions, and when this should occur for the greatest impact. Examples of relevant systems include the legislative and political process, curriculum development, commercial funders, media, etc.

Once a project is underway, strategic MLSCE involves:

- keeping the mission and outcomes of the project clear, and front and centre of all external and internal interactions throughout the project;
- helping identify pivot points and changes in end-users and messaging;
- identifying the most appropriate type of material or content for the audience (e.g. podcast, workshop, wānanga, interactive map);
- engaging with end users to evaluate usefulness of the developing science and feeding this into science work plans; and
- managing strategy for approaching sponsors and any commercial partners.

At the end of the project, science communicators should also be able to provide syntheses of the research across disciplines and organisations that are useful for the different end users of the research.

Translation and engagement

At its heart, science communication involves identifying stories of change and (sometimes) triumph that connect to the hearts and minds of everyone involved in the project. Throughout the life cycle of the project MLSCE brings a focus on practical implementation and real-world implications to the science. Ideally, this might inspire non-science audiences to engage with science and, where needed, to be part of (or run) projects.

Science communicators

For science communicators translation may need to be more broadly focused than simply using plain language words on paper. It involves finding appropriate, and sometimes innovative, ways to reach targeted audiences while simultaneously enhancing the uptake and impact of the research. Science communicators act as creative directors for communications materials, so that creative vision and science can mesh into something useful, appealing, and beautiful.

There is a growing need for science communicators to work with and translate complex data for specific audiences. Several of those interviewed mentioned that there is a need for capability building in this area.

Other elements of science communication translation include:

- combatting mis and dis-information;
- bridging gaps when journalists are stretched;
- finding a way to communicate when the topic is 'unsexy' or findings are unpalatable; and
- addressing misleading narratives and ensuring accurate interpretation of findings.

Engagement specialists

The key focus for engagement specialists is ensuring that affected communities are represented within the research and that scientists understand the needs and values of those communities. Facilitating the building of trust in both directions is not something that has an end date. Both science communicators and engagement specialists build audiences and can initiate collaborations or partnerships with other organisations through their understanding of the wider social and research landscape.

Support and administration

Although this aspect of MLSCE is less strategic, there is a considerable amount of skill involved. Key in this area is working to become trusted advisors for researchers. This often involves supporting researchers in expanding their own communication skills (such as rehearsing for media interviews or helping with presentations to policy folk) and helping quiet voices be heard.

More practically it also includes:

- communications channel management (e.g. media, social media, websites, newsletters);
- event management;
- project management of and budgeting for content production and delivery; and
- project management of and budgeting for authentic engagement and relationship building.

Measuring and reporting

Elements of measuring and reporting on mission-led science are a focus of science communication and engagement specialists as a project wraps up. Measurement from a MLSCE perspective includes:

- writing reports summarising workshops, wānanga, and stakeholder meetings;
- media monitoring and analysis (including linguistic and attitudinal analysis);
- recording statistics on engagement across the project (both quantitative, e.g. meetings with government, and qualitative, e.g. stories from those affected by the research);
- survey design, analysis, and response at varying stages of the project to identify attitudes, questions, challenges, and impact; and
- writing case studies and research synthesis documents that encompass the lessons or impact of the project.

Measurement of mission-led science communication and engagement impact

Mission-led science is engaged in making the world a better place. The impact of research findings and of the engagement with communities may not be felt for many years, particularly if the goal is behaviour or legislative change. Because of this time-lapse it can often be difficult to pinpoint a specific cause of change—as change is often brought about by a sequence of inter-related events and research or consequential shifts in public values.

Traditional western assessment practices rely heavily on quantitative and largely journal-based metrics. The impact of mission-led science is also not well-captured in traditional science measurement where narrow quantitative measures such as media mentions and social media follows do not adequately encompass the true impact of MLSCE.

"…it is almost impossible to know with any certainty that a specific decision made by an individual or group results from a specific encounter with relevant information." – National Academies of Science (2017)[30]

Work is being done around the globe on ways of evaluating indigenous methodologies. Aotearoa New Zealand is uniquely able to call on kaupapa Māori research evaluation, based in whakapapa and traditional ontology. Two Māori interviewees were keen for the work done by Nan Wehipeihana to be included in any examination of science measurement in Aotearoa New Zealand.[31]

An international conversation about measuring science success and impact is well underway.[32] [33]

"…transdisciplinary approaches... take time and require genuine non-academic stakeholder engagement… in transdisciplinary research, the research protocol is not defined a priori but emerges in the course of the dialogue with stakeholders." – YA-IAP-ISC (2023)[34]

With the move to a more collaborative and narrative approach to measuring science impact, comes the opportunity to revisit MLSCE as an integral part of transdisciplinary, multi-institutional mission-led research.

"Asking scientists to show impact to receive credit for communication could lead to the development of organizational mechanisms—including teams that include both scientists and communication strategists and tacticians—aimed at ensuring communication quality." – Besley (2020)[35]

Some suggestions of how to measure MLSCE outputs follow in Table 3. These suggestions are the result of the conversations and interviews undertaken for the report and from my own experience.

Table 3: Measuring the impact of MLSCE

Output	**Quantitative**	**Qualitative**
Building social license	• Media mentions • Web and social media numbers • Survey pre- and post-project	• Linguistic and attitudinal analysis of media outputs
Growing community	• Number of meetings • Meeting attendees • Requests for information/material • Newsletter recipients	• End-user and scientist interviews • Narratives of connection • System mapping • Ongoing connection with communities
Informed decision making	• Mentions in policy documents • Scientist inclusion in working groups • Number of policy/ministerial meetings • Regulation change	• Social narratives • Case studies • End-user interview • System mapping
Behavioural change	• Identifiable shift in outcomes (health, environment, economy, etc.) • Action from affected communities	• Social narratives • Case studies
Economic growth	• Money saved • Sales • Patents	• Stories from business • Stories from customer
Capability building	• Number of scientists trained • Change in media mentions over time	• Interviews • Case studies • Ease of ongoing connection with affected communities

Resourcing the inclusion of science impact

To maximise the benefits of science to society, it is important to resource the routes to impact adequately. Creating inclusive, interdisciplinary collaborative teams and including wider stakeholder participation requires resources.

Within Aotearoa, applications to the HRC are required to provide a description of how an applicant's research might be used and the anticipated benefits for New Zealand; and an action plan to maximise the use and benefits of research. It explicitly states that:

"Research impact is generated or enhanced by communication, relationships and actions that connect academic research to fields, people or organisations beyond academia." – HRC website[36]

Internationally, applicants to the Horizons Europe Fund must include a communications partner in their consortia and all proposals must include a draft dissemination, exploitation, and communication plan.[37]

The Alliance Advantage fund of Canada's Natural Sciences and Engineering Research Council requires applicants to explain how the project will reach—

"…beyond the partner organizations to impact society. Describe the ways in which interested individuals or groups will be able to learn about and use the products, services or policies that stem from this research." – NSERC website[38]

Several interviewees mentioned the need for better mechanisms for synthesising and connecting science with decision makers. The Chief Science Advisor system is excellent, but there were also suggestions to introduce a government-wide organisation that exists to filter research and identify research gaps, such as the What Works Network in the UK.

Impact output case studies

The remainder of this report examines the role of science communication and engagement in mission-led science and provides 12 contextualising case studies grouped according to the six MLSCE outputs. Each case study may have impact in other output areas, as is shown by the matrix at the end of each case study.

The case studies represent a wide range of programme funding and mission goals. These were compiled through interviews and from material provided by the researchers and communications and engagement staff involved.

The case studies included are by no means exhaustive as the number of excellent projects that could have been included was very high. .

Building social license

Science communication is more important than ever in a climate where mis- and dis- information are rampant. This is likely to be compounded by the state of the mainstream media, which is haemorrhaging journalists and journalistic platforms.

A recent report by the New Zealand Security Intelligence Service describes New Zealanders living in 'a hyper-active information environment in which disinformation can spread rapidly' with 'human and cyber-enabled foreign interference and espionage, seeding disinformation'.[39]

In this environment, MLSCE must generate public interest, support, and enthusiasm for scientific advancements. Building social license through positive publicity is necessary if research is to encourage a shift in mindset and subsequent implementation. It is also necessary to ensure taxpayer support of science.

How social license is built through MLSCE: branding, awareness raising through traditional media, social media, and other publicity.

Social licence case study 1: AF8 Roadshow

Mission: We can't predict earthquakes, but we can prepare for them.

Project: AF8 [Alpine Fault Magnitude 8][40]

Organisations involved: Local and National Emergency Management, QuakeCoRE, Resilience National Science Challenge

Audience: South Island communities

What: A 2021 survey monitoring levels of awareness and preparedness for disasters in New Zealand found 85 percent of New Zealanders have a high understanding of disaster risk.[41] However, only 13 percent are considered fully prepared if a disaster was to strike today.

AF8 aims to share Alpine Fault hazard and impact science and preparedness information widely. The goal is to increase awareness, enable conversation, and build societal preparedness to natural hazard events in the South Island. AF8 regularly seeks feedback from its partners, stakeholders, and communities to inform the programme's own focus areas, activities, and outputs.[42]

AF8 brings together emergency managers, scientists, policymakers, practitioners, and communities to build capability for earthquake readiness and response. It acts as a conduit for the direct application of Alpine Fault related research to support policy and practice.

Communications and engagement: The *AF8 Roadshow: The Science Beneath Our Feet* is the central communication and engagement initiative of the AF8 Programme.[43] With a science communicator/designer at its helm, it takes a design-led approach to public education and aims to support communities to move from hazard awareness to emergency preparedness. The itinerary of the Roadshow is now driven by local emergency management groups, who select the locations and engage with the relevant communities, deepening local relationships.

The Roadshow includes both public talks and school visits. Presentations generally feature an adapted version of a credible science scenario for a seven-day response period after a magnitude 8

Alpine Fault earthquake using graphics developed by AF8 researchers. Key information is communicated via animation. A narrative sequence identifies the hazard, then outlines the potential impacts and secondary consequences, before finishing with locally specific information and preparedness messaging. The presentations are followed by Q&A sessions that last for up to two hours 'or as long as the hall is booked for.'

AF8 also supports individual public talks for specific groups and community resilience projects including marae and whānau preparedness wānanga around the South Island.

AF8 Roadshow public talk at Kokatahi in 2021, where 170 people showed up and the talk was relocated to a basketball court to enable everyone to fit in. Photo: AF8 Programme

Impact: In total more than 20,000 people have attended more than 400 public talks through the AF8 Roadshow since the programme began in 2016.[44] The two-way conversations in the public presentations are crucial to the interpretation of risk at a local level and often continue well beyond the meetings in the form of follow-up emails and social media. They have resulted in the formation of local networks and preparedness planning.

In several smaller rural centres, a school visit combined with a public talk can engage a large percentage of the local population in Alpine Fault hazard and preparedness information in one day. For example, in 2023, in Lake Rotoiti the AF8 Roadshow engaged ~75 percent of the local population in Alpine Fault hazard science in one day.[45]

"My class was fully engaged in exploring the wide range of activities and information as it was presented in a way which really hooked them. They were able to build a much stronger understanding in a short period of time as the roadshow makes connections with the way children learn best. The presenters were fantastic! The experiments, explanations, choices of what they showed the different age groups. The best science-based opportunity I have had as a teacher too." – Teacher[46]

The programme delivers clear returns on investment, for example the community engagement and stakeholder planning carried out to prepare the region for an Alpine Fault earthquake resulted in an effective and efficient response to the 2020 Southland Floods. Communities were prepared, knew what to do to support each other and how to connect into the wider emergency management response.

There is global awareness and interest in the AF8 Programme, with the USA's National Oceanic and Atmospheric Administration (NOAA) and overseas universities reaching out for advice on public education tools.

Table 4: Impact matrix for AF8

	Business & Industry	Local & Central Government	Specific communities	Wider science sector	Educators and students	General public
Building social license						
Growing community						
Informed decision making						
Behavioural change						
Economic growth						
Capability building						

Social licence case study 2: NZ SeaRise Map

Mission: Making New Zealanders aware of how much and how fast sea level will rise along their own stretch of coast and in their neighbourhood.

Project: Endeavour Fund: NZ SeaRise: Te Tai Pari O Aotearoa Programme[47]

Organisations involved: Antarctic Research Centre, GNS Science

Audience: General public and planners

What: After a five-year programme of research, the NZ SeaRise programme released location specific sea-level rise projections out to the year 2300 for every 2 km of the coast of Aotearoa New Zealand in May 2022. These projections are accessed through an online tool that allows users to click on a particular location on the coast and see how much sea level is expected to rise, and by when, under different climate change scenarios.[48]

Communications and engagement: The NZ SeaRise team developed the projections map in consultation with a data expert, a science communication specialist and a group of stakeholders from government and industry.[49]

The map was designed to include qualitative information about people and their stories, including locally specific illustrations, stories from historic and recent newspapers, and case studies. It also directs users to simply written information about the science involved in the projections. Users can add additional context, such as marae, council boundaries, bridges, and runways. The map was

supplemented by information on the NZ SeaRise website, including videos, frequently asked questions, and fact sheets.

The media plan developed by the science communicator involved finding location specific angles for each media outlet's audience, e.g. the Southland Times was provided with information on Tiwai Point and the New River Estuary. The angles focused on people already taking action on sea-level rise. Programme members also spent three months prior to the launch working with data graphics experts and science journalists at *New Zealand Geographic*[50] and *Stuff.co.nz*[51] to ensure the richness of the data available was conveyed in engaging, visually striking and accurate ways.

Impact: The online tool is referred to in the MfE Coastal Hazards and Climate Change Guidance and users are advised to use the projections for planning and decision-making.[52]

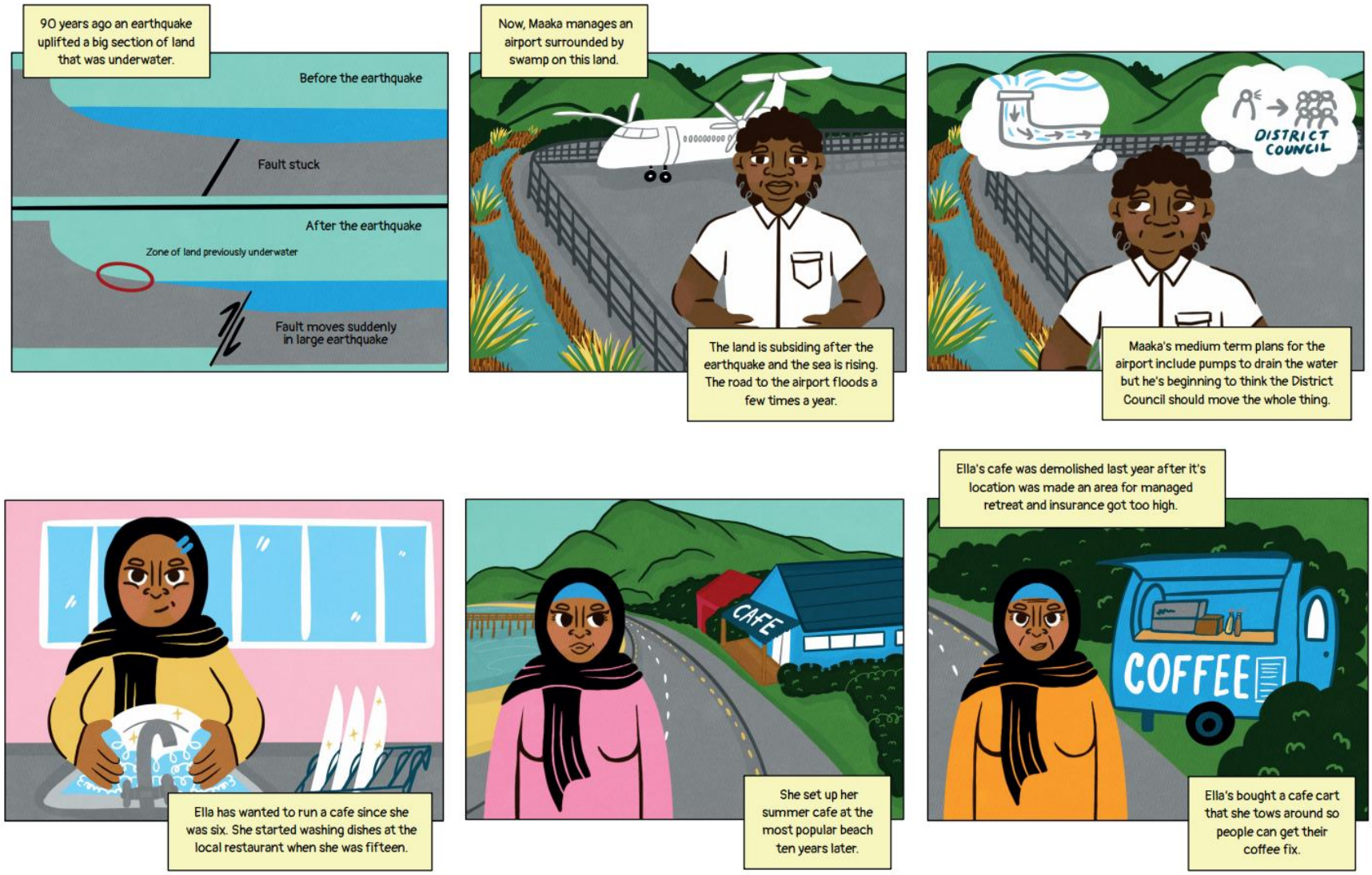
During the launch month, Google searches showed that public interest in New Zealand in 'sea-level rise' was more than 400 percent higher than at any other time in the previous decade.[53]

In the two weeks after the launch, there were 235 unique media stories on the SeaRise information. Overall, there was a nuanced and complex telling of the sea-level rise story.[54] New Zealand media coverage of sea-level rise tended to avoid worst case scenarios in favour of likely scenarios. And while sentiments were still heightened, words such as *catastrophic*, *doomsday*, and *apocalypse*, which often feature in media coverage of climate change and sea-level rise, were less or not apparent.

Rather than focusing on how much sea level would rise by a certain date, stories focused on the impacts of sea-level rise. And rather than focus on one or two very vulnerable locations, the media coverage covered the nation. Local media used the map and interviews to provide media coverage on the impact of sea-level rise on their coastal settlements and infrastructure.

Table 5: Impact matrix for NZ SeaRise

	Business & Industry	**Local & Central Government**	**Specific communities**	**Wider science sector**	**Educators and students**	**General public**
Building social license						
Growing community						
Informed decision making						
Behavioural change						
Economic growth						
Capability building						



Illustrations by Kimi-Moana Whiting for the NZ SeaRise Programme

Growing community for applied research

At the core of communication is trust in the relationships between partners and with communities. When you lose the trust of your communities, there is often no way back. We can see this happening in real-time, throughout the world, with the lack of trust communities are expressing in the mainstream media.

"…research also indicated that the target audience would be more open to this information if presented by someone identified from the local community, rather than an "expert."" – Nisbett & Markowitz[55]

The aim of MLSCE for growing community is to:

- connect scientists with communities who will use their research;
- help stakeholders and end-users who are not scientists to collaborate with researchers, so the research and its findings are fit for purpose and induce less stakeholder fatigue; and
- empower communities.

"Bringing together a range of voices, knowledges and interests, and involving next-users and end-users, increases the likelihood that resultant solutions will be fit for purpose." –NSC Directors Report[56]

It is important to note that engagement is participatory allowing the community in question to be part of the team and actively contribute.

"It requires building new relationships, establishing trust, and discovering who the influencers or advocates are within different organisations and communities… Scheduling meetings, sharing in cultural and institutional conventions such as coffee meetings and lunches, writing one-page briefings for a manager, and organising stakeholder events take time. This work can be hard to quantify or justify in terms of outputs in the first year of starting but over time will prove invaluable and can lead to ambitious and innovative collaborations." – Salmon & Goven (2022)[57]

How community is grown through MLSCE: engagement plans, identification of communities, building relationships, ongoing connection, two-way translation

Growing community case study 1: Engaging with the Pacific Rainbow+ community

Mission: Enhancing the mana of Pacific Rainbow LGBTQIA+ MVPFAFF+ communities in Aotearoa New Zealand through research.

Project: HRC Grant: Manalagi project[58]

Organisations involved: University of Auckland, F'INE Pasifika Aotearoa

Audience: Pacific Rainbow+ communities

What: Both Pacific and Rainbow individuals face stigma as a barrier to their health and wellbeing in New Zealand.[59] Previous surveys that attempted to profile this community suffered from a low turnout rate. The Manalagi Project was designed to turn this lack of data around by empowering Pacific Rainbow communities to help co-design health policy and services through research.[60] The

project also wanted to ensure visibility of Pacific queerness that had never been captured in research. This included acknowledgement of MVPFAFF+ identities. MVPFAFF+ stands for Mahu (Hawai'i and Tahiti), Vaka sa lewa lewa (Fiji), Palopa (Papua New Guinea) Fa'afafine (Samoa) Akava'ine (Rarotonga), Fakaleiti (Tonga), Fakafifine (Niue). Other terms include Fakaleiti, Rae rae, and Fafafine.

Communications and engagement: The project ethos was to be co-community driven, embedded and owned. The project would have been 'impossible' without the support of the F'INE Pasifika Aotearoa-Trust as community partners building a community base of support. The Manalagi team held 11 community consultation sessions with nearly 350 Pacific Rainbow+ individuals and their allies around what information was needed. A draft survey based on previous research was taken to the community for feedback and further co-design. Participants talked about their concerns, named specific issues they thought should be researched, detailed their dislikes about surveys, and dissected the language used.

Following ethics approval and a community survey testing period, the co-community designed Manalagi Survey went live during Auckland Pride Month. Open to members, allies, and friends of Pacific Rainbow+ communities across New Zealand, the survey was accessible for seven months.

In the final phase, members of the research team collected and shared narratives of community members through talanoa. The purpose of this phase was to supplement the quantitative data with the nuance of qualitative knowledge. Talanoa were held with 62 individuals, both in person and via Zoom.

Manalagi Project Te Tai Tokerau talanoa in Whangarei Photo: Manalagi Project / Patrick Thomsen

Complementing the research and talanoa, a grass roots social media campaign using community ambassadors, built ongoing community engagement and a platform for sharing the results.

Impact: 756 people participated in the Manalagi survey, surpassing the initial goal of 500-1000 respondents. Of the recorded responses, 482 identified as a member of the Pacific Rainbow+ community or were questioning their gender or sexual orientation/identity. This represents the largest sample from a survey that has centred Pacific Rainbow+ individuals in New Zealand.[61]

"It's the sacred aspect in encouraging pride in ourselves for me. The pointing upwards, bringing the heavens into our horizon. It means this project is being guided by a vision. I love the fact that it is built in relation to the heavens and is connected to the stars because it draws in navigation, an important knowledge and technology of our ancestors. This is a journey, a path and builds forward momentum, it is inclusive." – Community practitioner

After community feedback that there 'was no Pacific rainbow research', the project evolved. The project expanded to establish a television series, a 2-day symposium, an online repository for research findings[62], and a collaborative project with Te Papa Tongarewa including an upcoming book. The expansion underscores a central concern shared across Pacific Rainbow+ communities in New Zealand: the issue of erasure. Though the Manalagi Project was rooted in research, it simultaneously sought to enhance the overall wellbeing of Rainbow+ Pacific communities by addressing this pervasive invisibility.

Table 6: Impact matrix for the Manalagi Project

	Business & Industry	**Local & Central Government**	**Specific communities**	**Wider science sector**	**Educators and students**	**General public**
Building social license						
Growing community						
Informed decision making						
Behavioural change						
Economic growth						
Capability building						

Growing community case study 2: Wānanga Paetukutuku

Mission: to grow and enhance excellent Māori researchers and Māori-led research that together build the foundations for flourishing Māori futures.

Project: [Ngā Pae o te Māramatanga Centre of Research Excellence](#)[63]

Audience: researchers, iwi, hapū, local and national government, and community groups

What: With 22 years of building relationships at their heart, Ngā Pae o te Māramatanga (NPM) is one of Aotearoa's original CoREs. NPM positions itself as a conduit of information and communication, ensuring that researchers are appropriately connected with Māori communities in a timely and collaborative manner. NPM researchers do not consider themselves separate from the wider community, rather they are a fundamental resource to the communities that they are, more often than not, members of.[64]

An example of growing community for applied research is NPM's Paetukutuku webinars, where researchers from each of NPM's individual partner organisations can interact with people in their wider communities on specific topics.

In response to the catastrophic effects of Cyclone Gabrielle and previous events, NPM held a webinar in May 2023 to discuss what regions needed to recover from extreme weather events.[65]

A screenshot of the webinar with Hera Ngata-Gibson showing footage from Uawa Tolaga Bay in Cyclone Gabrielle.

NPM knew Māori communities were adversely affected, but their voices appeared missing when it came to governmental response. NPM researchers wanted to hear directly from communities about what was happening on the whenua in order to hone their future research and find community partners.

Communications and engagement: The community's trust in NPM meant sourcing knowledgeable panelists with lived experience of recent extreme weather events was straightforward. The five speakers were community leaders at the front and centre of the response, Joe Te Rito (Ngāti Hinemanu), from Ōmāhu; Hera Ngata-Gibson (Te Aitanga a Hauiti), from Uawa; Willie Te Aho (Te Whanau a Apanui), from Raukokore; Meihana Watson (Ngāti Hinemanu, Ngāi Te Upokoiri) the Chair/Piringa of Ōmāhu Marae; and Kelly Stratford, Deputy Mayor of the Far North District Council. The panel told stories and identified issues of local and national significance facilitated by NPM research leader, Shaun Awatere (Ngāti Porou).

Impact: Nearly 400 people from a wide variety of organisations—including local and national government, iwi, hapū, and community groups—registered, alongside researchers across the country. Those unable to attend were sent links to the webinar recording. Attendees were given a chance to ask questions and the post-panel discussion lasted more than 45 minutes.

"Firstly though, we had to understand what the issues were, so the local knowledge was invaluable. We needed to address the issues, which included fixing the culverts to maintain the drains. We did it ourselves and when we got smashed [by Gabrielle] the work we'd done pretty much protected our part of the papakāinga." Hera Ngata-Gibson

NPM is aware of a variety of research projects, collaborations, and connections that have come about as a result of this webinar, including work on insuring marae, the impact of slash, and marae as the source of community support post-disaster.

Table 7: Impact matrix for Paetukutuku webinars

	Business & Industry	Local & Central Government	Specific communities	Wider science sector	Educators and students	General public
Building social license						
Growing community						
Informed decision making						
Behavioural change						
Economic growth						
Capability building						

Informed decision-making

Mission-led science is aimed at creating positive change, some of which require regulatory or other government intervention. Policy developers vary in their science-related capabilities and need to have scientific information interpreted and validated by trusted sources.

Science communication aims to present research to policymakers in a way that contributes to clear, evidence-based policy-making and implementation. This includes ensuring the correct policy developers are involved or informed as well as translating research findings into language and outputs useful for policy. A significant element of MLSCE in this area is the synthesis of research in areas of interest that is condensed into short, easy to digest information with excellent referencing.

While science communication for informed decision-making is often targeted at policy-makers and politicians, it can also aid business, iwi, hapū, community, and industry in making choices.

As an example of the impact MLSCE can have in this area, the BioHeritage National Science Challenge recently conducted an analysis and found that 40 percent of BioHeritage publications were cited in at least one policy document. This is significantly higher than comparable biodiversity research in New Zealand (around 20 percent) and also significantly higher than citations by BioHeritage authors prior to their BioHeritage work.[66] BioHeritage puts this impact down to a shared understanding of the mission and a focus on building diverse, collaborative teams. It also acknowledges the impact of science communication in their outputs, including a change in focus to more accessible outputs and the impact of improved relational skills for researchers.

How informed decision-making is aided by MLSCE: Relationship building between policymakers and researchers across government. Synthesising diverse research into policy-appropriate briefs and advice. Translating complex or technical findings, methods and frameworks into language and formats useful to local and central government and other bodies who may find the research useful such as Iwi, hapū and industry bodies.

Informed decision-making case study 1: National strategy for type 2 diabetes

Mission: To improve the prevention and treatment of cancer, cardiovascular disease, diabetes and obesity, and achieve equitable health outcomes in Aotearoa New Zealand.

Project: Healthier Lives National Science Challenge

Organisations: University of Otago, Diabetes New Zealand, Edgar Diabetes and Obesity Research

Audience: Central government

What: In 2020, Healthier Lives joined Diabetes New Zealand, Edgar Diabetes and Obesity Research, and philanthropists Tony and Heather Falkenstein, in commissioning PwC New Zealand to undertake a year-long investigation into the cost of New Zealand's type 2 diabetes pandemic. Currently $2.1 billion annually (0.67 percent of GDP) is spent on type 2 diabetes and this is projected to rise by 63 percent to $3.5 billion by 2040. Modelling of four health interventions found they would save hundreds of millions of dollars, increase life expectancy, and improve quality of life for many New Zealanders.[67] The report's major recommendation was the development of a national strategy for preventing and managing type 2 diabetes.

Communications and engagement: Healthier Lives published opinion pieces in Newsroom[68], The Conversation[69] and other media outlets calling for government action to address the diabetes pandemic, both prior to and following the launch of the report. Other media outlets reprinted or responded to these articles and Healthier Lives Challenge Director, Professor Jim Mann, was interviewed on Radio New Zealand's Morning Report.[70]

Prof Jim Mann (Director, Healthier Lives National Science Challenge), Hon Peeni Henare (Associate Minister of Health), Ms Heather Verry (CEO, Diabetes NZ), Prof Rachael Taylor (Director, Edgar Diabetes and Obesity Research Centre), Hon Aupito William Sio (Associate Minister of Health). Photo by: Luke Pilkinton-Ching

Impact: *The Economic and Social Costs of Type 2 Diabetes* report was launched at Parliament in March 2021 by then Associate Ministers of Health. Press releases elicited widespread media and social media coverage of the report's findings, which continued for six weeks across national and regional media. Several health organisations issued statements in response to the report.

Professor Mann co-chaired a working group which has developed a national plan of action for diabetes. Its implementation is a work in progress.

"I've been looking after people with diabetes for 40 years. I knew the findings were going to be terrible, but I didn't think it was going to be anything like this." - Professor Jim Mann

Table 8: Impact matrix for National Strategy for type 2 diabetes

	Business & Industry	Local & Central Government	Specific communities	Wider science sector	Educators and students	General public
Building social license						
Growing community						
Informed decision making						
Behavioural change						
Economic growth						
Capability building						

Informed decision-making case study 2: Fruit harvest post Cyclone Gabrielle

Mission: Ensure that food produced in New Zealand is safe for all consumers.

Organisations: NZ Food Safety Science and Research Centre (NZFSSRC) – funded half through MBIE and half by industry members; Plant and Food Research, ESR, AssureQuality

Audience: NZ Apples & Pears Inc, Zespri, orchard owners

What: Cyclone Gabrielle struck in February 2023 flooding affected orchards across the upper North Island. At the time, the apple harvest was underway, and the kiwifruit harvest was due in seven weeks. Farmers were unsure about what they could pick safely and what could be sold.

NZ Apples and Pears and Zespri asked NZFSSRC to investigate contamination risk of fruit from flooded orchards. This included determining how far above the floodwater microorganisms would affect fruit and how long it would take for any microorganisms to decay and the fruit to become safe to eat. NZFSSRC carried out literature review to answer these questions.

The industry was keen to understand more. NZFSSRC went on to work with Plant & Food Research, with support from ESR and AssureQuality, to rigorously test fruit and determine what was safe for consumption. For apples, this included an immediate investigation into the effectiveness of washing and sanitiser procedures against flood-associated microorganisms. Microbiology results indicated that, despite having been under floodwaters, there were no apples that failed the stringent FSANZ food safety criteria for ready-to-eat food, even before washing.[71]

Apple orchard after Cyclone Gabrielle. Photo by Plant & Food Research

Testing results for kiwifruit indicated that flooding did not result in microbial food safety issues in the harvest period 7-12 weeks later. No sampled fruit failed stringent FSANZ food safety criteria for ready-to-eat food.[72] However, a few of the hundreds of samples of apples and kiwifruit tested did exceed the limits for E. coli which, while not a pathogen, is an indicator of food safety risk. In the normal course of events such counts are sometimes observed in unwashed fruit from orchards. There was nothing to suggest that the results observed were due to the flood with two such occurrences detected 90 cm above the flood line and only one below the flood line.

Communications and engagement: NZFSSRC has been in operation since 2016 using a strategic partnership model. Their key focus is on building relationship and trust between the food industry and food researchers. Communication and engagement have been embedded from the beginning of the organisation. This allows NZFSSRC to drive accessibility of science information and respond immediately to issues. It also means the industry trusts NZFSSRC and will come to them in times of trouble. From a loose grouping of competing businesses, NZFSSRC now facilitates quarterly sector-based taskforces that sees research and best practice shared across organisations.[73]

Impact: NZFSSRC has economic analysis that shows that $164 million a year is saved through the centre's work.[74]

According to the Ministry for Primary Industries, kiwifruit is Aotearoa New Zealand's top export crop, and was worth nearly $3 billion in 2022. Apples and pears exports were worth $865 million in 2022; however, 2023 saw a 16 percent reduction in kiwifruit crop volume and apple export volumes were the lowest since 2012. [75] These decreases in crop volumes made it more important to be able to use undamaged fruit while ensuring the continuation of New Zealand's reputation for safe foods.

Table 9: Impact matrix for Apples & Pears post Cyclone Gabrielle

	Business & Industry	Local & Central Government	Specific communities	Wider science sector	Educators and students	General public
Building social license						
Growing community						
Informed decision making						
Behavioural change						
Economic growth						
Capability building						

Behavioural change

Initiating and embedding a behavioural shift is a complex undertaking and is usually the result of a complex interweaving of factors. Behavioural change is a common aim of mission-led science and requires the previous three elements of MLSCE: social license, community engagement and informed decision making.

"…achieving real world impact is more likely when participating parties understand one another." – NSC Directors Report[76]

Behaviour change case study 1: Lumi Drug Scan

Mission: Help prevent, detect, and solve more crime

Project: Strategic Science Investment Fund: Lumi™ Drug Scan[77]

Organisations: ESR, NZ Police Evidence Based Policing Centre, Kiwinet

Audience: Front-line police

What: Approximately 10,000 drug samples are intercepted by NZ Police each year. At the point of interception, the officer traditionally only had circumstances and their experience to guide their decision making about how to proceed. Submitting samples to the laboratory was suitable for cases heading to court but not rapid enough for real-time decision making. Previous chemical test kits weren't sufficiently accurate and exposed users to health and safety risk. Handheld devices were too expensive for wide-scale deployment, limiting their accessibility.

The project combined forensic science, data science and police frontline knowledge into a world-leading solution. It created a portable hand-held near-infrared device, a mobile phone application,

cloud-hosted machine learning models, and an analytics dashboard. The mobile app is available on Police phones, allowing them to test suspected drug samples in real-time. The insights and data obtained from each sample scanned is then captured in an analytics dashboard.[78]

Communications and engagement: Throughout the co-design process, researchers worked specifically with police staff. This allowed ESR's scientists to understand the problem statement, co-design the workflow with frontline police, and to pilot and test the Lumi solution.[79]

Impact: Lumi™ Drug Scan improves the throughput of investigations, improves officer health and safety, and supports opportunities to consider health responses for individuals found in possession of illicit drug samples.[80,81] The dashboard gives near-real time information to law enforcement leaders about drug use at macro and local levels, helping ensure resources can be directed to where they are needed. Lumi has also helped those on the frontline of health care to identify almost immediately which drugs have affected the unconscious person brought to the emergency department.

"When you are showing them the evidence right then and there on Lumi™ saying: 'this is what it's come back with, it's clear to both of us what the substance is, and I want to give you help for your drug habit by giving you a referral' – it makes it easier to interact with them." – frontline New Zealand Police officer[82]

Police attended a festival and dealt with an intoxicated person. In doing so they located a small bag of white powder. They called an ambulance and while waiting used a Lumi device to test the substance identifying it as MDMA. They were able to inform the ambulance staff who could then treat the patient appropriately in real time. Photo: NZ Police

Since the national rollout of Lumi in June 2022 more than 6,700 samples have been tested by frontline officers. 1,800 officers have been trained and now have access to the Lumi app.[83] The machine-learning element of Lumi means its latest update uses results from over 1 million scans. It recognises an extensive range of real-world drug samples and other substances that might be encountered by frontline responders. The overall accuracy of the model is now 96 percent.

In the commercialisation space, ESR is working with Australian law enforcement agencies to help them realise the benefits of real-time drug screening for frontline deployment. Lumi was trialled at two music festivals and ESR is looking at opportunities to develop Lumi specifically for the festival testing process. In 2023, Lumi™ Drug Scan won the Excellence in Forensic Science Award at the 2023 World Police Summit and was shortlisted for a prestigious KiwiNet Research Commercialisation Impact Award.[8485]

Table 10: Impact matrix for Lumi Drug Scan

	Business & Industry	Local & Central Government	Specific communities	Wider science sector	Educators and students	General public
Building social license						
Growing community						
Informed decision making						
Behavioural change						
Economic growth						
Capability building						

Behaviour change case study 2: He Rourou Whai Painga

Mission: Show that consuming an eating pattern of high-quality predominantly New Zealand-produced food and beverages offers health benefits to consumers and their families.

Organisation: High Value Nutrition National Science Challenge[86]

Audience: The study included 200 participants across Auckland, Christchurch, Wellington, and Kōkiri Marae in Lower Hutt. The study population was approximately 30 percent Māori, who all received a kaupapa Māori wellbeing assessment.

What: He Rourou Whai Painga brought together researchers and 30+ New Zealand food and beverage companies in a single study. This was a $4 million investment in decreasing the burden of metabolic diseases such as heart disease and diabetes. The study took a whole-whānau approach, so participants brought their family with them on this journey, setting them up for long-term adoption of a healthy dietary pattern. Whānau members were also included in key measurements.

The study provided approximately 75 percent of each family's food (for the 200 participants and their whānau) for 12 weeks. The dietary intervention focused on plant-based foods such as vegetables, legumes, fruits, whole grains and cereals, nuts and seeds, olive oil and a moderate intake of seafood. Participants were then monitored for 12 months.[87]

Communications and engagement: Participants received support over their year-long participation, including targeted nutrition support, guidance on food preparation, recipe ideas and social media groups to connect with other study participants in their community.

Impact: The public launch had more than 25 items of media coverage across mainstream and industry media and gained international media interest. After the launch there were more than 1,000 expressions of interest from the public in taking part in the study.[88]

"We always used to have a kawa, and that was once a week we would do takeaways on a Friday, and I was noticing that it was coming into our lives more and more. I didn't want that for us." – Trial participant

Professor Nicole Roy, High Value Nutrition's Digestive Health Priority Research Programme Leader, has been awarded nearly $1.2 million by the HRC to evaluate the effect of an Aotearoa NZ Diet for metabolic health on the gut microbiome - the work will build on the He Rourou Whai Painga study.[89]

Table 11: Impact matrix for He Rourou Whai Painga

	Business & Industry	Local & Central Government	Specific communities	Wider science sector	Educators and students	General public
Building social license						
Growing community						
Informed decision making						
Behavioural change						
Economic growth						
Capability building						

Economic growth

Science communication and engagement are often sidelined in the process of taking innovative science-driven products to market. However, the inclusion of MLSCE can make science more accessible for inclusion in real-world solutions that address societal challenges, supporting return on research investment and connecting researchers with the innovation ecosystem.

MLSCE is necessary in understanding what the end-users or clients for the new product need and how to communicate the benefits. Researchers can benefit from two-way translation in this process.

In talking to two science entrepreneurs, both mentioned that while there was support for many elements of taking a business to market, there was no support for science communications and making their work accessible. Both had family support that enabled their success.

A well-known example of economic success arising from mission-led science is the Riddet Institute's Ferri-Pro™ protein-iron complex, which was licenced to global food giant Nestlé in 2019. This represents the single biggest commercial deal to emerge from Massey University, both in terms of commercial impact and societal benefits. Nestlé and Riddet Institute teams worked together for more than three years on the scale up, manufacture, applications, and regulatory aspects of Ferri-Pro™.[90]

How MLSCE contributes to economic growth: translating complex or technical products into language and formats useful to industry and business, profiling customers and their needs, honing product approaches for individual audiences, creating engaging ways for customers to engage, building buy-in from collaborators, and identifying potential users.

Economic growth case study 1: Wilderlab

Mission: Improve ecological monitoring in Aotearoa, and help Kiwis connect with their rivers, lakes and oceans

Organisation: Wilderlab NZ Ltd[91]

What: Wilderlab is an award-winning Environmental DNA (eDNA) testing laboratory in Wellington. It began operation in 2019 with a credit card purchase of their first PCR machine from eBay. Although Wilderlab has received research and development grants from Callaghan Innovation, it has not taken on any external investment and certainly qualifies as a bootstrapped organisation.[92]

The user-friendly eDNA sampling kits alongside a fast, reliable and low-cost sequencing service has created what Wilderlab Director Shaun Wilkinson calls an 'exponential uptake of eDNA monitoring across New Zealand'. The Wilderlab flagship multispecies testing panel is tailored for Aotearoa's unique fauna and flora. Wilderlab's custom reference database and purpose-built software allow them to identify thousands of species of fish, birds, mammals, reptiles, amphibians, plants, fungi, protists, bacteria, and other organisms from just a cup or two of water.

Audience: Local and national government, primary sector, catchment groups, scientists, conservationists, and educators.

Communications and engagement: All Wilderlab material is written in plain English. The website contains videos explaining the eDNA sampling process and information sheets to help with interpreting results, available in English and Te Reo Māori.[93] Wilderlab provides eDNA kits for schools and educational material including a custom card game and education pack called eRangers. Wilderlab has also built a publicly available app that translates individual sample results into a colourful 'Biodiversity Wheel of Life' that communicates the eDNA results, including species silhouettes for added engagement.[94]

Wilderlab's interactive web application (developed on behalf of the Environmental Protection Authority) allows clients to choose to make their data public.[95] The web app is a resource for anyone with an interest in Aotearoa's biodiversity, water quality and biosecurity.

Impact: Wilderlab currently employs 12 people and is a limited liability company with commercial production and sequencing laboratories. In 2023, it distributed over 15,000 eDNA kits costing $290 each. Wilderlab's turnover in the 2024 financial year was $5M, with approximately 10 percent of this coming from export revenue.

As at May 2024, over 11,000 samples are publicly listed on the web app within New Zealand, with another ~1000 shown around the world. This represents around a third of all samples taken, the majority of which are kept private on the request of Wilderlab's customers.

Wilderlab staff demonstrate the eDNA sampling protocol in the Hutt River Te Awa Kairangi. Photo by Wilderlab

To date, around 500 samples have been collected by school groups with Wilderlab planning to roll out a learning pack with sponsored kits for intermediate-level volunteer science programmes in late 2024. School groups have been involved in important discoveries, such as the detection of the rare *Gollum galaxias* in a previously unknown area near Te Anau.[96]

In early April 2023, Wilderlab testing kits detected the invasive freshwater golden clam *Corbicula fluminea* in the Waikato River. Because freshwater gold clams reproduce so rapidly and form large populations, they can clog water-based infrastructure, such as electricity generation plants, irrigation systems, and water treatment. They may also compete with native species for food and stir up sediment that can smother benthic organisms. [97] This species is very difficult to control, and thanks to the early warning as a result of eDNA monitoring it is now under national surveillance.

Wilderlab have added a more specific and sensitive assay for detecting the *Corbicula fluminea* as well as other invasive bivalves and are working closely with the Ministry of Primary Industries to provide extra confirmation for any positive Corbicula fluminea detections outside of the Waikato River.

In early 2024, Wilderlab scientists and collaborators from DOC, MfE and three regional councils published a paper detailing their new stream health scoring tool – the Taxon Independent Community Index (TICI).[98] This machine-learning algorithm condenses the large amount of eDNA sequence data within a sample down to a single interpretable metric that can be used to gauge the ecological health of the waterway. Over 16,000 TICI scores have now been generated from around

Aotearoa, with the TICI now forming an essential component of several national and regional environmental reporting programmes.[99]

Table 12: Impact matrix for Wilderlabs

	Business & Industry	Local & Central Government	Specific communities	Wider science sector	Educators and students	General public
Building social license						
Growing community						
Informed decision making						
Behavioural change						
Economic growth						
Capability building						

Economic growth case study 2: Eco-index

Mission: Improving nationwide biodiversity management, reporting and investment

Project: Eco-index Ltd[100] spun out of the Biological Heritage National Science Challenge

Audience: Land managers, iwi, industry, central government, regional councils, catchment and conservation groups, businesses, biodiversity credit markets and impact investors.

What: The Eco-index initiative provides science-based digital tools to help decision-makers across many sectors to level-up their biodiversity planning, reporting and ecosystem reconstruction efforts.

The New Zealand Merino Company began a partnership with Eco-index in 2022.[101] Eco-index analyses found that, of the 2,400,000 hectares of farmland within the New Zealand Merino Company farm group, 40 percent supports native ecosystems. Just over 12,000 hectares of ecological reconstruction is required to reach a minimum goal of 15 percent cover to enhance biodiversity across all 700 of its supplying properties.[102]

Communications and engagement: With a dedicated communication and relationship manager from its inception, Eco-index has invested significant time to understand the needs of potential users and partners. Clear communication across all parties and funder flexibility has meant Eco-index could pivot to meet users' needs while building a diverse community focused on data-driven biodiversity decisions.[103]

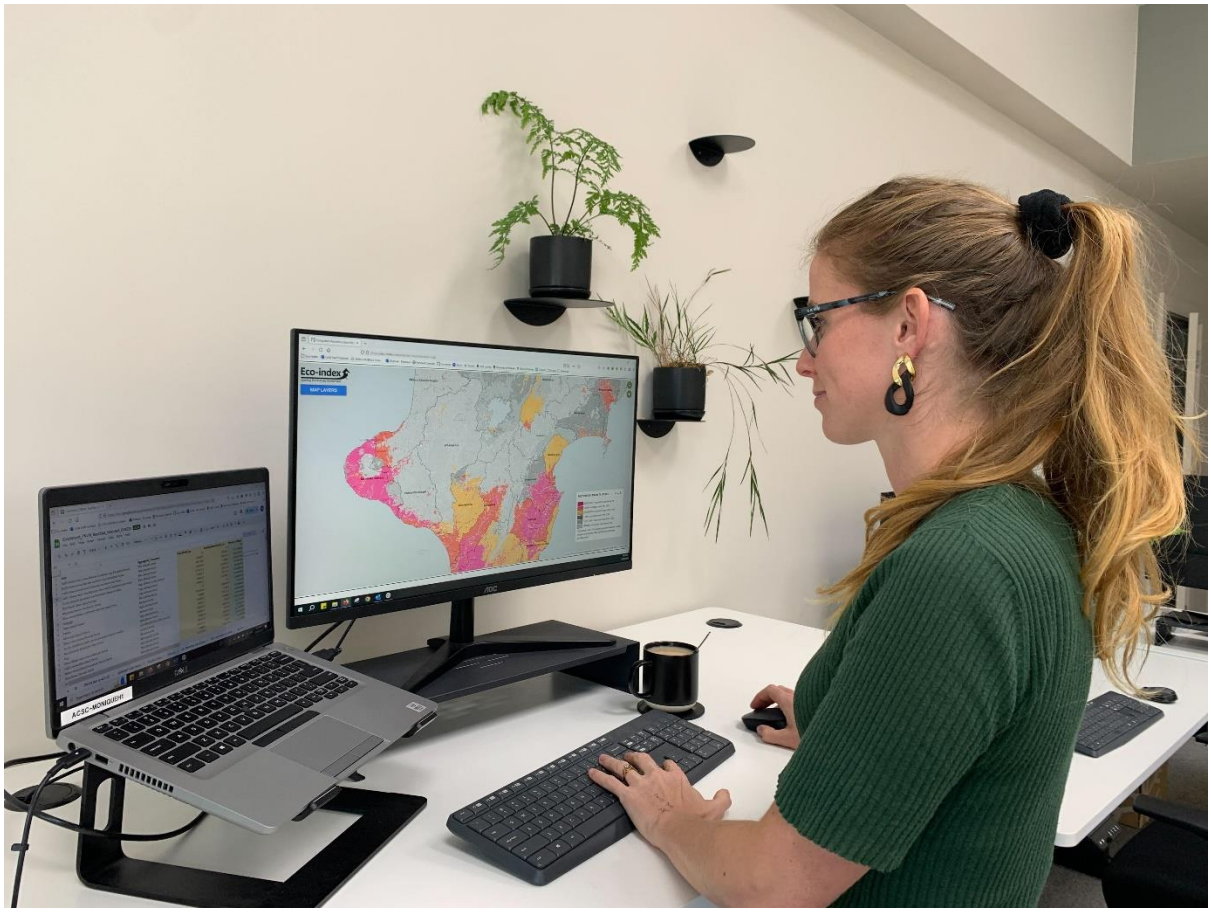


Photo by Monique Hall

Impact: Quality MLSCE that prioritises high trust and integrity has resulted in uptake of Eco-index outputs beyond the normal performance/outcomes of a research programme. This has directly led to commercial opportunities that the team are pursuing through their spinoff company.

Eco-index currently works with seven partners and clients, delivering custom digital toolkits to support and inform a range of biodiversity management decisions. These include iwi, industry, and regional government organisations. For the New Zealand Merino Company, Eco-index has unlocked ecosystem reconstruction priorities and opportunities while also assisting the company's ambitions to attract international impact investment.

"As sheep farmers near Lake Coleridge, we're really lucky that we've got little pockets of beech, tōtara, kahikatea, and mataī still on our land. This map is going to be really good for planning native planting on our farm and the other farms near us. We are trying to regenerate what should be growing here," – Farmer

In addition, thousands of people have engaged with the online, open access ecosystem map that Eco-index produced under their commitment to digital public goods.[104]

Table 13: Impact matrix for Eco-index

	Business & Industry	Local & Central Government	Specific communities	Wider science sector	Educators and students	General public
Building social license						
Growing community						
Informed decision making						
Behavioural change						
Economic growth						
Capability building						

Capability building

Capability building in the science sector ranges widely depending on the audience. Initiatives that target teachers and students from years 1-13 and into under-graduate level are well known.

Building capacity in researchers is also vital, especially if mission-led science is the goal. Understanding how to build relationships with communities, how to speak engagingly to different audiences, and how to promote research findings to engender the most impact are all elements of MLSCE where researchers' capabilities need enhancing. For those working in a fundamental science space MLSCE is often more about building a culture and ensuring researchers are engaged.

An example of science communication working to build capability is how the MacDiarmid Institute brought its researchers together in 2018. The aim was to seek an external focus for their fundamental science work, and to understand how their research would have the biggest impact on the lives of people in Aotearoa and around the world. The leadership and communications team worked with researchers to identify values and capacity.[105] There was collective interest in the sustainability challenges facing New Zealand and the world, and in creating and exploring innovative, sustainable materials. This has led the MacDiarmid Institute to a refocusing of their research and external communications towards materials science for sustainability.[106]

The Our Land and Water National Science Challenge communications and engagement team's overview of the programme's research outputs allowed science communication outputs from multiple projects to be identified and synthesised into three capability-building initiatives. The team built relationships with the external programme hosts as a pathway to impact. The Aotearoa Catchment Extension Project managed by NZ Landcare Trust provides nationwide capability development for people working with and in catchment groups.[107] The initial intake represents potential impact in 150 catchments. The NZ Association of Resource Management capability building programme similarly draws in text, findings and insights from Our Land and Water plain language

outputs.[108] A series of learning modules for rural professionals hosted by the NZ Institute of Primary Industry Management have content drawn almost entirely from Our Land and Water non-academic research outputs.

How MLSCE helps build capability: training researchers in communications skills, working strategically to identify audiences and their needs, supporting meaningful collaboration, promoting both researchers and their work, curriculum development, event management, translating science for educators, students, and general public.

Capability building case study 1: Media Savvy

Mission: Increase public understanding of research, science, and innovation by enabling researchers to work effectively with media.

Organisation: National Strategic Plan for Science in Society Fund: Science Media Centre[109]

Audience: Researchers, journalists

What: The Science Media Centre (SMC) covers hundreds of issues every year, including climate change and environmental crises, earthquakes, cyclones and other natural hazards, infectious disease and biosecurity outbreaks, water quality and food safety, social issues and emerging technologies. They work with journalists to facilitate stories of better science quality and work behind the scenes to help newsrooms navigate misinformation and dubious claims.[110]

The SMC's experience shows that the best way to get quality media coverage is to improve researchers' skills in communicating their area of expertise. Researchers can apply these same skills to improve their research impact, raise the profile of important issues, attract funding, and engage with peers and the public. They run a variety of media training services around the country from developing basic skills for working with news media, through to more intensive two-day Science Media Savvy workshops. Their courses include a fully funded two-day course supporting kaupapa Māori and whakawhanaungatanga, and express 15-minute one-on-one training opportunities at selected conferences.[111]

Communications and engagement: Science Media Savvy workshops are designed to help researchers gain the confidence and skills they need to engage effectively with media and communicate their science in public. More than basic media training, the courses are designed to meet the specific needs of scientists. The training offers practical exercises to help researchers explain complex ideas clearly, introduce tools and strategies for connecting with new audiences, all while providing feedback and support from fellow researchers.

Impact: Since 2013, Media Savvy has trained 2,000 total researchers, of which 840 have come through their flagship Savvy workshop, with 750 completing short Savvy Express sessions, and the remainder in special content creation workshops for video, blog, podcast, and animation.[112] This does not include the many, many hundreds over the years who have participated in a large group interactive talk, online webinar or short session led by the SMC team.

"Savvy gave me an appreciation that journalists are people and that I didn't need to be scared of that category of people. It helped me realise that even if I'm not articulating my thoughts perfectly, journalists aren't there to trip me up and make me look stupid, they are there to help tell an

important story. Appreciating that started me on a trajectory to where I now have the confidence and motivation to accept even live interviews and take any opportunity to change hearts and minds on climate change. It also gave me an ongoing relationship with the Science Media Centre that has been really beneficial." – Dr Natalie Robinson

A Media Savvy workshop in progress. Photo: Science Media Centre

The Savvy workshops aid in establishing new, trusted relationships between researchers and the SMC team, and between researchers and journalists they encounter in the workshop setting. For research communities that are reluctant to engage with journalists, Media Savvy workshops offer a circuit breaker to break down stereotypes and change attitudes.

A comprehensive independent review of the NZ SMC was carried out in late 2020[113], finding that it contributes to improved quality, breadth, and depth of science reporting and delivers a range of services that are efficient and user-focused and have good uptake. It also found that trust and confidence in the SMC are high and that there continues to be a need for the SMC.

"I've noticed that when I go to the workshops [for] scientists the way the SMC explains the media is 100% right. They understand how it works at the moment which makes me confident they are well placed to understand how it is changing." - Journalist

In the first ten years of its existence, the SMC handled more than 12,000 media queries, produced more than 20,000 media items, and worked with 500 plus journalists.[114]

Table 14: Impact matrix for Media Savvy

	Business & Industry	Local & Central Government	Specific communities	Wider science sector	Educators and students	General public
Building social license						
Growing community						
Informed decision making						
Behavioural change						
Economic growth						
Capability building						

Capability building case study 2: Empowering patients to take on diabetes

Mission: produce a super low-cost, type-one diabetes solution that's accessible to everyone

Project: Science for Technological Innovation National Science Challenge (SfTI)[115]

Audience: Type-one diabetics, nurses

What: Diabetes is an epidemic with massive social and economic costs, particularly for Māori, Pasifika, and other indigenous peoples. Currently only 10 percent of people with type-one diabetes have access to modern insulin pumps and there is no funding for continuous glucose monitoring. Insulin pumps are patented within the grip of the medical tech industry and cost around $10,000 per person plus an extra $2,000 a year in consumables.[116]

From a Te Ao Māori perspective, the body is considered tapu and blood is valued as sacred, which can lead to hesitation in accepting external technology.[117] In addition, existing devices are so technically complex that even medical specialists sometimes struggle to use them.

A team of tech, digital and social researchers have produced an ultra-low-cost insulin pump. It uses simple technology and parts are expected to cost less than $150. They intend to combine this with their world-first, non-invasive ultra low-cost continuous glucose monitor that uses LED lights to detect blood glucose levels. The pump is unique and can be cheaply produced because the software algorithms running the pump are separate from the device itself. This new technology means patients could receive the right insulin dose at the right time, without having to do anything themselves.[118]

Communications and engagement: SfTI requires that researchers make genuine and authentic long-term connections with industry and community as part of the funding application process.[119] SfTI also provides training and support to develop these relationships throughout their project. The impact of this is that the communications approach is embedded into these projects from the start, linking the research with the outside world, its market, and natural audience. SfTI has also explicitly supported early career Māori researchers, including mandating rangatahi involvement in SfTI's main projects.[120]

The team working on the diabetes project co-designed their products with end-users.[121] The diabetes team used surveys and hui with rural and urban communities with a high incidence of diabetes and urban diabetes clinics to get feedback on how to make diabetes devices user-friendly and intuitive. Nurses also had input on how the device will be used during the design and optimisation phase and in creating training materials. This will help nurses to effectively train people with diabetes, and their whānau, in how to use the technology with ease.

Working further to understand the commercial elements of the project meant the researchers realised that the $150 part costs would likely turn into a sales price of $2,000 or so by the time it reaches the patient, which still leaves devices out of reach.

Dr Lui Holder-Pearson, Dr Grace Walker, and Dr Jake Campbell with a young diabetes patient. Photo: SfTI

Impact: The researchers have now incorporated into a company called Tautoko Tech and are aiming to raise investment by the end of 2024.[122] If the money raise is successful, the team will develop the

pump with the support and education software to be ready for sale in New Zealand by the end of 2026 and beginning the FDA approval pathway.

Feedback from end users in community was that they would not be able to pay anything extra for these devices. This has led to Tautoko Tech's current plan that the end user doesn't pay, rather the health system or insurance companies (outside of New Zealand) would pay.

"I know it's a struggle that we have, but to sit there and hear it from my nans and my koro and the fears they have for my generation and the future generation, it just hits differently… I'm only just getting started back in the family and I dunno how much longer I have [with them, so] if we could actually help with making the last couple of years easier for them and find ways to take care of them a lot better [it would be] amazing 'cause I'm not ready to let them go." – Diabetes researcher[123]

Working with nurses helped the team realise that the design of the pump needs to be simple and backed up by education and support that increases health literacy, while allowing nurses to focus on care.

Table 15: Impact matrix for Diabetes Research

	Business & Industry	**Local & Central Government**	**Specific communities**	**Wider science sector**	**Educators and students**	**General public**
Building social license						
Growing community						
Informed decision making						
Behavioural change						
Economic growth						
Capability building						

Capability building case study 3: Maths Craft

Mission: Making mathematics accessible through craft.

Programme: Maths Craft New Zealand[124]

Organisations: Te Pūnaha Matatini, University of Canterbury, Massey University, and New Zealand Mathematical Society

Audience: General public, especially school aged children

What: Maths Craft New Zealand is a non-profit outreach initiative which brings maths to the masses by celebrating the links between mathematics and craft. It is run by University of Canterbury mathematicians and Te Pūnaha Matatini Principal Investigators Dr Jeanette McLeod and Dr Phil Wilson. Their aim is to show young and old alike the fun, creativity, and beauty in mathematics through the medium of craft, and to demonstrate just how much mathematics there is in craft. The focus is helping people experience what it means to think like a mathematician.

Maths Craft is also used by Jeanette and Phil in their university teaching at all levels from first year undergraduate to Masters level. They have an active research programme in all aspects of Maths Craft, from its use in outreach to new discoveries in mathematics.

Communications and engagement: Maths Craft runs free festivals and workshops, aimed at the public of all ages and backgrounds, where everyone is welcome - experts and amateurs, maths-fans and maths-phobes, the crafty and the curious.

The team developed a free, entirely self-contained Maths Craft in a Box which they fine-tuned after working through Te Pūnaha Matatini's Engagement Incubator process.[125] This is delivered directly to schools with everything teachers and students need to explore the fascinating world of fractals. Maths Craft in a Box used design communications expertise from Dr Jo Bailey of Massey University and mathematics education expertise from Dr David Pomeroy of the University of Canterbury.

Crowds fill the Christchurch Arts Centre's Great Hall at the 2018 Maths Craft Day. Photo by Maths Craft

Maths Craft also offer professional development workshops for mathematics teachers, dedicated to bringing Maths Craft to maths class. The focus is on developing mathematical thinking and self-efficacy in mathematics and learning techniques for engaging students in the classroom.

Impact: The Maths Craft Team won the Cranwell Medal from the New Zealand Association of Scientists in 2019[126] and the Gillian Thornley Award from the New Zealand Mathematical Society in 2022[127]. In addition, they were runners-up for the Science Communicators Association of New Zealand Excellence in Science Communication Award in 2019, and Jeanette has twice been shortlisted for the Prime Minister's Science Communication Prize.[128]

Over 16,000 people have attended Maths Craft festivals and workshops; more than 10,000 school students have explored fractals through Maths Craft in a Box, with another 10,000 students to receive the Box in the next few months of 2024. Maths Craft in a Box has reached across the country, from huge urban schools to tiny rural schools.

"We received emails and photographs from teachers proudly displaying their work and discussing their classroom experience. Our online survey responses were also full of praise and enthusiasm with comments like: 'My kids are having such an awesome time with this!' and 'The Maths Crafts team is doing an excellent job to help teachers and students to be engaged in learning while having fun.'" – Dr Jeanette McLeod[129]

Participants in the maths teacher workshops leave with a portfolio of Maths Craft lesson plans which tie into the New Zealand curriculum, instructional handouts written by mathematicians, and craft material for their own classes.

Eleven students have completed summer projects and theses through Maths Craft and the Maths Craft team have published four academic articles on the programme, with more currently under submission.[130]

Table 165: Impact matrix for Maths Craft

	Business & Industry	Local & Central Government	Specific communities	Wider science sector	Educators and students	General public
Building social license						
Growing community						
Informed decision making						
Behavioural change						
Economic growth						
Capability building						

Conclusions

If the scientific community wishes policymakers and citizens to use and fund science, then the science system needs to be organised in ways that help this happen. The hope of this report is that those who allocate and distribute science funding appreciate the increase in impact when science is communicated professionally and resourced for the appropriate engagement.

A start in this area would be funding applications that require mission-led projects to detail their intentions and ring-fenced budget for bringing about impact. This would also involve measurement of communication and engagement impact that moves beyond media mentions and social media follows, to a more nuanced narrative reporting structure with a more holistic approach to benefits across the country.

A further step would be to require the involvement of a science communicator and engagement specialist in the leadership team of any mission-led science consortia from funding application through to the project's wrap-up.

Committing to improved communication and engagement for impact would involve stable budgets to both employ science communication and engagement experts and sustain goal-directed, organization-led communication campaigns.

To promote economic growth in commercial science, it may be beneficial to add science communication and engagement support and training to the business advice already provided to business startups.

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Finally, this report is for Lias Matiu Roberts Morris.

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