



Manaaki Whenua
Landcare Research

Towards a Māori transdisciplinary framework and model for integration

SSIF Māori Flagship project

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Executive summary

Project

This SSIF Māori Flagship research began in October 2019, following many discussions in the company on how we could better integrate our science and research across the company, and increase the use of mātauranga Māori in our science. In line with this desirable goal we are challenged to determine what this integration means, what it might look like, and then how it could be implemented.

We started this work by casting a Māori lens over what integration meant and this report brings findings and Māori information and knowledge together in one place to contribute to these discussions. This work provides an indigenous integrative research framework and model to be used by Manaaki Whenua, to guide and promote integration and encourage more interdisciplinary and transdisciplinary ways of thinking and working to address an increasing array of complex and challenging issues and questions that are arising globally, nationally, regionally, and locally. It provides guidance for integration in Manaaki Whenua to provide opportunities for current and new science investment.

Key objective

Produce an indigenous integrative research model and framework to address complex issues and questions and provide guidance for integration in Manaaki Whenua and provide opportunities for new science investment.

The key milestone is:

To provide guidance for integration in Manaaki Whenua and provide opportunities for new Māori research SSIF and external funding investment.

Critical steps

- Complete a literature review of indigenous transdisciplinarity and Te Ao Māori concepts, values and principles, and document key characteristics and understandings for framework development.
- Hold an internal workshop with kairangahau Māori (Māori staff) in Manaaki Whenua to discuss key concepts, characteristics, and elements of integration and transdisciplinarity.
- Hold an internal workshop with key science staff and selected Portfolio Leaders to discuss integration in the company and alignment with kaupapa Māori/Te Ao Māori concepts and principles for use in guidelines and frameworks.
- Develop a provisional kaupapa Māori framework and model for integration and transdisciplinary research.
- Produce a white paper using results and provide a model and framework for discussion and circulation, as a precursor to a journal paper.
- Develop two new investment 'transdisciplinary' opportunities for science planning and funding with key staff, external stakeholders and researchers.

Methods

A range of methods were employed from October 2019 to June 2020 to achieve critical steps. These are detailed in the methodology section of this report.

For the project (SSIF/SPB Portfolio): "Towards a Māori Integration Framework" an application was made (start date 1/7/2019) to the Landcare Research Social Ethics approval process for research involving human participants, application number: 1920/03. [Towards a Māori Integration Framework](#).

Results

- We completed a literature review of indigenous transdisciplinarity and Te Ao Māori concepts, values, and principles, and these are documented in the reference section of this report.
- We held an internal workshop with kairangahau Māori, in Hamilton 2019, to discuss key concepts, characteristics, and elements of integration and transdisciplinarity.
- Due to Covid-19 we replaced the internal workshop with key senior science staff and PLs with a survey and questionnaire, undertaken between April 2020 and June 2020 and responses are given in the results section of this report.
- A provisional kaupapa Māori framework and model for integration and transdisciplinary research is presented in this report.
- This MWLR report replaces the white paper stated in the critical steps because of the volume of results and findings that were collated and documented. It is intended to generate a journal paper for submission from this report.
- We are in the process of discussion with Manaaki Whenua staff and external stakeholders and researchers, opportunities for new investment using the frameworks, model, and 'transdisciplinary' themes given in this report.

Conclusion and recommendations

There is emerging evidence to suggest that knowledge integration and systematic use of kaupapa Māori processes to underpin integrative and multi-faceted research can play an important role in breaking down knowledge, and social and cultural silos within a research context.

Furthermore, due to the reciprocal relationship that Māori and many other indigenous cultures have with the environment, Māori-led approaches can help Manaaki Whenua achieve its goal to both protect and enhance the land environment and grow the country's prosperity.

1 Introduction

The core purpose of Manaaki Whenua – Landcare Research Ltd (Manaaki Whenua – MWLR) is to drive innovation on the management of terrestrial biodiversity and land resources. Innovative solutions will include the integration of Māori (the indigenous people of Aotearoa New Zealand) and western science to develop uniquely Aotearoa problem-solving and solutions. There is emerging evidence to suggest knowledge integration and systematic use of kaupapa Māori processes to underpin integrative and multi-faceted research can play an important role in breaking down knowledge, social and cultural silos within a research context (Hudson et al. 2012; Allen et al. 2014; Goven et al. 2015; Lyver et al. 2018a; Wilson et al. 2018; Cole 2017; Moewaka-Barnes et al. 2020). Furthermore, due to the reciprocal relationship Māori and many other indigenous cultures have with the environment, Māori-led approaches can help Manaaki Whenua achieve its goal to both protect and enhance the land environment and grow the country's prosperity.

This SSIF Māori Flagship with funding from Strategy 22 investment and Society, Culture and Policy SSIF investment began in October 2019 following many discussions in the company on:

- how we could better integrate more generally across disciplines and knowledges
- what that integration should look like
- how it could be implemented.

We started this work by casting a Māori lens over what integration and transdisciplinarity means, and this report brings findings and Māori information/knowledge together in one place to contribute to these discussions. This work provides an indigenous integrative research model and framework to be used by Manaaki Whenua, to guide and promote integration and encourage more interdisciplinary and transdisciplinary ways of working to address an increasing array of complex and challenging issues and questions that are arising globally, nationally, regionally, and locally. It also provides guidance for integration in Manaaki Whenua to provide opportunities for new science investment.

1.1 Objective and milestone

Produce an indigenous integrative research model and framework to address complex issues and questions and provide guidance for integration in Manaaki Whenua and provide opportunities for new science investment.

The key milestone is:

To provide guidance for integration in Manaaki Whenua and provide opportunities for new SSIF Māori Flagship projects and external funding investment.

1.2 Critical steps

- Complete a literature review of indigenous transdisciplinarity and Te Ao Māori concepts, values and principles, and document key characteristics and understandings for framework development.
- Hold an internal workshop with kairangahau Māori (Māori staff) in Manaaki Whenua to discuss key concepts, characteristics, and elements of integration and transdisciplinarity.
- Hold an internal workshop with key senior science staff and Portfolio Leader's to discuss integration in the company and alignment with kaupapa Māori/Te Ao Māori concepts and principles for use in guidelines and frameworks. Due to Covid-19 this was replaced with a survey and questionnaire, undertaken between April 2020 and June 2020.
- Develop a provisional kaupapa Māori framework and model for integration and transdisciplinary research.
- Produce a white paper using results and provide a model and framework for discussion and circulation, as a precursor to a journal paper. This paper has been replaced by this MWLR report.
- Develop two new investment 'transdisciplinary' opportunities for science planning and funding with key staff, external stakeholders, and researchers.

1.3 Background

1.3.1 Integration and integrative research

Integration is the action or process of integrating. It is often defined as: mixing things, people or disciplines together that were formerly separated or siloed. Research can be integrated in many ways (Allen et al. 2013; Goven et al. 2015). Integrated research was defined by Duncan and Robson-Williams (2019), as 'research that involves people with different expertise contributing to a research project. The contributions might be knowledge, understanding of a problem, concepts, frameworks, data, methods, skills, or interpretation'. They then defined the term 'integration' for Manaaki Whenua as: 'relating to the research involving people with different expertise who contribute to a research project. These contributions may include knowledge, understanding of a problem, concepts, data, methods, skills, or interpretation' (Duncan & Robson-Williams 2019).

With the goal of integration in Aotearoa New Zealand, an area often lacking or poorly understood is te ao Māori, kaupapa Māori, and mātauranga Māori (e.g. Māori knowledge, values, and perspectives) and how these can be incorporated and implemented. A small specialised and dedicated Māori team (ngā kairangahau – Manaaki Taiao) exists in Manaaki Whenua, mainly in the Landscape, Policy and Governance (LPG) team, but Māori staff work across the company and there are many examples of kaupapa Māori (Smith 1999) and Māori centric and relevant projects in different parts of the company, with differing levels of integration.

Integrated research can be put into practice in many different ways. The terms 'multidisciplinary', 'interdisciplinary' and 'transdisciplinary' are widely used and are useful for differentiating the different types of research that can be developed in an integrated way –

usually based on the complexity of the issue or problem being addressed and the range of disciplines and expertise required to be involved. These approaches determine what roles scientists, researchers, stakeholders, Māori e.g. iwi/hapū, and other actors might play in the research activities and the different types of knowledge(s) that can be elicited, produced, and used together. These are all valuable approaches that build integrated research and allow different disciplines and sources of knowledge to be brought together on an equal footing. They also allow different disciplines and sources of knowledge to work together towards common goals and outcomes (Duncan & Robson-Williams 2019).

Multidisciplinary, interdisciplinary, and transdisciplinary are therefore useful theoretical concepts and approaches for understanding how different people, disciplines, and sources of knowledge can be involved together in integrative research. The terms are also useful for understanding how different types of knowledge(s) can be used in the research processes, and what methods and practices to use. In this report we explore from a te ao Māori perspective what is meant by integration and what would constitute transdisciplinarity if we were to achieve that (Cole 2017). These terms multidisciplinary, interdisciplinary and transdisciplinary are explained more fully below. We start, though, by providing a brief understanding of what mātauranga Māori, Vision Mātauranga, and Māori values are.

1.3.2 Mātauranga Māori (Māori knowledge)

Mātauranga Māori or Māori knowledge systems are specific to indigenous Māori people, and the term has its origins in Polynesia and Aotearoa New Zealand (Best 1924a,b; Buck 1950; Marsden & King 1975; Marsden 1988, 1989; Mead 2003; Mead & Grove 2001; Black 2014; Hikuroa 2017; Mercier 2018). The term has many definitions that cover belief systems, epistemologies, values, and knowledge both in a traditional and contemporary sense (Harmsworth & Awatere 2013; Awatere & Harmsworth 2014; Awatere et al. 2017; Mercier 2018, NZAS 2019, 2020; EPA 2020). Mātauranga Māori can be defined as the knowledge, comprehension or understanding of everything visible and invisible existing in the universe (Williams 1997).

The status of mātauranga Māori is recognised in legislation and in the Treaty of Waitangi defined in reports such as WAI 262. The Wai 262 claim (Waitangi Tribunal 2011) defined mātauranga Māori as 'the unique Māori way of viewing the world, encompassing both traditional knowledge and culture'. Through this claim, the claimants were seeking to preserve their culture and identity, and the relationships from which their culture and identity are derived. Mātauranga Māori, which involves observing, experiencing, studying, and understanding the world from an indigenous cultural perspective, is often equated with 'wisdom'. It encompasses the physical through to the meta-physical, including but not limited to empiricism or logic (whakaaroaro), ethics (tikanga), epistemology (whakaponotanga), resource management (kaitiakitanga), and spirituality (wairuatanga), and is a dynamic and evolving knowledge system (Harmsworth & Awatere 2013; Awatere & Harmsworth 2014, Awatere et al. 2017). As with western knowledge, in terms of epistemology mātauranga Māori has both qualitative and quantitative aspects.

It is important to recognise the multifaceted and dynamic nature of mātauranga Māori, which is a continuum from ancient to modern. Various explanations by a large number of authors have been given, including:

- A large body of knowledge of Polynesian origin, ~5000yrs of indigenous knowledge coming from Polynesia and then Aotearoa – dynamic and evolving
- Reference to the source of the knowledge, the three baskets of knowledge: kete aronui, kete tuauri, kete tuatea
- Derived and translated through each generation from ancestors and elders
- Localised specific to iwi/hapū/whānau (tribes)
- Mātauranga Māori first used in a restrictive fashion to refer to knowledge created under the inspiration of a 'ngā atua Māori' (non-Christian 'god(s)') – the preserve of 'tohunga Māori' (late 1800's) – to reinforce and distinguish the Māori belief system (Royal 2009)
- Mātauranga Māori now used in an all-encompassing, global way to refer to all knowledge created by Māori according to their experiences, history, worldview, culture, and aspirations (20th/21st century) (Awatere et al. 2017)
- Often used synonymously with wisdom and experience (Williams 1997; Marden 1988, 1989; Royal 2009; Black 2014; Mercier 2018)
- Encapsulates a Māori worldview and involves observing, experiencing, studying and understanding the world from an indigenous cultural perspective (Marsden 1988; Mercier 2018)
- Providing foundation and meaning for the modern 21st century Māori worldview, beliefs, values, innovation, research, thoughts, ideas, frameworks, models, technology and practices etc (Awatere & Harmsworth 2014; NZAS 2019, 2020; EPA 2020)
- Contemporary, historic, local, and traditional knowledge (Harmsworth et al. 2002)
- Systems of knowledge transfer and storage, as well as the knowledge itself (Harmsworth et al. 2002; Black 2014)
- Achieving goals, aspirations and solving issues from an indigenous perspective (Harmsworth et al. 2002)
- Contemporary definition: 'Knowledge that arises from, based on, or contributes to the distinct culture, identity and collective experience of Māori' (FRST, pers. comm.).

1.3.3 Vision Mātauranga

Government (now MBIE) Vision Mātauranga (VM) policy (MRST 2007, 2009; Rauika Māngai 2020) aims to 'unlock the science and innovation potential of Māori knowledge, resources and people for the benefit of Aotearoa New Zealand'. As a policy, it provides a Government-led framework and goals to increase Māori participation and increase Māori capacity in science in Aotearoa New Zealand. One key goal is to increase awareness and understanding of Māori knowledge (mātauranga Māori) and how it can be used in science for the benefit of Aotearoa-New Zealand. VM policy (MRST 2007, 2009) comprises 4 key themes that encourage and promote Māori research participation:

- Indigenous innovation – contributing to economic growth through distinctive science and innovation
- Taiao/environment – achieving environmental sustainability through iwi and hapū relationships with land and sea
- Hauora/health – improving health and social well-being
- Mātauranga – exploring indigenous knowledge and science and innovation.

The outcomes VM policy is trying to achieve are (w)holistic: to achieve desired social and cultural outcomes, social equity, Māori and community well-being, empowerment, reduce disparities, build capacity and capability, kaupapa Māori research, increase knowledge base, innovation, etc.

VM policy therefore can:

- encourage 'distinctive ways of knowing' – knowledge systems that complement science
- recognise a role within research and science for 'kaupapa Māori research' (Māori led research methods, process, framing, projects, e.g. Māori research for Māori by Māori, underpinned by Māori values and principles) where co-design, co-development, and Māori led research is important
- promote science research to address Māori needs
- recognise that mātauranga Māori is a dynamic and evolving knowledge system
- increase relevant and responsive research for Māori (addressing issues, finding solutions to complex challenges and issues, etc.)
- encourage integration and more interdisciplinary and transdisciplinary forms of research.

1.3.4 Māori values

Māori values (Henare 1988; Marsden 1988, 1989; Barlow 1991; Harmsworth 1997; Mead 2003) are derived from the traditional belief system based on mātauranga Māori. Values (e.g. whakapapa, whanaungatanga, manaakitanga, kaitiakitanga, wairua) can be defined as instruments through which Māori make sense of, experience, and interpret their environment (Marsden 1988, 1989). They form the basis for the Māori worldview (Te Ao Māori), and provide the concepts, principles and lore, Māori use to varying degrees in everyday life, and to form ethics and principles.

1.3.5 What is transdisciplinarity?

Transdisciplinarity is a relatively young approach. Swiss philosopher and psychologist Jean Piaget (1896–1980) developed the concept 7 centuries after disciplinarity had evolved. The term first appeared in France in the 1970s, used by Piaget, Erich Jantsch, and André Lichnerowicz at the international workshop, 'Interdisciplinarity – Teaching and Research Problems in Universities', organized by the Organization for Economic Co-operation and Development (OECD) in collaboration with the French Ministry of National Education and the University of Nice.

From the 1970s onwards it became increasingly useful to describe 'across' and 'beyond' knowledge and disciplines as key concepts and approaches that could be (or should be) used to explain and understand the 'total system'. Transdisciplinarity was seen as a 'superior' stage to interdisciplinarity. Its goal was to understand the present world, of which one of the imperatives is the unity of knowledge. Since the early 1980s, transdisciplinarity has been defined as working 'across knowledges' (Nicolescu 2008, 2010; Nicolescu & Ertas 2013) evolving to break down disciplinary barriers in order to understand and merge diverse perspectives (Bernstein 2015).

To find the truth, and separate fact from fiction or myth, science (going back to around 600 BC in Greece) started to separate the subject and object through objectivity and crude theory. To explain this difference, a subject is a being who has a unique consciousness and/or unique personal experience(s), or an entity that has a relationship with another entity that exists outside itself (called an 'object'). In other words a subject is an observer, and an object is the thing observed.

The beginning of science started with developing a theory, a hypothesis, conducting experimentation, and using objectivity as the main approach to understanding the natural world and the universe. On the other hand, to stay true to Māori ontology, mātauranga Māori tries to keep everything as whole and does not separate the object and the subject (i.e. it keeps everything – subject and object – together). We see this interconnection in many Māori values, most importantly, in whakapapa (ancestral connection and lineage which places humans within nature and not apart), so a healthy planet (or environment) means healthy people and vice versa, and in proverbs (e.g. ko au te wai, ko te wai ko au – I am the water, the water is me; ko au te awa, ko te awa ko au – I am the river, the river is me; ko te awa te mātāpuna o te ora – the river is the source of spiritual and physical sustenance; nō te kawa ora a 'tupua te kawa' hei taura here nā Te Awa Tupua me ōna tāngata ki te kawa nō tawhito rangi – The natural law and value system of Te Awa Tupua, which binds the people to the River and the River to the people)). The excerpt below from Basarab Nicolescu (2010) eloquently sums up the way science broke from an ancient vision and understanding of the world. It reinforces this contrast between science and mātauranga Māori (wholism), where we can observe, understand, and make sense of the world from two very different positions.

Modern science was born through a violent break with the ancient vision of the world. It was founded on the idea—surprising and revolutionary for that era—of a total separation between the knowing subject and Reality, which was assumed to be completely independent from the subject who observed it. This break allowed science to develop independently of theology, philosophy, and culture. It was a positive act of freedom. But today, the extreme consequences of this break, incarnated by the ideology of scientism, pose the potential danger of self-destruction of our species.

On the spiritual level, the consequences of scientism have been considerable: the only knowledge worthy of its name must therefore be scientific, objective; the only reality worthy of this name must be, of course, objective reality, ruled by objective laws. All knowledge other than scientific knowledge is thus cast into the inferno of subjectivity, tolerated at most as a meaningless embellishment or rejected with contempt as a fantasy, an illusion, a regression, or a product of the imagination. Even the word "spirituality" has become suspect and its use has been practically abandoned (Nicolescu 2010).

Transdisciplinarity has been heralded as an ideal approach for addressing and finding solutions to complex or 'wicked' problems and to encourage work across disparate types of disciplines, knowledge, and practices. It reinforces the need to find creative solutions and think outside the box. Key aspects of transdisciplinarity are that it is systems (dynamic) focussed, acknowledges and seeks knowledge sources beyond science, recognises the importance of learning, embeds integration, relies on adaptation, and builds in implementation pathways to the research itself (Newig et al 2008; Pohl & Hadorn 2008; Jahn et al. 2012; Bammer 2013; Polk 2014; Van Kerkhoff 2014; Mitchell et al. 2015; Cordell et al. 2015). Bammer (2017) said that: 'Researchers interested in tackling complex real-world problems – such as global climate change, biodiversity loss, and uptake of renewable energy generation – recognize that, to be effective, they need theories and methods to combine knowledge across disciplines, take into account stakeholder perspectives, deal with data gaps and other un-certainties, and support policy and practice change'.

Much of the literature defines transdisciplinarity as 'an approach that works across disparate types of knowledge and practices, in order to tackle complex problems' (Wolff et al. 2019). Careful attention to research design and methodology is important (Wolff et al. 2019). Transdisciplinarity is characterised by stakeholder involvement, and produces engaged, socially responsible science (Bernstein 2015; Binder 2015). It has a high reliance on using other knowledge, local or indigenous, as well as science (Cornell et al. 2013). The literature shows that transdisciplinarity is often time consuming, challenging, and researchers and participants need to be reflexive (Binder 2015).

The acceptance that complexity renders knowledge provisional is being completely honest about the purpose of the research and is critical to building relationships between researchers and participants. Gaining an understanding of the values people hold influences the research process and the possible outcomes toward sustainable and just natural resource management (Cram et al. 2012). It has been suggested that in order to enable sustainable and just natural resource management, transdisciplinary research should include values and ethics in the design, implementation, and reporting of projects (Wolff et al. 2019).

In the search of solutions to complex real-world problems, and in particular, complex socio-ecological problems, the benefits of transdisciplinary research (TDR) are many, and have been widely promoted across, for example, land use science, climate change, sustainability science, and natural resource management. A more integrative understanding and framing that moves beyond the limits of disciplinary knowledge and sectoral viewpoints is being pursued. Zscheischler & Rogga (2015) stated that research concerning sustainable land use must consider diverse societal needs and values as well as local knowledge and consequently should involve various scientific disciplines, stakeholders and target groups. These approaches are largely to better understand the complex interdependencies among and within socio-ecological systems. There is therefore an increasing demand for new diverse ways of knowing, new forms of knowledge, the co-production of knowledge, and to use trans-knowledge as a basis for well-informed creative options for action.

1.3.6 The different approaches towards transdisciplinarity and integration

Below we examine the main differences of the different approaches (Fig. 1).

Disciplinarity

Disciplinarity refers to expertise in a single discipline, including the understanding of methodology and the capacity to obtain, experiment, investigate, analyse, and employ specialized knowledge. Distinct methodologies are usually developed within disciplines, and vast amounts of knowledge are built within disciplines. Disciplines are usually silos of expertise, knowledge, perspective, culture, and language. Integration forces these, and varying perspectives to be shared with others, to work together on complex problems or challenges. Many scientists and researchers are trained in a single discipline or disciplines (e.g. chemistry, geology, soil science, botany, physics, social science), and gain a high degree of disciplinarity, in this sense, within their selected areas of expertise, or through projects and programmes.

Multi-disciplinarity

Multidisciplinary research has been described as the 'division of labour' model, where those involved in the research project maintain their disciplinary boundaries or ways of working (e.g. world views, methodologies, and methods) (Mobjörk 2010). This approach can be less complex and time-consuming and can be used to examine a problem from multiple angles.

In theory, multidisciplinary research is expected to occur within or across scientific disciplines or institutions and has been characterised as retaining 'disciplinary autonomy' (Wickson et al. 2006). Integration is expected to occur at the start (e.g. with a shared problem formulation) and at the end (when the findings from different lines of research are brought together). In practice, different disciplines, or scientific and non-scientific approaches, can work side by side. Usefully integrating the research at the end can be challenging, especially if there was insufficient time spent preparing for it at the start.

Interdisciplinarity

Interdisciplinary research occurs across scientific disciplines and is expected to involve the relevant disciplines working together to develop formulating collective issues, shared development of a research process, and an integrated methodological approach (Wickson et al. 2006; Mobjörk 2010). This approach encourages researchers to think beyond their disciplinary boundaries at the outset and integration occurs throughout a research project.

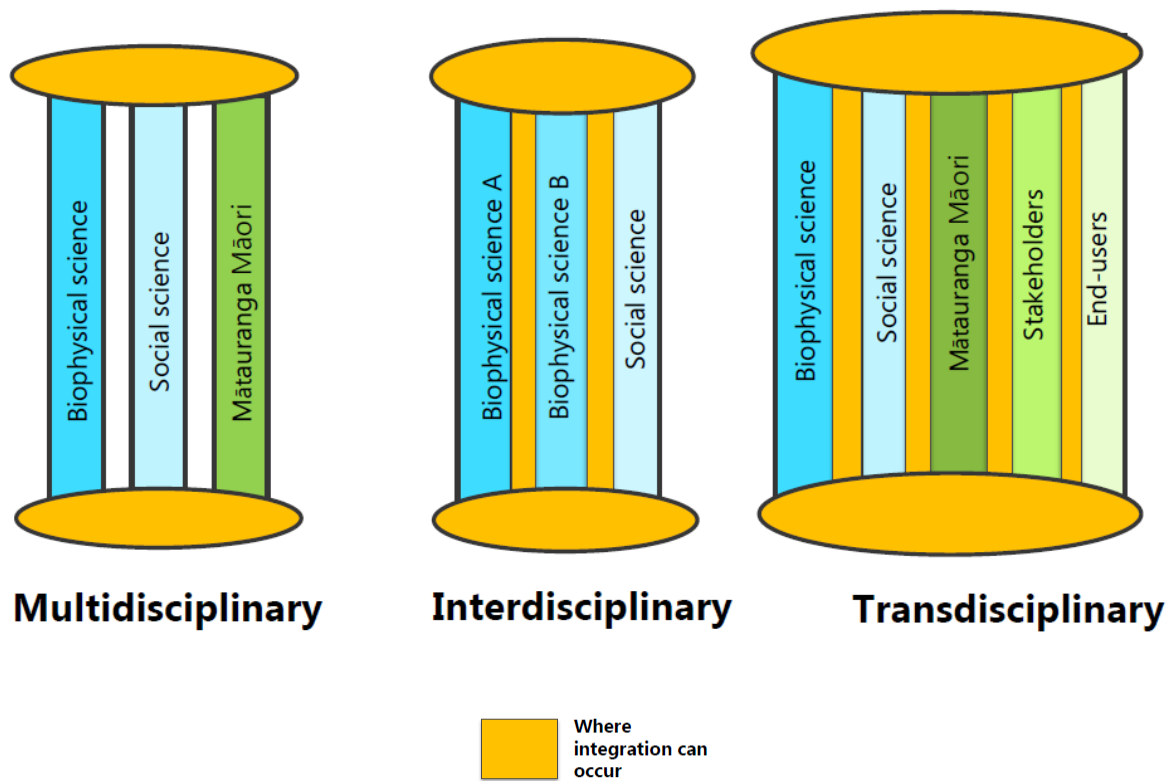


Figure 1. Illustration of how multidisciplinary, interdisciplinary, and transdisciplinary approaches to integrated research differ in terms of where, when, and how integration occurs, as well as who is involved (Duncan & Robson-Williams 2019).

1.3.7 Why trans-disciplinarity?

Transdisciplinary research has become a core element of many international sustainability agendas and as a result the formation of cross-sectoral networks and research programs that pursue transdisciplinary outcomes has increased (Popa et al. 2015; Zscheischler & Rogga 2015; Wolff et al. 2019). Solving sustainability problems increasingly involves decisions based on values. Mainstream scientific methodologies are often poorly equipped to deal with complex sustainability problems. It therefore requires civic participation and the building of social legitimacy for proposed transition pathways to sustainable societies. In this context, sustainability scientists have recognized the need to move from interdisciplinary approaches to transdisciplinary collaborations, which bring together scientific and extra-scientific expertise (Popa et al. 2015), with a move towards 'complex systems science'.

For more than two decades, sustainability transformation research has sought to better understand how large system changes toward just, equitable, and sustainable futures. They are decisively influenced by Western scientific knowledge because it is currently the dominant knowledge system that sets prevailing standards for research (Davis & Ruddle 2010). Knowledge systems exist through 'agents, practices and institutions that organize the production, transfer and use of knowledge' (Cornell et al. 2013). Knowledge from other knowledge systems, such as indigenous and local knowledge (ILK) systems, are rarely involved in research, especially in transformation research (Blythe et al. 2018, Lam et al. 2020). The importance of questioning the values, background assumptions, and normative

orientations shaping sustainability research has been increasingly acknowledged, particularly in the context of transdisciplinary research which aims to integrate knowledge from various scientific and societal bodies of knowledge (Popa et al. 2015).

Environmental research is also one area where transdisciplinary practice examples are beginning to manifest out of theory (Harrison & Loring 2020); maybe because environmental research is fundamentally intersectoral, often strongly place-based and requires collaborative approaches based on diverse knowledge sources and interests. In such settings, local and indigenous knowledge is harder to marginalise or ignore. Good practice in the literature includes scientists and local residents working together (Landstrom 2017) and collaborations across professional cultural boundaries (Harris & Lyon 2013). Approaches involving researchers and communities with indigenous and non-indigenous partnerships are also emerging in this space (Harrison & Loring 2020; Henwood et al. 2019).

1.3.8 How does transdisciplinarity work?

Transdisciplinary research involves research occurring across scientific disciplines and institutions but extends to societal actors (e.g. stakeholders, practitioners, and end users). This approach involves all participants formulating the issue, deciding the research focus, agreeing to the approach and methods, undertaking the research, and interpreting and disseminating the findings. Integration occurs throughout the duration of project (Duncan & Robson-Williams 2019).

Understanding existing practices and developing support resources are very important, as there are opportunities for impact when working with stakeholders, practitioners, and end users, and involving other knowledge holders (e.g. Māori and/or local knowledge) in research projects. Transdisciplinary research can help scientists understand local issues, see local perspectives of a problem, and elicit knowledge and understanding from local observations. It can also provide an opportunity for scientists to convey how they see an issue and explain the data and tools they use and how they relate to an issue (Duncan & Robson-Williams 2019). This way of undertaking integrated research, which is akin to weaving knowledge together rather than one form dominating the other, can be an enriched learning endeavour for all parties and can allow research to be co-produced and framed so it has relevance, credibility, and legitimacy from both a local and a scientific perspective (Cash et al. 2006; Duncan & Robson-Williams 2019). Research developed and conducted in this way is expected to have a higher likelihood of gaining a depth of understanding of the issues and lead to better interventions for change to achieve desired outcomes and find solutions (Mitchell et al. 2015).

1.3.9 Complexities of integration

Integration is complex in its own right, and involves not only more people, disciplines, and knowledge sources but also very different ways of working (Duncan & Robson-Williams 2019). It may also be difficult to bring researchers and/or stakeholders together consistently over time, to build the relationships needed to develop methodologies, a research agenda or project, or to maintain project momentum.

Risks

There can be many barriers and limits to undertaking more interactive and co-productive forms of integrated research. Many of these are linked to the need for the initial time required to build strong relationships and trust between actors and parties. Another difficulty is how to keep integrative teams together over the long term. Interdisciplinary and transdisciplinary research can be profoundly challenging – developing a research process that suits all, conducting processes that collectively formulate research issues, integrating a methodological approach, and the many issues with sharing knowledge and intellectual property. There can be many difficulties finding a common understanding of the language and terms used in the research, which stresses the need for translators, and translation between disciplines and various knowledge systems (Duncan & Robson-Williams 2019).

There can also be risks in undertaking integrated transdisciplinary research. For example, researchers, practitioners or stakeholders with political agendas might seek to frame the issues and research in directions that favour particular institutions or are at odds with other organisations and stakeholders. Also, end users might be calling for research that does not advance knowledge the wider scientific community deems science excellence or cutting edge (Duncan & Robson-Williams 2019).

1.3.10 Key themes of transdisciplinarity

Theorising transdisciplinary concepts and approaches and providing good practice examples is essential in order to understand how transdisciplinarity works (Tötzer et al. 2011). However, there are few practical examples to show how it works to deliver beyond notions of 'stakeholder engagement' (Angelstam et al. 2013) and little coherence to the corpus of published work (Landström 2017). There are also gaps about how transdisciplinarity may help repair epistemological divisions between indigenous and colonising populations, especially where the focus is on social justice and ecological sustainability. There is also a potential for not dealing with knowledge in an equitable way and marginalising some knowledge – from the dominant knowledge forms such as science – to a perspective or accessory (e.g. indigenous, local). Researchers from different fields need to be enabled to work closely on common problems over extended periods, creating conceptual models that transcend discrete disciplinary interests (Harrison & Loring 2020). Further transdisciplinary projects acknowledge interdependence of socio-ecological systems, restructuring disciplinary knowledge and the creation of new shared knowledge (Jakobsen et al. 2004).

Bammer (2017) explored the key features or characteristics of transdisciplinarity identifying key themes and producing a series of toolkits from reflection and learnings to date. This analysis highlighted several essential themes: a need for change; collaboration; co-production of knowledge and policy development; and methods for knowledge synthesis. It advocated advances in research implementation, systems thinking, knowledge synthesis, and integration methods. We have used these characteristics and themes in the conclusions of this report.

1.3.11 Issues and summary

The question this SSIF Māori Flagship addresses is how to guide and increase Māori research and understanding within integrative research, as a specialist area of expertise and knowledge to contribute to research projects across the company and to create new research and investment opportunities. Māori research is ideally situated to promote integration, as it inherently works across various disciplines, knowledges, and perspectives to address and find solutions for issues, problems, and challenges.

1.3.12 Manaaki Whenua and integration

A number of discussions have taken place in Manaaki Whenua over the past 2 years on the topic of integration and what this actually is: [What is Integrative Research? \(sharepoint.com\)](#). The discussion explained some of the differences between multidisciplinary, interdisciplinary, and transdisciplinary approaches and whether Manaaki Whenua was already undertaking integrative research and what the opportunities and challenges were. It also highlighted the need to build integrative capacity in the company. Findings were supported by a survey and a detailed report assessment (Duncan & Robson-Williams 2019). More recently, through a Māori flagship project (2020–2021), we have extended this conversation to include a kaupapa Māori perspective, which partly addresses the role mātauranga Māori may have in our science and research and the best way to incorporate this. A more detailed approach is given for including Te Ao Māori following correct process and guidelines. This work provides an indigenous voice in the company and starts the conversation on how indigenous knowledge may better utilised and understood in an integrative and transdisciplinary science and research context.

To date, Manaaki Whenua has developed an i³ interface (integration x innovation x implementation) website that focuses on supporting integrated research [Integrated Research Toolkit – Home \(landcareresearch.co.nz\)](#). This i³ site builds on the experience and current capacity within Manaaki Whenua, provides an overview, and brings together key concepts, resources, and methods that help guide us towards integrative research (e.g. from framing problems to finding solutions). The site also highlights challenges and opportunities. The interface is also a pathway towards systems thinking and transdisciplinarity (Duncan & Robson-Williams 2019). The Māori flagship project (2020–2021) was invited to incorporate some of its findings, concepts, methods, tools, and case studies in this i³ site and build resources and capacity across staff, disciplines, and knowledge.

The SSIF flagship research contributes to the i³ interface given above, primarily to identify how mātauranga Māori and kaupapa Māori can sit alongside modern science and be used to achieve effective integrative research in Manaaki Whenua, and to demonstrate transdisciplinarity (based on key characteristics/properties of transdisciplinarity given in the literature). The Māori integrative framework, method, and model presented in this report can be used as a toolkit (kete) or vehicle (waka) towards effective integrative and transdisciplinary research that embraces Te Ao Māori and mātauranga Māori. It can be used in actual projects, opportunities, and future co-design, to achieve best practice for integrative science and research across disciplines and knowledges (away from silos) towards some preferred level of disciplinarity (i.e. multi-, inter-, trans-). It can also be used to build capacity in the company

for undertaking integration in a respectful manner following Māori cultural best practice (tikanga). In terms of resources at a practical level, we have given selected examples of our kaupapa Māori work to illustrate their key characteristics and how they fit the process model and framework given in this report. To date, Māori-led science/research case studies, showing strong integrative and transdisciplinary characteristics, include the 2014–2021 SSIF Wetlands Programme and Te Reo o Te Repo handbook <https://www.landcareresearch.co.nz/publications/te-reo-o-te-repo/> and the 1998–2004 Waiapu integrated catchment project (Ngāti Porou), Gisborne East Coast [Integrated Research Toolkit – Case study: Māori community goals for ecosystem health \(landcareresearch.co.nz\)](#). Other Māori case studies were being considered at the time of writing this report.

2 Methods

A range of methods were employed between October 2017 and June 2020 to complete the following critical steps:

- Complete a literature review of indigenous transdisciplinarity and Te Ao Māori concepts, values and principles, and document key characteristics and understandings for framework development.
- Produce summary statistics of Māori research within Manaaki Whenua.
- Hold an internal workshop with Māori staff in Manaaki Whenua to discuss key concepts, characteristics, and elements of integration and transdisciplinarity and discuss kaupapa Māori/Te Ao Māori values, concepts, and principles.
- Complete a survey and questionnaire with key senior science staff and selected PLs in the company to gain responses on integration and where they see alignment with kaupapa Māori/Te Ao Māori concepts and principles.
- Develop a provisional kaupapa Māori framework and model for integration and transdisciplinary research.

For the project (SSIF/SPB Portfolio), 'Towards a Māori Integration Framework', an application was made (start date 1/7/2019) to the Landcare Research Social Ethics approval process for research involving human participants, application number: 1920/03. [Towards a Māori Integration Framework](#).

2.1 Literature review

A literature review and summary were carried out from October 2019 to April 2020. The review included a comprehensive search of all previous and existing literature on internationally and nationally on indigenous transdisciplinarity and Te Ao Māori concepts, values and principles. This review used a search of key words, and then documented key characteristics, understandings, and findings of integration and transdisciplinarity. Findings of this literature review have been included as an important part of framework development.

The literature search was important to scan both nationally and internationally on the topic of research integration frameworks in the context of:

- 1 *multi/inter-disciplinary research projects to solve complex problems (i.e. socio-cultural-economic issues)*
- 2 *integration methods of multiple knowledges to address planetary health*

A summary of the methodology and steps used for the literature review is given below:

Part 1. Structured Literature Review

Materials & Methods

We followed the structured literature review method of Zscheischler & Rogga (2015). Briefly, in August 2019 we surveyed ISI Web of Knowledge and Scopus databases (years 1991–2019) using combinations of the search terms *integrative research*, *knowledge transfer* in conjunction with *indigenous* or *Māori*. We restricted our search field to *environmental science*, *resource management* and *land management*, as we felt these were most relevant to MWLR's core purpose and goal. This approach was repeated for the Manaaki Whenua grey literature. We identified 340 peer-reviewed articles. No reports from the MWLR grey literature were found using these terms. No other terms were considered. Bibliographic information was exported to a database (endnote X9), where we sorted the literature into two main sub-categories: *Indigenous* (104) and *non-indigenous* (236). Finally, within the *indigenous* sub-category we filtered the material for relevance and scope according to the terms *integrative research*, *knowledge integration/transfer*, and *frameworks*, which concentrated the material to 11 peer-reviewed publications. We then conducted an ancillary search in the field of kaupapa Māori or Māori-centric peer-reviewed publications and reports based on the expert guidance from team members, which resulted in 11 more, therefore N = 22 for the purposes of this review. Any statistical findings reported here are based on this dataset. However, for the purposes of supporting the introduction and discussion sections, we include additional literature.

Part 2. Statistical description of the literature

This section outlines result of the descriptive statistical analyses to describe/categorise the literature according to: quantity, geographical distribution, and paper category. This gives an overview of the current state and distribution of peer reviewed indigenous integrative, knowledge transfer and frameworks.

Paper categories:

We used the categories outlined in Zscheischler & Rogga (2015). The distribution of our sample publications across categories provides an indicator of the current state of knowledge and discussion. Zscheischler & Rogga (2015) postulate that the more developed a (scientific) concept is, the greater the frequency of empirical research publications based on a theoretical foundation. We allocate our sample of papers according to 7 categories:

- 1 Discussion/ Opinion, Theory: theoretical reflections; current analyses of academic domains, policy areas, and fields in which our search terms is applied; normative viewpoints, barriers and opportunities and opportunities for indigenous integration, reflections and experiences from practice
- 2 Case Study: Studies present integrated practices and field work conducted as an integration project beforehand, or evolved in an integrated project during the process
- 3 Conceptual: Publications consider, introduce, and discuss intellectual figures or notions of indigenous integration in a given context

- 4 Methodological: Methodological approaches, modification of existing methods, discussions of quantitative approaches and data analyses used in the research community, or research tools and methods conducive to practising indigenous integration
- 5 Research Paper: Studies present research findings based on multiple case studies or meta-analyses of indigenous integration practices (qualitative and quantitative research)
- 6 Review: Papers deliver research syntheses, meta-analyses, and critical evaluations of existing publications
- 7 Other: Editorials, comments, research notes, conference reports, and workshop reports

2.2 Manaaki Whenua summary statistics

Manaaki Whenua summary statistics were derived from the research office November 2020 (Appendix 1). These indicate the current Māori research involvement across the company and for every portfolio, programme and project analysed across 5 main Vision Mātauranga (VM) categories.

We used company data for the last 3 years (2018–2020) to get a better picture of the investment and project trends in relation to the inclusion of Vision Mātauranga across MWLR science which could be indicative of integration. As MBIEs VM scale was used to group this data, the caveats that should be taken into consideration are:

- The interpretation of the VM scale is not streamlined across portfolios or even within RPAs.
- VM scores are subjective and generally left to project leaders to score their own projects (i.e. research partners are not typically part of that decision process).
- VM scores are one indicator for integration or transdisciplinarity (i.e. inclusion of Māori values, knowledge, and methods in science projects), and do not tell the whole story.
- The dataset has limitations and improvements in data quality are needed.

Vision Mātauranga

To increase the Māori component in Manaaki Whenua research, and to monitor Māori research across the company, MBIE proposals use a 1 to 5 Vision Mātauranga classification scale (developed 2014, based on previous work by FRST, MRST, Aaron McGlinchy (pers. comm.), and Māori science researchers, e.g. Harmsworth 1999–2002) and this has been interpreted by Manaaki Whenua (Table 1) below into the categories: (1) Research with no specific Māori component; (2) Research relevant to Māori; (3) Research involving Māori; through to greater recognition and evidence of kaupapa Māori and mātauranga Māori in the last 2 categories: (4) Māori-centred research; and (5) kaupapa Māori.

Brief definitions help guide job leaders choose a ranking, when setting up a new project/job. It is an approximate system, based on example criteria from the tables below. There is room for discussion and interpretation across the rankings from 1 to 5, but some classes and definitions are clear cut. A definition of mātauranga Māori is given below.

We analysed the total research being carried out across the company to gain a picture of current levels of Māori research, and which portfolios it currently sits, its \$ value, and in each category to show the proportion of Māori-centred research and kaupapa Māori. This was thought to help with gaining a picture of the current level of integration from a Māori perspective and provides an indication of the amount of mātauranga Māori (across knowledges) that might be being incorporated and used in each project/programme within each portfolio.

Table 1. Vision Mātauranga (VM) ranking for projects and jobs

Vision mātauranga	Manaaki Whenua definition
(1) Research with no specific Māori component	Science-led project not involving or specific to Māori but could be of interest to Māori.
(2) Research relevant to Māori	Science project regarded as relevant to Māori along with other end users, Māori not generally involved in the design/development of project or methods, outputs/outcomes can be designed for a broad range of end-users, stakeholders, Māori.
(3) Research involving Māori	Dominantly science-based project but could involve Māori as minor players, Māori could be involved in the work as participants or users, research is often relevant to Māori and could contribute to Māori aspirations/outcomes or address critical issues.
(4) Māori-centred research	Generally addressing Māori issues, Māori are key players, uses collaborative Māori co-design, co-development, methods, frameworks, can be Māori led, and builds Māori capacity and capability next to science; uses mātauranga Māori next to science; Māori are often key end-users of the research, focussed on a Māori problem or issue; delivers to Māori aspirations, outcomes.
(5) Kaupapa Māori research	Māori led, research for Māori by Māori guided by Māori values/principles, Māori design, Māori methods, uses central mātauranga Māori throughout, focussed on Māori aspirations/outcomes, builds Māori capacity and capability; high Māori participation (communities/iwi/hapū/marae/individual); focused on Māori outputs, issues, aspirations, outcomes.

Definitions for mātauranga Māori

The definition should be broad and embracing to reflect the dynamic evolving nature of mātauranga Māori. Māori knowledge (mātauranga Māori) is defined as knowledge that arises from, is based on, or contributes to the distinct culture, identity, and collective experience of Māori. It includes knowledge:

- 1 that reflects the range of values, concepts, principles, practices of world views that define Māori as a distinct social/cultural group
- 2 relates to technologies and practices that have developed from systemic and inter-generational observation and experience in Aotearoa-New Zealand and its natural environment
- 3 that specifically addresses an issue of significance or importance to Māori.

2.3 Internal Māori wānanga/workshop

An internal workshop/wānanga was held with Māori staff (8 participants and 3 facilitators) from across the company on 17–18 September 2019 to discuss key concepts, characteristics, and elements of integration and transdisciplinarity. A wānanga exercise was planned and completed by kairangahau Māori 17–18 September 2019 (Appendix 2). This work was also carried out under tikanga under a broader ethics process and guideline for the project 'Towards a Māori Integration Framework'. Ethics application 1920/03, a group consent form, was developed and agreed upon for this wānanga. The content of the workshop was about gathering Māori researcher/practitioner experience/knowledge. Results of the wānanga exercise are presented in this report (section 3.3).

The wānanga included the following kairangahau Māori staff:

Facilitators: Selai Letica – RPAL, Garth Harmsworth – Toi Rangahau Māori, and Yvonne Taura – Kairangahau Māori

Participants:

- Holden Hohaia – GM Māori Development
- Shaun Awatere – Senior Kairangahau Māori
- Nikki Harcourt – Senior Kairangahau Māori
- Phil Lyver – Senior Kairangahau Māori
- Mahuru Wilcox – Kairangahau Māori
- Lara Taylor – Kairangahau Māori
- Jade Hyslop – Kairangahau Māori
- Jonno Rau – Pedologist

This hui was to co-develop and draft key practice principles for integrated research to identify and draft key practice principles that kairangahau Māori (Manaaki Taiao (MT)) use with their Māori partners to integrate Māori and western knowledges to achieve their cultural, social, environmental, and economic aspirations.

The expected outcome of the hui was:

- 1 A co-developed definition(s) of what good knowledge and project integration 'looks like' in relation to MT and MWLR research, from a kaupapa Māori perspective.
- 2 A list of barriers and opportunities for knowledge integration in MT and MWLR.
- 3 A list of key practice principles and actions that support and implement knowledge integration as identified by the MT rōpū.

2.4 Senior staff survey and questionnaire

A senior staff survey was carried out between April and June 2020. A questionnaire was developed (Appendix 3) and sent to senior Manaaki Whenua staff – including chief scientist, general managers, and portfolio leaders (10 respondents). The following people were approached to participate in this kaupapa Māori integrative research and agreed to share their ideas and answer key questions:

- Fiona Carswell: Chief Scientist
- Graham Sevicke-Jones: GM Science & Knowledge Translation
- Pete Millard: GM Science
- Suzie Greenhalgh: PL Society, Culture & Policy
- Chris Phillips: PL Managing Land & Water
- Sam Carrick: PL Characterising Land Resources
- Sandra Lavorel: PL Climate Change Adaptation & Mitigation
- Geoff Ridley: PL Biota
- Chris Jones: PL Wildlife Management & Conservation Ecology

The full list of questions can be seen in Appendix 3. Responses are summarised in the Results section under key questions and key themes, while full responses for all participants are given in Appendices 3.1 – 3.6.

2.5 A provisional kaupapa Māori framework and model for integration

Based on the literature review and summary, previous learnings, an internal wānanga/workshop with kairangahau Māori, and a senior staff survey, we developed a provisional kaupapa Māori framework and model for integration and for transdisciplinary research presented in section 3.5 of this report.

3 Results

We present results from a universal international literature review using key terms (section 3.1), MWLR summary statistics (section 3.2 and Appendix 1), an internal kaupapa Māori workshop (section 3.3 and Appendix 2), a senior staff questionnaire (section 3.4 and Appendix 3), documentation and summary of existing Māori values and principles, and an examination of existing frameworks and models that have been used for this work 'to develop a Māori transdisciplinary framework and model for integration' (section 3.5 and Appendix 4). The findings and conclusions in this report are based on a wide variety of information sources, as given in the methods, and synthesised collectively. A literature review using key words (e.g. indigenous, frameworks, integrative) was used as a starting point to gather and investigate information.

3.1 Literature review and summary results

A broad review was carried out nationally and internationally using key terms such as: *indigenous integrative*, *knowledge transfer* and *frameworks*. Few publications were downloaded and analysed with these terms. Key references that were downloaded and briefly summarised are given in the reference section of this report. Below are some of the findings of the literature search and review. The histogram (Fig. 2) presents the publications identified, and allocation of our sample according to 7 categories.

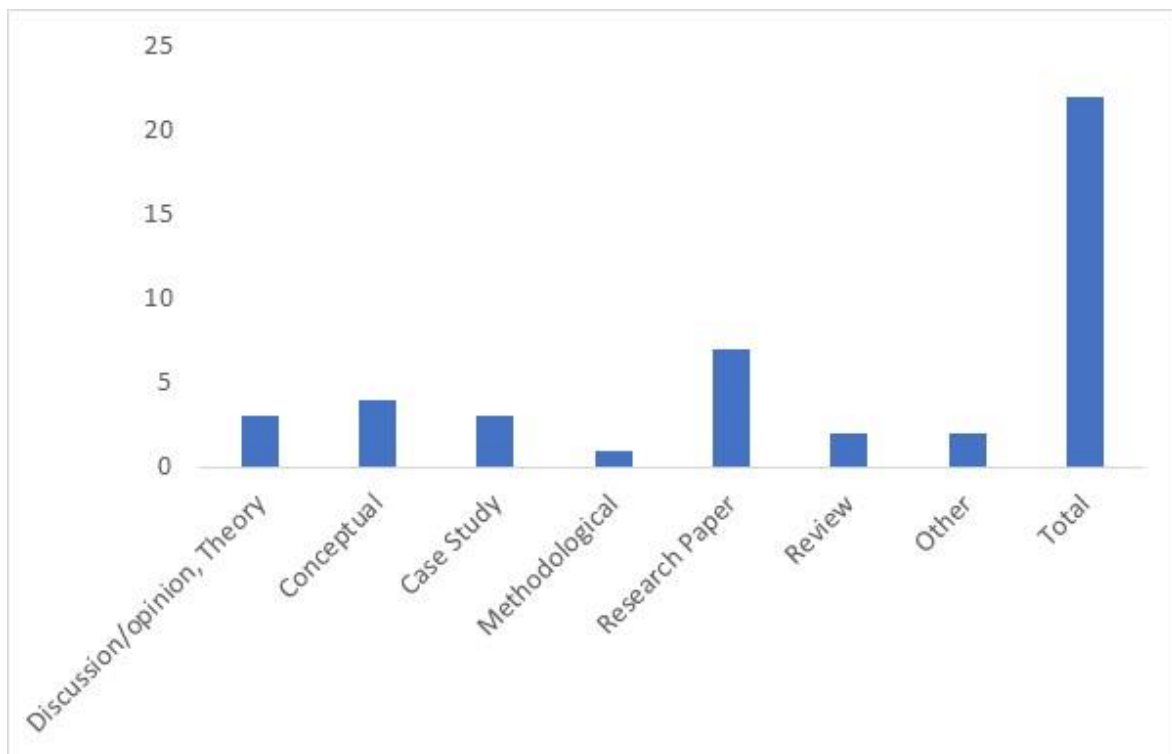


Figure 2. Overview of the literature sample based on categories.

As was the case in the transdisciplinary literature reviewed by Zsceischler and Rogga (2015), most of our literature sample overlapped in many categories and did not fit well into a single category. The small sample size reflects the paucity of indigenous literature in the public science arena, especially with reference to indigenous and integrative key terms, and no publications were found articulating indigenous views of transdisciplinarity. Most indigenous papers with any reference to integration were in environmental topic areas (e.g. water, land, values, indicators/monitoring, sustainability), many addressing complex problems but primarily to describe an indigenous approach, issue, or perspective. From a conventional science practice perspective, the low number of methodological and review publications indicates the limited amount of material from an indigenous perspective and ontology included in science. This review indicated a dearth of documented indigenous work and knowledge influencing innovative and integrative approaches in science. The literature in New Zealand indicates that kaupapa Māori and Māori-centric approaches are limited and sporadic in the science literature, but prolific and numerous in indigenous Māori controlled publications that reflect indigenous ethics, issues, based on kaupapa Māori method and perspective, and focussed mainly on indigenous readership (e.g. Ngā Pae o Te Maramatanga CORE, universities, health, social science). Most indigenous papers show a high degree of knowledge exploration and creation (based on epistemological beliefs, theory, and concepts) that are largely embedded in community, kaupapa Māori, and commonly use iterative and adaptive experience and practice. The majority emphasised qualitative and subjective approaches (e.g. experiential/empirical/observation/interview), rather than objective approaches, for example, using direct measure or metrics. All the downloaded papers, to some degree, articulated indigenous characteristics and perspectives of projects (e.g. collaboration, participation, types of knowledge used) that could contribute to, or guide integration and inform transdisciplinary practice.

3.1.1 Quantitative Trends

Using the search terms along with ancillary literature provided by our experts, we found the total publication rates for indigenous or Māori integrated research were persistently low over the last two decades, with only three outputs matching the search terms in 2018, the highest annual output over this almost 20-yr period (Fig. 3).

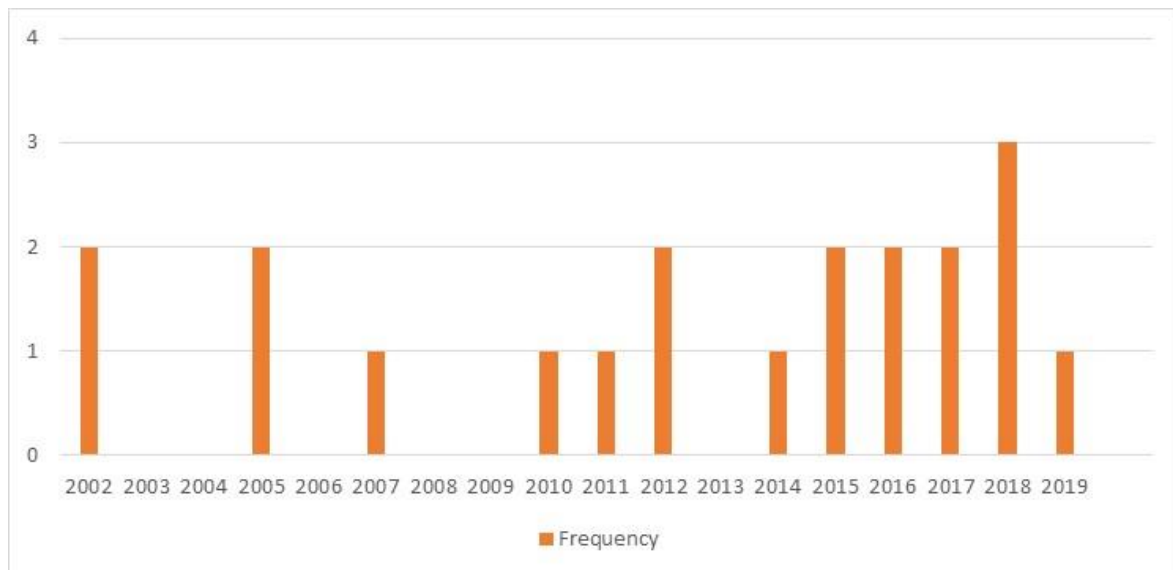


Figure 3. Annual publication output between 2002 and 2019.

Internationally, outside Australia and New Zealand, only four papers came from elsewhere, including Germany, Canada/Ecuador, and Japan/Panama. This limited sample size was somewhat influenced by our constrained search terms, and the fact that we did not search grey literature external to MWLR. It also reflects that much indigenous literature remains unpublished.

Part 2. Literature Domains

In order to find out more about the content of indigenous research being carried out internationally and in Australia and New Zealand – under the definitions and search terms of indigenous, frameworks, integration, and/or transdisciplinarity – we analysed the indigenous literature further under four main domains:

- **Outcomes and impacts (causal and contextual)** – providing examples that explain perceived successes and challenges within existing integrative research
- **Barriers and opportunities** – identifying the main factors that either diminish or enhance the value of undertaking integrative or collaborative research
- **Knowledge gaps** – important areas of knowledge(s) missing that when included can fulfil the expectations of effective integrative research
- **Frameworks (principles, values, concepts, etc.)** – that have been used and documented, especially those developed by indigenous researchers and applied in some way to achieve integrative research.

This provided us with additional information on what the indigenous projects were trying to achieve in terms of outcomes and impacts, what were some of the barriers and opportunities noted, what were the knowledge gaps cited, and the frameworks that were used based on principles, values, and concepts. Using this more in-depth analysis, we were able to organise the literature content under several key headings, for ease of access, and the resulting literature bibliography at the back of the report is given pertaining to the key topic areas of:

transdisciplinarity, indigenous frameworks, integrated knowledge systems/research collaboration, mātauranga Māori/Māori values, Māori frameworks, and kaupapa Māori. Hence indigenous literature in the bibliography is often given under more than one main topic area.

3.2 Manaaki Whenua summary statistics

The internal statistics from Manaaki Whenua VM scale categories provided us with extra information of what is going on inside the company with regards to Māori research and knowledge across projects, programmes, and portfolios. This can be analysed over successive years to indicate trends, and track, for example, the number of projects that are kaupapa Māori led, influenced by Vision Mātauranga, or are incorporating mātauranga Māori or Māori researchers to some degree.

Within the last 3 years (2018–2020), the data showed that the number of Manaaki Whenua projects with a VM research score of 2, 3, 4, and 5 (MBIE VM scale) has been gradually increasing over the period of analysis (Fig. 4). It also indicated that Māori related (VM score 4) and kaupapa Māori research (VM score 5) areas were limited in number in the company as expected, and this reflects the specialist nature of the work and high degree of expertise and capacity required in Māori centred research. The statistics do show that Māori research is of high interest in the company, possibly influenced by MBIE VM funding policy, but also indicates a commitment and genuine interest by staff in the company for the inclusion of Māori research in integrative science and research. Māori related (VM score 4) and kaupapa Māori research (VM score 5) are two main areas where we would expect the most Māori staff, Māori led and kaupapa Māori work, and highest level of mātauranga Māori in projects. These VM category areas typically include the greatest level of Māori led research design and the highest amount of Māori community/organisation participation.

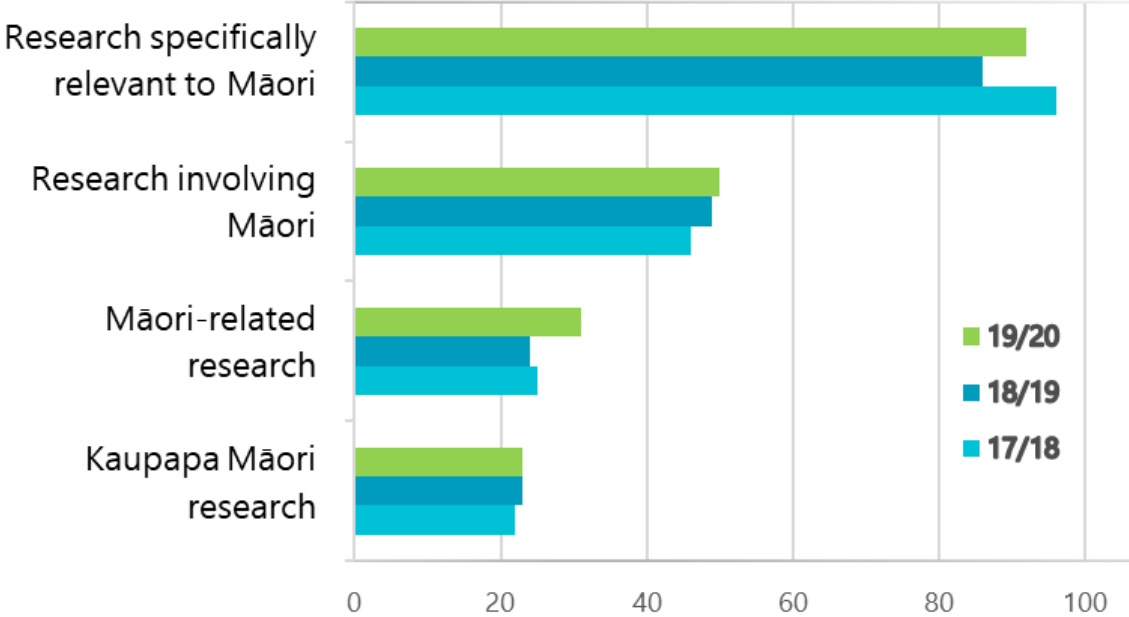


Figure 4. MWLR number of Vision Mātauranga jobs score 2–5 (2018–20).

Māori research is making a significant contribution to revenue in the company. This revenue is spread across all the main portfolios particularly: Plant biodiversity & biosecurity, Wildlife management & conservation, Society, culture and policy, Characterising land resources, and Managing land and water. In the last 3 years (2018–2020), this revenue is generated from a wide variety of projects that include VM research categories 2, 3, 4, and 5 and related activities (e.g. partnerships) indicating Māori research is important across the company and is becoming integrative. Collectively, Māori research and projects including a Māori theme are making a valuable contribution to the MWLR revenue pipeline; contributing to over \$87.5 million in revenue (Table 2), ~37% of the overall revenue generated for the same period.

Table 2. MWLR revenue tagged to Vision Mātauranga research score 2–5 (2018–2020)

Portfolio	Sum of financial period
Biota	\$9,891,334
Plant biodiversity & biosecurity	\$23,839,294
Wildlife management & conservation	\$14,585,273
Society, culture and policy	\$12,248,685
Climate change adaptation and mitigation	\$10,000
Characterising land resources	\$12,340,810
Managing land and water	\$12,957,088
Bio Heritage (NSC)	\$1,612,945
Total	\$87,485,429
% of MWLR total revenue	36.6%

Within the last 3 years (2018–2020), most investment for Māori based research using an analysis of VM research scores of 3, 4, and 5 (and related activities) has come from a number of key sources: ~28% MBIE contestable (e.g. NSCs, Endeavour, Smart Ideas, Partnership programmes etc), ~10% SSIF and then ~9% commercial (Fig. 5). It is unknown at the time of writing where the exact balance of investment comes from.

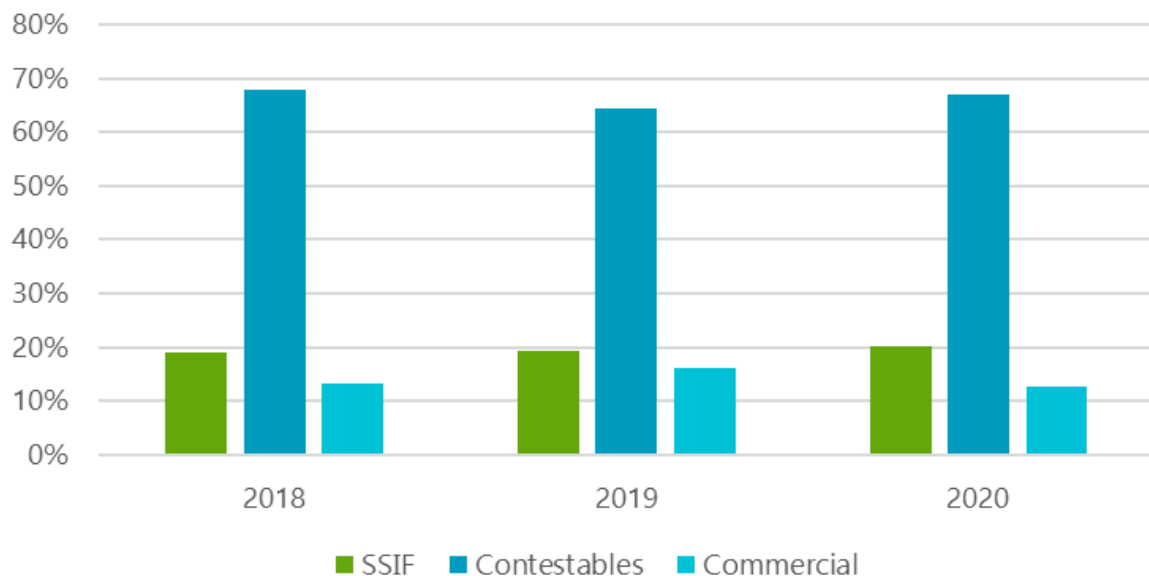


Figure 5. Percentage funding of each investment source of Vision Mātauranga research score 3–5 (2018–2020).

3.3 Internal Māori wānanga/workshop

An internal Māori workshop/wānanga was an early initiative to collect information for this Māori flagship project held in Hamilton in September 2019. The internal workshop/wānanga with kairangahau Māori from across Manaaki Whenua, followed a number of structured sessions over 2 days, where focussed conversation and discussion was facilitated in each session, under key themes (Appendix 2). The workshop/wānanga exercise provided a strong Māori perspective using Māori staff expertise and knowledge to explore and understand Māori and general concepts, characteristics, and elements of integration and transdisciplinarity. The workshop then identified and developed kaupapa Māori/Te Ao Māori based values and principles that could be used to guide integration, increase integrative research and science in the company, and increase Māori research and the use of mātauranga Māori in projects. This shared expertise and knowledge has been used to develop the Māori integration framework and model shown in this report.

Results from this 2019 wānanga were divided into five main sections: Objective thinking, Reflection, Interpretation, Decisions, and Mahitahi – working together. We collated summaries of key concepts, themes, and key Māori values to consider some of the underlying values and principles that could guide the development of integrative frameworks and integrative science and research towards transdisciplinarity (away from silos).

As part of results, questions and responses of the wānanga are given below. A number of key questions were explored and discussed under key headings in each wānanga session.

Objective thinking:

What type of research is carried out where you integrate knowledge?

- Science/mātauranga Māori informing policy, using methods and approaches to understand wetlands, freshwater, soil health.
- Good examples of integrating knowledge are seen in research programmes such as: Values, monitoring outcomes (VMO) programme – integration greatly helped across perspectives/knowledge.
- Biological Heritage National Science Challenge Scoping group process – foundations being laid for potential integration (group dependant).
- Empowering local institution; reversing cultural extinction; informed by kawa and tikanga.
- Land use potential and capability – LPG and soils team.
- Land use management opportunities; Kairangahau RPAL – Society, Culture and Policy Portfolio.
- Social science within LPG.
- Partnership on projects: leadership, policy, application, data gathering.

What values/principles do you use?

- There are many Māori values and principles that can guide integration or integrative research.
- Mana motuhake; ahikāroa; whakawhanaungatanga; whakaheke kōrero – in respect to whenua and tangata.
- Mana of us and our research partners; transparency; caring and holistic processes; communication – kanohi ki te kanohi; understanding issues/solution options; power inequities.
- Determine what is assessed/measured; define how the data are reported and used; i.e. ecology + pedology + cultural values + economy; researchers measuring aspects that aren't relevant/at odds with the way Māori assess aspects.
- Respect; transparency; open communication; attempt to clarify roles and expectations of deliverables (not always well led).
- Shared outputs; community/iwi engagement; some community/iwi funding; equitable resourcing; shared whakaaro and thought leadership; equitable recognition for outputs.

Reflection:

What is a project/example/experience where integration helped/hindered the outcome/outputs/impacts?

- Helped:
 - When strong partnerships are developed early.
 - Examples such as Seachange – Tai Timu Tai Pari: partnership model helped; and later when it began to fall apart it hindered (i.e. project was put on hold until the partnership was re-established).

- Integrated Kaipara Harbour Management Group (IKHMG) and Marine Spatial Plan: equal, 'bi-cultural' kaupapa, and iwi-led collaboration.
- High level of integration in the Kaipara Harbour Treaty Settlement negotiations.
- Pupuri Mauhanga o Ngāti Kuri: iwi-led project.
- For any project that is led by aspirations, outcome, or goals from day 1; this enables a collective buy in and then provides an agreed frame for identifying the most useful – appropriate/relevant/digestible data/outputs.
- Hindered or integration poorly conceived:
 - IKHMG Kaipara management group where the management was hindered by the lack of integration at the governance level, which then affected management and downstream activities and outputs, and often results when integration is poorly conceived and developed.
 - Some projects attempt to carry out 'integrated research' but this was not equitable, and some parts were assimilated into others. It typically does not reach full potential. Involvement in projects such as SENZ – was innovative and challenging – did not deliver all expected outputs; parts became more assimilated than integrated.
 - Where a lack of understanding of what Māori knowledge is or what it can contribute (contextualised within Te Ao Māori). Hinders the integration and forms a barrier to Te Ao Māori being fully recognised and realised.
 - When the VM component is tacked on or becomes an appendage/outlier and is not fully respected or encouraged; often this is embarrassing/tokenistic – cannot deliver anything useful to Māori.
 - When other researchers/team members (within the company) go back to a 'default' way of operating (e.g. back to silos, not inclusive).
 - When people find it difficult to sit in a space of 'not knowing' and do not acknowledge their limitations.

What aspects do you love/hate in more integrative research?

Love these aspects	Hate these aspects
Where we work together/collectively to address common issues/problems (mahi tahi, kotahitanga)	Having limited time/constraints to build relationships and deliver meaningful work/ outputs (integration often takes place in longer timeframes)
Where Māori values and mātauranga Māori are used and regarded as important in all research and guide our actions, behaviour, and responsibilities. Values such as manaakitanga (hospitality, generosity, care, support), kaitiakitanga (guardianship of our environment), ngākau pono (being loyal, faithful, sincere), ngākau māhaki (pleasant, respectful, good mannered)	Limited capacity in Te Ao Māori/ mātauranga Māori /te reo Māori affects capacity and capability in teams to properly support and contribute to integration
Where the work/research is aspiration or outcome focussed and sets the kaupapa (framework, foundation)	Poorly resourced/difficulties in obtaining funding (e.g. lack of security, long term funding) – affects continuity, relationship building
Where we are active and participatory listeners, thinkers, and contributors	Not using the Treaty principles as a foundation for integration, not having understanding or empathy with Māori values or TOW principles

Love these aspects	Hate these aspects
Where we have equitable power arrangements in a project (sharing the same resources in a more equitable manner). Strive for equality in knowledges used	Where the work becomes an appendage (i.e. a minor part or diluted) within projects and becomes subsumed, assimilation vs. integration
Ability to open up and listen to the stakeholders/clients to understand their needs and deliver responsive/satisfactory products and solutions	The lack of support from iwi or national leadership for flaxroot or community goals (e.g. emphasis often on economics over environmental or social)

Interpretation:

What's the value of integration in science projects?

- Brings people to work together (across disciplines).
- Brings different sources of information and knowledge together; to share knowledge and produce more robust, meaningful, and relevant outputs.
- More likely to help solve complex issues/problems by working outside of silos.
- Encourages and provides broad/diverse worldviews, perspectives, and ways of knowledge and understanding.
- More likely to deliver on Te Tiriti o Waitangi – by being holistic across domains (cultural, social, environmental, economic).
- Changes the way people work together, build capacity, co-learn, and carry out research and science.
- Has many advantages and flow on effects – such as co-design of projects, co-production of knowledge, development of new methods and knowledge.
- Brings a richness of knowledge and perspective to our science. Advances our capabilities, skills, expertise.
- Shared understanding and knowledge can lead to better solutions.
- Can provide better equity in science, empowerment, improved learning, sharing, and moving away from isolated research with narrowly focussed outputs.
- Can generate something bigger, richer, more holistic, more meaningful than what could be done without integration.

What makes integration helpful?

- Meaningful research is more likely to lead to change and make a difference; offers new styles of operating, co-learning, collaboration, advancement.
- Can deliver new innovative methods and tools for collecting/recording information and knowledge.
- Encourages and allows space for building capacity/capability of staff and Māori teams and researchers.
- Through cooperation and working across disciplines and knowledges, it can elicit empathy and understanding of other perspectives (e.g., including open discussion, agree to disagree, facts, multiple truths).

- It can provide recognition, respect, and legitimacy to other people's values, knowledge and perspectives.
- People can take responsibility for their own learning/filling knowledge gaps.

What patterns have you seen in terms of who uses what?

- New styles of working globally, nationally to address complex issues, breaking down barriers, such as working collectively/collaboratively across disciplines, stakeholders, integrative styles of working.
- More of a focus on agreeing on what the outcome(s) is/are, e.g. agreed environmental outcomes, social outcomes, multi-dimensional outcomes, to achieve meaningful change, e.g. water reforms, biodiversity.
- Interest in using other types of knowledges, a range of knowledges (e.g. local, indigenous knowledge), developing transdisciplinary research based on knowledges.
- A change to informing research direction, co-design, identifying research issues and questions (patai), that includes a wider range of stakeholders (e.g. collaborative research).
- Accepting a broader set of perspectives, values, knowledge, and solutions from stakeholders including Māori.
- A move to adhering/recognising Te Tiriti o Waitangi and its principles.
- A higher level of interest in mātauranga Māori and Te Ao Māori and what this is and how it can contribute.

Decisions:

What should we consider when selecting/describing integration for Manaaki Whenua science/projects at the project level? What are the red flags?

Considerations	Red Flags
Who is the project for/who will benefit?	No or limited Māori staff/Manaaki Taiao enquiry/involvement from start
Is the timing for the work right?	Work is being rushed with last minute input
Who are the stakeholders? Are Māori included? Have Māori been brought into this work early (from beginning)?	Māori research included purely to improve funding, appease participants, or as tokenism (not genuine)
Are key partnerships in place? what relationship exists? does this require a partnership? or do relationships have to be built?	There is no attempt to include wider perspectives/knowledges, or a place for Māori researchers to pursue kaupapa Māori research or use their own research design.
The proposal has a suitable tone, āhua (form, characteristics, properties), approach, language that is inclusive.	The proposal doesn't include a relevant or a culturally safe space for Māori researchers or communities to be involved
Who is leading the idea? Can they be trusted?	The issues, goals, or expected outputs are not considered relevant to Māori
The work addresses key relevant Māori issues or problems	Not responding to Māori issues or building Māori capacity

Considerations	Red Flags
Funding levels – to support Māori research and capacity	Not increasing revenue or security for Māori
Sufficient resourcing and time allocated for Māori researchers to contribute and participate in the work equitably	Lack of/little participation in developing the proposal and project milestones. Little Māori time (hrs) in project
Reputable track record. The team or leader has some track record for including Māori research/ Māori researchers	Involvement of Māori only required at a later stage of the project – no co-development at beginning, and no, or little, approach for measuring success by Māori

In terms of achieving integration some of the barriers and opportunities considered were:

Barriers	Opportunities
Lack of resourcing and funding, under resourced Māori staff	Increased funding opportunities. External signals driving better support through funding/resourcing (e.g. MBIE endeavour, VM in projects, VMCF, NSCs supporting Te Ao Māori research, Ngā Pae o Te Maramatanga)
Mixed funding signals, highly competitive nature of contestable bidding, exclusion of skilled Māori staff and expertise that could contribute	Policy drivers from Government that support VM. Government signals in national policy e.g., MBIE VM, NPS-FM, Fit for a better future, etc. drive the need for more/inclusion of Te Ao Māori and VM
MWLR: Lack of Māori involvement in strategic planning, lack of Māori inclusion in high-level planning and resource allocation	MWLR: Company policy and directives, decisions, strategic planning, that include a Māori voice, VM investment across portfolios – presents opportunities within the company
Where behaviours such as ignorance, closed views, segregating Māori, exclusion, and lack of willingness to change become barriers	To encourage broader thinking and inclusion. Training and education for all staff, Tiriti o Waitangi workshops, Te Reo, building staff confidence and capability, working on projects together, co-learning, ability to understand other perspectives, willingness to change, partnership hui/wānanga
Poor understanding of indigenous rights, TOW, principles on which to adopt partnerships, participation, collaboration, integration	Understand and adopt Treaty principles across the company and how they may support and guide collaboration, participation, integration
Colonialism, racism (institutional, intentional, and unconscious bias), often causing disparities	To break down barriers and improve education and learning through open dialogue and integration, review programmes/processes that encourage inclusivity and diversity
Limited current Māori capacity – some staff over stretched, some under resourced	To build and increase Māori capacity and capability, build networks across projects
Understanding where and how kaupapa Māori and Māori-centric research can make effective impact/change	To increase understanding, awareness, and support from SLT and PLs to submit strategic Māori-led proposals
Lack of understanding of Te Ao Māori at senior level, limited MWLR capability (e.g. where VM can be used in science) for decision-making at portfolio and programme level	To build and strengthen the relationship between PLs and Manaaki Taiao members. To increase individuals/champions among MW staff (to support VM, kaupapa Māori)

Barriers	Opportunities
A narrow view of science and research – keep discipline based and siloed – having a narrow view of what science and science excellence is (e.g. high impact papers), and what constitutes expertise	Expand views of science excellence and how mātauranga Māori can fit in this. How does VM contribute to science excellence? Identify success/best practice models
Māori being funded in a few/limited number of singular projects, portfolios, and only contributing to restricted outcomes – i.e. not holistic (feature of some MWLR science)	Māori expertise recognised (and funded) across the company, portfolios, and able to contribute to complex multi-dimensional science and research (fits better with Te Ao Māori)
External: Poor alignment of projects with Māori needs and aspirations	MW kairangahau Māori working across portfolios to identify better alignment with Māori issues, needs and aspirations

Mahitahi – Key themes and values

Māori values are based on and derived from mātauranga Māori (Māori knowledge, traditional knowledge) and can guide our priorities, responsibilities, behaviours, practices, and actions. The way we use Māori values and our understanding have changed in the 20th and 21st centuries but are still based on traditional mātauranga Māori/mōhiotanga/āhuatanga. There are a multitude of Māori values and principles.

In the workshop/wānanga we explored a large number of Māori values and principles and discussed how they could be used to guide the development of a Māori integration framework. The premise was that principles are drawn from Māori values, and can be used to guide and give direction to what we are trying to achieve in this flagship project. We should understand them and embrace them. In the wānanga we attempted to draw out some of the key values and principles we thought could contribute to our understanding of *'integration and transdisciplinarity'* and important for guiding integrative science and research (Table 3). We wanted to finally narrow these down to a set of under ten. The approach sets in place the tikanga/kawa (customary protocols) that can be used to guide any integration process from a Te Ao Māori (world view) perspective, especially when working with non-Māori/colleagues/scientists/researchers/etc.

At the start we were provided with a whakatauki or proverb (Lara Taylor, pers. comm.):

*Wisdom is a thing of the heart.
It has its own thought processes.
It is there that knowledge is integrated
For this is the centre of one's being.*
(Rev. Māori Marsden)

Table 3. Some of the key Māori values that were considered important when considering transdisciplinarity and integration (source: kairangahau Māori wānanga September 2019)

Key Māori values	Meaning
Ako torowhānui	Holistic learning. Thinking holistically
Awhi mai, Awhi atu, tātou, ...	Embracing diversity
Hauora kaupapa/Whai oranga	Health and well-being, having a kaupapa/plan, seeking health and well-being, healing colonial trauma, and understanding unconscious bias
Kaitiakitanga	Care for 'all things project', people, data, process
Mahi ngatahi	Working together, in partnership
Manaaki Tangata	Care for people, respect for people
Manaaki Whenua	Principle of caring, hosting, looking after our environment and people. Developing respect between people and environment
Manahau	Cheerful, excited
Ngakau tapatahi	Integrity, using integrity, genuine, having heart
Pāhekoheko	Wanting to tackle things in an integrative way or manner. Cooperate
Tau uta uta	Reciprocity, reinforcing relationships. Giving back what you take. Reciprocal, long-term
Te Tiriti o Waitangi principles	All are important
Tiaki	The root word (kupu) meaning 'to care for', 'look after' acknowledgement of important things to our partners outside of project boundaries, while still delivering on outputs
Tūhono	Establishing bonds, connections, networks
Urutaunga	Adaptation, adaptability/responsiveness, resilience
Wairua/tanga	The spiritual dimension, spirituality
Whakamana	Empowerment, to give authority, status
Whakapapa/Whanaungatanga	Principle of relationships; building strong relationships and connections within and outside of manaaki

3.4 Senior staff survey and questionnaire

The full participant responses and comments are given for the 6 main partai/questions in Appendix 3. In order to present the nuance and richness of what people said, we have extracted, summarised, and presented a range of responses under each of the 6 key questions and headings below. This is presented thematically in italics by sub-headings:

(1) What is your understanding of integration in research? And what does integration look like in your portfolio/programme area?

Why do we need integrative research?

The environmental issues facing New Zealanders for managing our natural resources are complex. Understanding problems can be just as difficult as finding solutions.

A linear approach is unlikely to give a lasting solution. The social complexity of managing natural resources means you have different stakeholders with strongly held beliefs about what the problems are. Dealing with the problems is not at all about coming up with the best answer; rather, it is about engaging stakeholders to make sense of the problem's dimensions and then seeking win-win scenarios, drawing upon the full range of our expertise and knowledge.

Although we undertake research across biophysical, social, economic, and cultural perspectives, we have seldom integrated across research activities as well as we could. This requires a new way of working in a truly interdisciplinary (or transdisciplinary) fashion. If we can achieve this integration, we can increase the impact of our research and potentially: (i) influence the future direction of research funding (by developing a market niche for ourselves); (ii) open the door to new revenue streams, such as philanthropic funding, and; (iii) further increase the impact of our research. Integration, therefore, becomes a key value of our research for our stakeholders and a key value internally for us.

It is very rare for a single research project to deliver all the knowledge/tools needed to solve complex problems affecting multiple stakeholders in different ways. For such issues, multiple disciplines need to be brought together in an integrated package that can be combined with insights from other knowledge domains (such as indigenous knowledge) in order to deliver adoptable solutions.

Integration – what is it?

Building a common understanding from diverse perspectives and aspirations.

Bringing together knowledge and perspectives from different disciplines and/or world views to form a deeper understanding of a subject.

I see integration as involvement of people with more than one area of expertise in a research project – both for projects led by team members, and for team members participating in projects led by other research teams or portfolios.

Integration is about combining knowledge from multiple sources to solve bigger problems than could be solved through use of a single knowledge source. For Manaaki Whenua this could include integrating across disciplines as well as framing issues through the aspirations of stakeholders and partners.

Integration is dependent on the type of issue you may be exploring. Determination of the approach and methodology drives how inclusive the information sources are. In some instances the degree of integration of knowledge may be limited, especially within disciplinary issues.

Combining multiple lines of information to provide knowledge leads to a more inclusive understanding of the problem or issue being addressed.

I believe I have a reasonable understanding of what integration is from being involved in many projects over the years that have spanned the various definitions of integrative research – inter-, multi-, and trans-disciplinary.

Integration as being fit for purpose, depends on the questions you are looking at and the context. In some instances, it may be bringing a range of different stakeholders together within the research, or it may be bringing different disciplines together within a certain type of science (e.g. an ecologist with a soil scientist) or different disciplines together from across the sciences (e.g. an ecologist with an economist with a social scientist with a Māori values researcher) or some different mix/aggregation of the above.

The majority of projects involve some degree of integration – and this is along the spectrum of the possible types of integration outlined above. Almost always it is the integration of social, economic, and/or MM science with the biophysical sciences (not that often, it is not all 3 of the social, economic and MM).

My understanding and previous practice of integration: (1) co-design research questions and where possible process methods with all involved (multiple disciplines, multiple stakeholders); (2) where relevant co-produce data collection and analysis; (3) co-interpret results; and (4) co-communicate outcomes.

Integration in my research area is often driven by funding imperatives where bids are considered more likely to succeed if other research providers can be integrated – but I think the need and opportunity is greater for better integration within Manaaki Whenua, especially for Mātauranga Māori.

Kaupapa Māori research

Mātauranga Māori is an integrative framework in its own right. It can also provide input to other integrative frameworks that work either in inter-disciplinary or trans-disciplinary ways.

Barriers

Integration (or greater integration) is often curtailed by 2 key things – amount of funding and/or timeframe of the research. The more ambitious the integration (i.e. the more disciplines, stakeholder groups, partners) the more \$ and time you need.

The extent to which stakeholders are bought in – or perhaps how many stakeholders are bought in – is quite mixed. Both the extent of stakeholders and mix of social, economic, and MM and range of different relevant biophysical sciences involved in a project is constrained primarily by the \$ and time constraints side of things. However, I find most staff try to be cognisant of the different viewpoints they should be considering (even if they are not involved in the project).

Short-term projects do not generally lend themselves to integration as we know from experience that taking an integrated research approach is more time consuming and hence more costly.

(2) How does Māori research (e.g. kaupapa Māori, Māori-centred, mātauranga Māori/Māori knowledge) fit into this integration and your portfolio/programme goals/strategy?

Kaupapa Māori research

I believe most projects aspire to have a Māori research component.

Māori worldview thinking resonates with the ethos of many researchers.

When should kaupapa Māori be used in integrative research?

Māori research in this context can be invaluable for understanding the nature of the complexity and provide approaches that may lead to better solutions or pathways that lead to solutions.

Desire to be inclusive of all views when finding solutions; genuine science interest in different epistemologies.

It depends on the nature and the type of issue/understanding that is needed. Where we are lending to more complex issues and a broader understanding of all knowledges that could lead to a better understanding/solution/outcome is needed then the more integrative the research needs to be (integrative within the context of all knowledge being considered within the world view that exists for that knowledge).

Many, but not all, issues that we research will have cultural aspects that if we embrace, will lead to a greater impact from the work through greater adoption of better, more enduring solutions.

Recognition of desire of Māori peoples to reconnect and protect their heritage; recognition that all people are part of the solution so need to include all people; recognition that Māori are increasing empowered and are integral to any solutions.

The actual practice of integration of Māori research within all components of the programme is less than might have been desired, though there are some elements where this is more important than others.

There are several projects that tend to be run as Māori-centred research with Māori stakeholders, but these tend to be limited in terms of the other disciplines involved.

It was clear that all scientists are extremely keen for engagement with Māori knowledge, questions and needs.

Māori research is highly relevant to the Systematics Team and Biota Portfolio, as we are primarily researching taonga – and yet integration tends to be compartmentalised and often limited to team and portfolio staff members, rather than involving engagement with MWLR experts from other teams.

Treaty obligations

We also have a responsibility to be a good Treaty partner. So, Māori research should be central to much that we do, not just an 'add on'.

Not every project needs involvement by Māori, though at the broadest level we should, as a Treaty obligation, consider whether such involvement would add value.

Recognition of partnership principles is important.

Another factor may be the priorities of post-Treaty entities that frequently, and understandably, deal with socio-economic support for communities in the short term.

I'm working with the Systematics team on a strategic refresh of their approach and I think the Treaty partnership will be a cornerstone of how the Collections are developed. I'm not entirely sure what this will mean for broader integration in regard to mātauranga Māori.

Opportunities

It is a significant component of the portfolio with a Research Priority Area dedicated to it and a number of high-profile jobs in other RPAs focussed on working with, and for Māori.

My sense is we need more engagement for ensuring our research is really co-designed, with ideas coming bottom-up to the portfolio.

An example of potential opportunity for integration concerns the 2020 funding round for MBIE's Unlocking Curious Minds funding.

Barriers

Essential but my thinking is that scientists are struggling and do not know what they are doing in this area.

I would support much more Māori research, but we are limited in capacity. It is, though, a constant in any strategic thinking.

Inevitably it is the amount of resource available that governs whether the project lead seeks to do this.

To be honest they and me have struggled, and we have struggled to generate revenue to support advancement.

(3) Is Māori research, and building Māori capacity in your portfolio/programme important?

Is Māori research important?

Yes, Māori research should be important across most, or all, of our Portfolios.

Yes, including Māori research would be an important component.

Yes, to building Māori capacity/capability.

Māori research is important as it can provide an approach that is more appropriate to the type of issue/question that is being proposed.

Unfortunately, not all projects that would benefit from an input of Māori research will be able to realise these benefits.

We have escalating issues around data sovereignty, and what might come out of WAI 262 and the Convention on Biodiversity – Nagoya Protocol. Just about everything we do is affected so we need to have a strong partnership with Māori.

Knowledge systems

The role of different knowledge systems would ideally be assessed in the initial understanding of the question that is to be explored. The initial step is crucial to understand what knowledge will be necessary and at what stage.

Important:

- Māori knowledge regarding potential new values and uses around changing ecosystems (from direct climate impacts or from land use / management responses for e.g. climate mitigation like retiring land from agriculture)
- Māori values around future landscapes.

Building capacity

However, since the consolidation of the kairangahau into a grouping that sits within a team that is strongly linked to one portfolio my personal view is that the focus of work has narrowed.

We probably need to think of a range of solutions, such as building capacity for Māori research in some more of our non-Māori staff.

This may mean that for some elements of research (e.g. kaupapa Māori, Māori-centred, mātauranga Māori/Māori knowledge) capacity may be being deepened rather than broadened.

Our Science Team capability plan includes the intention to appoint a Māori researcher in systematics, or in aligned ecological or biosecurity research.

Ultimately building Māori capacity on climate adaptation would be an outstanding outcome.

Absolutely critical. I would love to have another Māori ecologist with a PhD.

“DRAFT Te Nohonga Kaitiaki Guidelines for Genomic Research on Taonga Species” was commissioned by Genomics Aotearoa, and prepared by Te Nohonga Kaitiaki research team led by Maui Hudson (U. Waikato). If there was already a Māori scientist aligned with the team or portfolio, we would welcome collegial discussion.

Approaches

According to the principles for integrated research I outlined above, the process for this needs to start sooner than later when we start designing our research.

Integrated approaches are vital in managing biodiversity/pests/supporting cultural harvests and kaitiakitanga and in collaborating with all stakeholders.

In recent years it has been heartening to see some established scientists engage with Māori and to watch the change in their heavily western science-oriented perspectives.

In perspective the challenge is to make sure we scope the type of Māori research which is the best fit for our brief – or we partner better with that various Māori users who will pick up our data and apply it.

The more we can facilitate such exposure, the more we can support integrated research, but this isn't about going on cultural awareness courses – it needs genuine opportunities to co-develop research.

Barriers

Maybe because this group (kairangahau team) is over capacity their ability to become involved in a broader range of projects where the capability could be widened is limiting individual researchers to focus only on what interests them or on say kaupapa Māori research. It is hard to generalise but that seems to be the perception.

However, as we are capacity constrained, we need to be quite strategic about how we use the resources we have.

Due to funding constraints, I welcome discussion about how we could align our research more effectively with one or more Māori staff members to then explore opportunities arising from this alignment.

But we are struggling with insufficient staffing and finding the right people who can help us connect in a meaningful and sustainable way.

(4) What does interdisciplinarity and transdisciplinarity look like? What does it mean in your portfolio/programme?

What does interdisciplinarity and/or transdisciplinarity mean to you?

For me interdisciplinarity is about building between disciplines to leverage the different types of knowledge.

Transdisciplinarity to me is about asking different questions, based on the integration with practitioners/policy makers/community members, etc. The questions should transcend the disciplines and shape the entire research agenda.

It's about finding the best approach or mix of approaches to address the research question or to support stakeholder/end-user needs. I will always encourage staff to consider widening their perspectives on what might be effective.

Interdisciplinary research involves multiple disciplines or perspectives coming together to collaborate and, through integration, create solutions. Transdisciplinary work is wider still and involves taking stakeholders and end-users on the journey with you, to maximise the range of perspectives considered and increase chances of adoption once the work is finished.

Interdisciplinarity = true collaboration across scientific disciplines with sharing of concepts, language, and some methods, along with complementary disciplinary research around common questions and objects. It needs to result in some common, integrated outputs and outcomes that would not have been possible for any of the disciplinary approaches / scientists alone.

The key addition to interdisciplinarity is that stakeholders are tightly involved. This research tends to be strongly place-based. Note that not all research needs or can be transdisciplinary depending on research questions or context.

Many of our so-called integrated projects are multi- or interdisciplinary and only a few are really transdisciplinary where the research agenda is truly co-developed with stakeholders who sit within the research team.

The predominant use of multiple science disciplines usage in providing a better understanding or solution tends towards multidisciplinary research with the occasional use of an interdisciplinary design.

What does it look like in the company?

I believe most of what we do is transdisciplinary but, we struggle to maintain the integration. The disciplines tend to silo, despite the best of intentions.

To be honest, I don't ever think in labels when working to develop new projects or programmes.

Not all research questions require these approaches and much of what we do can be dealt with in a mono-disciplinary or multi-disciplinary way.

Some questions, of course, don't need interdisciplinary or transdisciplinary research and research should be fit-for-purpose.

One aspect that I don't understand, however, is the absence in the interdisciplinary model diagram of mātauranga Māori; I assume that this could be an active component in many cases?

I was drawing on the example of natural philosophy/natural history and modern Citizen science. I have a 2-pager draft think piece 'Biota science and mātauranga Māori' trying to sort this out.

Barriers

We have both interdisciplinary and transdisciplinary research in the portfolio and projects sits along a spectrum. I will say, though, that truly transdisciplinary projects are hard to achieve...just because of the time taken to develop, fund, and undertake a truly transdisciplinary project.

We also need to be mindful that working in either of these ways can take considerably longer than classic, single discipline reductionist science. Not all the work we do needs this approach, but in my opinion more does.

In that context, and the funding bounds we have, the breadth of trans/interdisciplinarity is limited to technical domains within our portfolio.

A limitation in achieving this can be the effort and time required (especially for a smaller initiative), as well as having access to and relationships with relevant representatives to secure their willing involvement. Capacity issues with over-stretched Māori scientists and representatives are often mentioned as a limitation.

Our use of complex methods to enable complex problem solving which may enable the usage of transdisciplinary design or research is weak. This is in part driven by a lack of understanding externally of the value of these approaches and an expediency in solution finding.

Little opportunity to practice except for in some of these strange groups I end up in.

How to implement?

I've also strongly argued for a while now that the company needs to have some key 'big topics' which it is targeting to integrate at a pan company level, where the portfolio's co-ordinate activities to make a collective big impact. That also creates some really interesting opportunities for many disciplines to work together.

Effective planning of new initiatives needs to take a transdisciplinary approach to ensure that potential collaborators, stakeholders, and end users are all engaged from an early stage – resulting in a more robust research proposal and greater chance for developments that lead to funding success.

The right tool needs to be used for the type of issue that is being addressed so it is not appropriate to use interdisciplinary or transdisciplinary approaches for simple or even complicated issues.

Note that excellent interdisciplinary research can be done about social actors/stakeholders (e.g. through interviews, workshops, surveys, etc.) without being transdisciplinarity.

(5) Does Māori research and increasing Māori staff capacity help us achieve 'integration' and 'science' goals for Manaaki Whenua? Impacts? Science excellence? Science outcomes for Aotearoa New Zealand?

Is Māori research (and Māori researchers) a pathway towards integration?

For me, absolutely yes to help achieve both integration and science goals.

No question for me about the ability to have/increase impact both with Māori research and capacity.

Yes, it could help achieve better integration, science goal delivery and outcomes for Aotearoa New Zealand and depending on how science excellence is defined then that could also be achieved (this goes into the need to adequately recognise science excellence that does not just sit within the biophysical definitions)

It could, but an understanding of what is needed to be addressed is the first step where a deliberate approach to determining the knowledge that would be necessary to address the question at hand. In some instances, utilising a Kaupapa Māori approach may be the only appropriate approach.

The answer is both yes and no and it very much depends on your philosophical stance, i.e. at one level everything should have a Māori perspective to honour the Treaty, but the reality is not everything will. In the natural resources sector where most of MWLR work is focused, increasingly Māori research should become an integral part of much of what we do, particularly in the bigger projects.

So clearly Māori research has an important role to play here.

In terms of Māori sitting alongside/within/however you want to describe it other research in solving a problem, then yes, it is likely to be an important component of many solutions we would like to see and implement in NZ.

Science excellence

I do struggle with the science excellence side as I don't see our Māori researchers developing a lot of academic papers. I think this is a real gap in our Māori research. So, I don't know really how 'excellent' our Kaupapa Māori research is. There are an increasingly number of indigenous focused publications in the literature and it would be good to see more based on our research.

Science excellence comes from having good scientists with adequate resources, irrespective of race, culture or nationality. In saying that, if we could find a good scientist who is also Māori, we should grab them.

Outcomes and benefits for Aotearoa-NZ?

Impacts and outcomes – absolutely! Otherwise we are delivering research that serves the needs of only part of Aotearoa New Zealand.

Yes, for all aspects. It is appropriate to address commitments under Te Tiriti o Waitangi, and because current capacity appears to be inadequate to meet demand. Funding agencies are also rewarding such integration in their decision-making.

For national outcome, partnering could also be considered with Māori researchers in collaborating CRIs in addition to MWLR, if capacity is available there and inter-CRI competition can be overcome.

I wonder if a kaupapa-Māori approach can also resolve the traditional trade-offs associated with land use planning at catchment scale (e.g. such as conservation vs extractive use; scenic value vs production, etc.).

Probably the way forward is to lean on some of the knowledge of the Māori researchers who have learned to walk in both worlds – traditional (science) journals AND making a real impact for Māori communities.

Having a greater understanding of when and where different knowledge systems could lead to better outcomes is not well known.

Present limitations

Generally, Māori research/staff capacity is limited and consequently the use of a mātauranga Māori either independently or in combination of other knowledge systems limits the benefits this may provide.

Clearly, one issue is fragmentation of effort – having staff ‘smeared’ across multiple projects making a minor contribution to each is far from ideal, for the individuals or the quality of the research. However, that is a classic situation when ‘demand’ outstrips ‘supply’.

There is no right or wrong answer to this question. Overall, there is no doubt that we are capacity constrained at present. Just having more staff, though, won’t solve the issue.

Recognising the different time dimensions to work within each knowledge system is also not well understood.

Where we really need a hand is the connecting to iwi all over the country and maintaining that relationship. Our scientists are too stretched in finding funding and doing the science to also maintain the relationships.

Contribution to integration?

Integration comes from a willingness to work alongside other skill sets/disciplines, part of which comes from being open-minded about what those different approaches can bring to a project. That comes from encouraging folks to think outside of their field.

The integrative framework may be a more enduring form of decision making that a larger proportion of a catchment's population can agree/adhere to.

It is only in the bigger projects where there is usually enough resourcing to take a more integrated and transdisciplinary approach. Whether 'integration' is achieved just by including Māori research is debatable.

Implementation

I do think there should be a greater ability for non-Māori folks to work with Māori. It doesn't just have to be Māori researchers that work with Māori stakeholders. There are certain aspects of research where that would be the case, e.g. Kaupapa Māori research.

While we focus on outcomes and impacts, rather than just outputs, increasing our capacity for Māori research should help.

But again, holistic solutions require holistic skillsets so we should be envisaging that a range of skills, including Kaupapa Māori skills are brought together to solve problems.

A new initiative developed at a recent workshop on Emerging Opportunities, involving Systematics team members, is to establish a MWLR interdisciplinary discussion forum. This is being led by a cross-team steering group and will promote pan-MWLR video discussions of selected broad research areas – e.g. the beech forest ecosystem. Māori research expertise will be an essential component of any such forum, likely to be kicked off later in May.

(6) What's required to increase Māori research, Māori research excellence, and Māori research capacity in/across Manaaki Whenua?

What's required to increase Māori research and capacity?

Easy one: more Māori scientists. Harder question – where do we find them?

More Māori staff and Pākehā staff confident to manage their own interactions/hui/'research with/for Māori'.

I've focussed on scientists as opposed to social researchers as I think we've got a really good core team in that area already.

The only negative I've noticed is a perception that Māori researchers are uncomfortable with facilitating research links between stakeholders and non-Māori scientists. I've been made aware of this from a number of sources so it's something we need to change. My perception (easy to say – I'm an introduced pest) is that Māori communities have been, without fail, interested to talk with and listen to a science perspective. We shouldn't pre-suppose that one

set of research techniques is intrinsically better for a community's needs without allowing that community to have their say.

What is Māori research and what is it in relationship to mātauranga Māori and Māori science?
I don't know!

Kaupapa Māori expertise?

Kaupapa Māori research should be done by Māori staff.

The value of knowledge systems

Internally, a greater understanding of the value of other knowledge systems in providing an integrative approach or preferred approach is needed. The current understanding lends more to enclosing Māori research into a classical science approach rather than the recognition of a bona fide solution.

Māori research excellence

Desire of Māori researchers to publish in the academic literature...and do it. It is very mixed in this organisation with some Māori researchers being incredibly active publishers, but most are not.

Capacity issues

Increasing internal capacity may provide the ability to work with more Māori but still may not provide better solution for Aotearoa New Zealand where the view may be for a more 'usual' approach.

Unless universities (and possibly some component of schools/communities) support young Māori to develop science careers, we will be complaining about the lack of good Māori scientists for years to come.

More support by having specific Māori research leads aligned to portfolios would make a big help.

This may entirely be due to a lack of capacity and individuals spread too thinly or not. Obviously, if there was more capacity, and it was available, it would likely get used more.

As I indicated earlier, I believe that the consolidation of the kairangahau has been a double-edged sword – it has created a cohesive 'team' or community of practice for Māori focused work, but it may have reduced its effectiveness in being able to be involved in a much wider range of projects.

Implementation/approaches

This is as much an external issue as it is an internal, building trust and confidence in new approaches where the tendency is solution first, methodology later is difficult.

We need a steady pipeline of talent with the right skills and interests to be able to work as described above, coupled with revenue streams that will allow it to happen. The latter will become easier the more successful we are seen to be in working in this way.

Shifting any system takes time and commitment and is a journey especially when the benefits are not readily identifiable. Ensuring the right approach at the onset is crucial rather than everything having a necessary inclusion.

Māori researchers being part of projects and staying with that project. Everyone in projects need to recognise the budgetary constraints around a project and therefore scope the different elements more effectively.

So capacity, availability, willingness to be engaged in things outside a Māori researchers immediate area of expertise may all be factors that will contribute to whether Māori research and Māori research excellence can be increased.

Because our team does not have direct alignment with a Māori researcher, I suggest that consideration might be given to some formalisation of alignment to a team and/or portfolio.

Enabling integration at an earlier stage of planning and involvement. With one or more MWLR Māori staff members becoming the norm rather than the exception. To achieve this, however, I would anticipate that additional resourcing would be required, possibly involving an additional appointment(s).

Māori stakeholders are more than willing to work with folks who are there to help support their aspirations for their rohe. Just like anything else, it comes down to relationships.

Create a work ethic that not everything that involves Māori needs a Māori researcher involved. I think increasingly non-Māori staff are not wanting to do this for fear of being criticised by their peers (which I often hear is from within MWLR).

Build a community of trust within MWLR. I often feel that there is not much trust between non-Māori and Māori researchers, and this can hinder fruitful relationships. This is a generalisation and a perception based on conversations I have been part of and what I have seen in some instances. Again, it is not universal.

Funding

We probably need to look to the funding model – should we be more strategic about landing bigger pieces of work – should these be central-Government funded or not? I do think learning from our experts on how to walk in both worlds has promise, but what would I know?

Again, it is generally only in the very large M\$, multi-year projects where the project teams can tend to involve a wider range of disciplines and thus individuals.

Somehow, we also need to have a clear plan for generating external revenue, as without solid funding from clients we will really struggle.

3.5 Māori values and principles for integration and framework development

Māori values and principles for integration and framework development were investigated and results are given as part of a comprehensive review, supplemented by discussions and analysis.

Māori values and principles for framework development

Working as a collective is very important to Māori, usually for a common interest or towards a set of collective goals, interests, and aspirations. From other information/data sources and literature a large number of Māori values and principles have been collated, documented, and discussed, especially those which form principles that can be used to guide the development of integration and transdisciplinarity. These were added to the values discussed at the internal Māori staff wānanga, Hamilton (section 3.3), and were then used to provide guidance to develop an integration framework and model in the next section of this report. For example tikanga/kawa (customary process and protocols) are developed for a project, for the duration of the project, through the following types of principles.

Kaupapa Māori research

Kaupapa Māori research is research undertaken by Māori, for Māori and with Māori. Developed by Māori academics (e.g. Smith, L 1996; Smith G 1997; Pihama 2001; Cram 2001; Bishop 2005), kaupapa Māori research is an approach that validates Māori cultural values, beliefs, knowledge, and worldviews. Kaupapa Māori is also a framework that provides a culturally safe space to conduct research where Māori cultural 'norms' are respected, protocols and customs are valued, and knowledge is pursued. It asks the following key questions for every project:

- What research do we want to carry out?
- Who is that research for?
- What difference will it make?
- Who will carry out this research?
- How do we want the research to be done?
- How will we know it is a worthwhile piece of research?
- Who will own the research?
- Who will benefit?

Some of the key principles that underpin kaupapa Māori research include:

- seeking transformative outcomes for Māori
- working according to tikanga
- operating within the kawa (protocols, rules) in your context
- understanding that some knowledge needs to be protected and is not open to everybody
- advancing mātauranga Māori
- community engagement.

See www.kaupapaMāori.com for more information about kaupapa Māori.

Principles of Kaupapa Māori

Kaupapa Māori theory is based on a number of key principles. Graham Hingangaroa Smith (1990) initially identified six principles or elements of Kaupapa Māori below. These elements and principles have since been expanded by other Kaupapa Māori theorists such as Linda Smith (1997), Leonie Pihama (2001), and Taina Pohatu (2005). Other theorists who have also contributed to the development and growth of Kaupapa Māori methodology include Russell Bishop (2005), Kuni Jenkins (2001), Cheryl Smith (2003), and others (Table 4).

Table 4. Key Māori principles from kaupapa Māori literature (expanded and explained below)

Māori Principles	Explanation
Tino Rangatiratanga	Self-determination relates to sovereignty, autonomy, control, self-determination, and independence. The notion of Tino Rangatiratanga asserts and reinforces the goal of Kaupapa Māori initiatives: allowing Māori to control their own culture, aspirations, and destiny.
Taonga Tuku Iho	Cultural Aspiration asserts the centrality and legitimacy of Te Reo Māori, Tikanga and Mātauranga Māori. Within a Kaupapa Māori paradigm, these Māori ways of knowing, doing, and understanding the world are considered valid in their own right. In acknowledging their validity and relevance it also allows spiritual and cultural awareness and other considerations to be considered.
Ako Māori	Culturally Preferred Pedagogy acknowledges teaching and learning practices that are inherent and unique to Māori, as well as practices that may not be traditionally derived but are preferred by Māori.
Kia piki ake i ngā raruraru o te kainga	Socio-Economic Mediation asserts the need to mediate and assist in the alleviation of negative pressures and disadvantages experienced by Māori communities. This principle asserts a need for Kaupapa Māori research to be of positive benefit to Māori communities. It also acknowledges the relevance and success that Māori derived initiatives have as intervention systems for addressing socio-economic issues that currently exist.
Whānau	Extended Family Structure sits at the core of kaupapa Māori. It acknowledges the relationships that Māori have to one another and to the world around them. Whānau, and the process of whakawhanaungatanga are key elements of Māori society and culture. This principle acknowledges the responsibility and obligations of the researcher to nurture and care for these relationships and also the intrinsic connection between the researcher, the researched, and the research.
Kaupapa	Collective Philosophy refers to the collective vision, aspiration, and purpose of Māori communities. Larger than the topic of the research alone, the kaupapa refers to the aspirations of the community. The research topic or intervention systems therefore are considered to be an incremental and vital contribution to the overall kaupapa.

Māori Principles	Explanation
Te Tiriti o Waitangi	The Treaty of Waitangi is a crucial document that defines the relationship between Māori and the Crown in New Zealand. It affirms both the tangata whenua status of whānau, hapū, and iwi in New Zealand, and their rights of citizenship. The Tiriti therefore provides a basis through which Māori may critically analyse relationships, challenge the status quo, and affirm the Māori rights.
Āta	<p>Growing Respectful Relationships is a transformative approach within the area of social services. The principle of āta relates specifically to the building and nurturing of relationships. It acts as a guide to the understanding of relationships and well-being when engaging with Māori. Āta focuses on our relationships, negotiating boundaries, working to create and hold safe space with corresponding behaviours. Āta gently reminds people of how to behave when engaging in relationships with people, kaupapa and environments. Āta intensifies peoples' perceptions in the following areas:</p> <p><i>It accords quality space of time (wā) and place (wāhi).</i></p> <p><i>It demands effort and energy of participants.</i></p> <p><i>It conveys the notion of respectfulness.</i></p> <p><i>It conveys the notion of reciprocity.</i></p> <p><i>It conveys the requirement of reflection, the prerequisite to critical analysis.</i></p> <p><i>It conveys the requirement of discipline.</i></p> <p><i>It ensures that the transformation process is an integral part of relationships.</i></p> <p><i>Āta incorporates the notion of planning.</i></p> <p><i>Āta incorporates the notion of strategizing.</i></p>
Working principles of kaupapa Māori research	
Whakapapa	Defined generally as being 'genealogy', also encapsulates the way in which Māori view the world. It is a way of thinking, of learning and storing and debating knowledge. In terms of Kaupapa Māori research, whakapapa is integral as it allows for the positioning and contextualising relationships between people, communities, participants, landscape, and the universe as a whole.
Te Reo	The Māori language is integral to Kaupapa Māori; the Māori world view is embedded in the language. The way in which we communicate using Te Reo Māori provides an insight into the way we interact with the world and the way in which we build and maintain relationships.
Tikanga Māori	Customary practices, ethics, cultural behaviours, considerations, and obligations. Tikanga Māori is important in order to enable us to appropriately navigate and operate within a Māori context, and make judgements and decisions within this space.
Rangatiratanga	Related to the Principle of Tino Rangatiratanga (self-determination, autonomy, power, control). The notion of Rangatiratanga, or chiefly status, chieftainship, provides the right to exercise authority and leadership. It is relevant in the research process in terms of allowing Māori to control and lead their own research processes and methods.

Important values and principles from other sources	
Arohatanga	To form a caring, respectful, and supportive environment and make sure a project is safe, for the extent and continuity of the project and its members.
Āwhinatanga	To care, help, support, stewardship, and assistance. Embracing the team or collaboration through respect and support for individual members.
Hononga	The union, connection, relationship, and bond that establishes networks, and helps link people and their perspectives and knowledge forms. It underpins mahitahi (work together, collaboration, cooperate) and respects diversity.
Kawa	Localised protocols, customs, e.g. marae
Kotahitanga	Unity, togetherness, collective action.
Manaakitanga	Showing care, respect for others. Principle of 'respect' for other peoples' perspectives and knowledges, indigenous Māori perspectives, that drives communication, dialogue, and aims for equality. Supports kotahitanga but also embraces diversity.
Mana Motuhake	Achieve independence and autonomy driven by kaupapa Māori. Mana motuhake can be achieved through rangatiratanga and tino rangatiratanga (status, leadership).
Mātauranga Māori	Māori knowledge (mātauranga Māori) as a dominant knowledge form/system provides the basis for the Te Ao Māori worldview that is recognised within integration. Includes a wide spectrum of culturally based knowledges (Māori beliefs, te reo Māori, cosmology, religion, Māori philosophy, ethics) and provides the foundation for tikanga (customs, values) and kawa (ceremonies, procedures, protocols).
Mōhiotanga	Knowing, knowledge, understanding, awareness, perception, respect for knowledge and understanding.
Pāhekoheko	To combine, join, unite. The principle of integration, cooperation, and interaction from a Māori perspective that drives interconnections and interdependencies across knowledge forms and disciplines.
Tautokotanga	To guide and support a project towards goals and outcomes, and to support all of its participants and researchers during this journey. Guidance is generally based on tikanga and kawa.
Te Ao Māori	A Māori world view or (w)holistic perspective based on knowledge(s).
Tikanga	Following correct cultural or customary protocols, process, rules in a relationship. Tikanga ensures correct process and steps are followed from the onset to the end of a project, e.g. towards integration and collaboration.
Tohungatanga	Specialist knowledge, specialised in Te Ao Māori and mātauranga Māori, having expertise, a principle to honour in-depth knowledge, expertise, and skills.
Tūhono, Tūhonotanga	Processing connection and bonds.
Whakamāramatanga	Understanding, explanation, clarification of knowledge and perspectives. Linked to mātauranga Māori and mōhiotanga.
Whanaungatanga	Relationship, kinship, forming relationships that are binding, and strengthening family and ancestral connections. Develops kinship rights and obligations.
Whakawhanaungatanga	Forming relationships and connections. Relating well to others.
Whakaurunga	Entry, participation, and introduction into a collaborative process, or research project.
Whakaute	Showing respect, caring, and legitimisation of all things Māori.

Te Tiriti o Waitangi principles

Many groups and organisations have attempted to develop principles based on Te Tiriti o Waitangi, the Treaty. The principles have been almost as contentious and widely varied in interpretation as the original Treaty. A key set of principles, developed in 1989 by the Department of Justice, was used through the 1990s by most Government departments. These Treaty principles (Department of Justice 1989) combined provide a good platform for discussion for collaboration, partnership, Te Ao Māori, and integration, are summarised in Table 4.

Table 5. Te Tiriti o Waitangi principles

Māori Principle	Explanation
Principle of Government (Kawanatanga)	Sovereignty. It stated that government had the right to govern and to make laws. That right, however, was based on a conditional requirement to include Māori interests from Article 2 of the Treaty as a priority (redrafted in 1990 by the National Party to indicate government to govern for the common good).
Principle of self-management (Rangatiratanga)	Confirms that iwi should have the right to organise iwi affairs and, under the common law, control and manage resources they own. Active protection of Māori interests. This principle recognises sustainable tribal development, government interest in devolution, a move towards greater autonomy with less dependence on the state. Again, this principle is consistent with government policies since 1988 and encouragement of the private sector, and the promotion of economic and social development (redrafted in 1990 by the National Party to reflect self-management within the scope of the law).
Principle of equality	All New Zealanders are equal under New Zealand law. Rights and privileges are the same for all people in New Zealand society (Article 3). This also identifies the large disparities in many areas in society that require attention through targeted policy and action in order to achieve social equity. Aspects of this principle led to closing the gaps policies in the late 1990s, and strategic objectives to reduce and correct large social and economic disparities and disadvantage of certain groups in New Zealand society, particularly between ethnic and socio-economic classes. In 1991, the Government introduced the mainstreaming policy to the state sector.
Principle of reasonable cooperation	Government and iwi are obliged to accord each other cooperation on major issues of concern. Recognition of the Treaty in all aspects, by central and local government. This has been interpreted by many Labour Party politicians as being based on mutual respect and good faith between Treaty partners. This principle was used to improve under-representation of indigenous peoples on policy and management controlled by central and local government.
Principle of redress	The government was responsible for providing effective processes for the resolution of grievances in the expectation that reconciliation could occur.

4 Discussion – Transdisciplinarity and indigenous research

Integration, transdisciplinarity and indigenous research

The key milestone for this project was to provide guidance – from a Māori perspective – for integrative research and integration in Manaaki Whenua, and to provide ideas on what this integration should look like. Integration can be people and disciplines working more effectively and cooperatively together to reach a common goal or set of goals, to achieve a common purpose or agreed outcome. It usually embraces shared perspectives, shared specialist skills and knowledge, and may facilitate a greater understanding of values and priorities. Integration can also go further towards integrating or synthesising knowledge systems, which is also an important component of transdisciplinarity. To achieve the project milestone, the main objective in this study was to produce an indigenous integrative research model and framework that could address complex issues and questions and provide guidance for integration in Manaaki Whenua and subsequently provide opportunities for new science investment. Much of the literature inside NZ and internationally shows that integration is a key component or characteristic for transdisciplinary research, and transdisciplinarity in general. Next to other key themes and characteristics such as engagement and collaboration, it is an essential building block for transdisciplinary research.

Emerging evidence suggests that knowledge integration and systematic use of kaupapa Māori processes to underpin integrative and multi-faceted research can play a vital role in breaking down knowledge, social and cultural barriers (away from silos) within a research context. Furthermore, due to the reciprocal relationship that Māori and many other indigenous cultures have with the environment, Māori-led approaches could help Manaaki Whenua work collectively to achieve its goal to both protect and enhance the land environment, grow the nation's prosperity, while achieving equity and social justice, and contribute to the achievement of Māori aspirations across multiple dimensions.

Throughout all the reviewed literature, there have been recurring themes and common components and characteristics of transdisciplinary research. The themes advocate advances in collaboration, research integration and implementation, shared methodologies, systems thinking, co-production of knowledge and knowledge synthesis, and the engagement and influence of policy to effect change. In this way it promotes transformation from working in silos to more cooperative, collective, and collaborative styles of working/operating, co-learning, sharing knowledge, and effecting change. Bammer (2017), exploring the key features and characteristics of transdisciplinarity, developed 8 toolkits or key themes/modules:

- Toolkit # 1 Co-producing Knowledge
- Toolkit # 2 Engaging and Influencing Policy
- Toolkit # 3 Dialogue Methods for Knowledge Synthesis
- Toolkit # 4 Collaboration
- Toolkit # 5 Change
- Toolkit # 6 Research Integration and Implementation
- Toolkit # 7 (Dynamic) Systems Thinking
- Toolkit # 8 Integration Methods

In a previous study (Moewaka-Barnes et al. 2020), we took Bammer’s 8 components and aligned them with the key characteristics of kaupapa Māori research (see Table 4) and explored these similarities based on Te Ao Māori and kaupapa Māori concepts and research methods. Previous work found many commonalities between transdisciplinary research and kaupapa Māori research, although kaupapa Māori is often explained through a Māori lens that requires some translation and interpretation. Indigenous epistemologies (Reo 2017) also reflect strong associations and interconnections between the health of people, environmental integrity and community aspirations along with intergenerational engagement and self-determination (Durie 1998).

We compared some of these commonalities and some of the differences in Table 6 (Moewaka-Barnes et al. 2020), giving some explanation where there was no direct agreement or where there was a different perspective/explanation for the same theme.

Table 6. A framework for transdisciplinary approaches to guide the development of new research and integration (adapted from Bammer 2017; adapted from Moewaka-Barnes et al. 2020)

Transdisciplinary approaches	Kaupapa Māori themes
<p>Working collaboratively Researchers develop relationships with counterparts from other disciplines and selected stakeholders/communities Working together on an agreed issue, toward a shared outcome; commonly instigated by researchers</p>	<p>Working collectively Māori led/community led; relationships developed with other knowledge holders Working together on agreed kaupapa with a commitment to tikanga and working in decolonising ways <i>Changes power dynamics and directions i.e. shifts in who usually establishes and determines collaborations, values and practice</i></p>
<p>Holistic and multi-level thinking Exploring interdependencies within whole systems using de-siloed design approaches</p>	<p>Holistic and critical thinking Exploring interdependencies and interrelationships; consideration of culture, assumptions about what knowledge is valid Critical and challenging of dominant paradigms <i>Challenges ways of looking at the world, relationships and place of humans</i></p>
<p>Knowledge Synthesis Bringing different knowledges and perspectives to bear on a common issue Working across disciplinary knowledge boundaries, co-producing knowledge</p>	<p>Dissolving barriers Breaking down multiple boundaries – knowledge systems, roles, expertise, and hierarchies <i>Challenges participants to learn about themselves, their ‘expertise’, assumptions, and role. Challenges who knowledge holders are and concepts of science and research; often requires stepping out of comfort zones</i></p>

Transdisciplinary approaches	Kaupapa Māori themes
<p>Integrative methods</p> <p>Methodologies oriented to collaborative, de-siloed approaches</p> <p>Creativity, co-design, and dialogue used to create new integrative methods</p>	<p>Inclusive methods</p> <p>Research methods selected for their ability to ‘speak’ constructively to each other and to contribute to kaupapa</p> <p>Explicit consideration and valuing of diverse methods and decolonising methodologies</p> <p><i>Participants are challenged to creatively consider purpose and process over hierarchy and familiarity of method</i></p>
<p>Change Orientation</p> <p>Making change happen by engaging and influencing policy, planning, and action</p> <p>Addressing power inequalities to improve decision making</p> <p>Comprehensive understandings facilitate solutions to complex problems</p>	<p>Transformation</p> <p>Māori and community agency is enacted through research, implementation, and action</p> <p>Addressing power and colonisation throughout – in relationships, concepts, roles, processes, and ideas of transformative change</p> <p><i>Decolonising Māori-led approaches will challenge ideas of evidence, determine what change occurs where, and who benefits</i></p>

Summary

The world is facing increasingly complex environmental, social, cultural, and economic challenges. It is a complex dilemma where many alternatives and options need to be taken into account simultaneously. In Aotearoa New Zealand, there are growing concerns about the declining state of our environment, but also a number of growing social, cultural, and economic disparities, leading to a more unequal society and shifting power and economic relationships.

Conventional approaches to science are struggling to find answers and solutions for complex and ‘wicked problems’ (e.g. global and national climate change, pandemics, health disparities between ethnic groups and communities, indigenous biodiversity loss, soil degradation, equitable resource management, knowledge governance, sustainable land management, water quality, and water resource management). What we are seeing is a connection and overlap between many issues, and growing evidence of the links between the environment, society values and social cohesion, and human health and well-being. There is a need for integration, especially where trade-offs and balances have to be reached between sustaining a myriad of values, and achieving economic prosperity, social and cultural equity, and justice.

To solve these complex issues, governments, industry, researchers, and communities need new ways of working together to deliver (w)holistic solutions that work within ecological and economic limits. There is an emerging view of the necessity for collaboration, knowledge synthesis, systems thinking, and integration. Meanwhile, increasing questions are being asked about the ‘Western’ view of the natural environment as the sole view that underpins resource management, where human beings are the sole beneficiaries (e.g. ecosystem services) and place themselves above rather than within the environment or ecosystem. The latter view

aligns well with a Te Ao Māori view, where indigenous Māori are inherently part of the environment, and the environment is part of them.

Multidisciplinarity, interdisciplinarity, and transdisciplinarity were all shown in this research to be very valid research concepts and approaches in their own right, and each addresses different problems and types of research question that often require specific approaches, methods, and disciplinary approaches. There are also many instances in science where a very focussed disciplinary approach is fully warranted and requires specialist methods, knowledge, and expertise (e.g. classifying an organism, finding a vaccine, modelling nutrients). At the other end of the spectrum, transdisciplinarity is 'an approach that works across disciplines, using disparate types of knowledge and practices. It has a high reliance on using other knowledge, such as local or indigenous, rather than science alone'. Transdisciplinarity is characterised by stakeholder involvement, and produces engaged, socially responsible science. It is important in transdisciplinary approaches that these forms of knowledge are recognised, used, and understood equitably with respect and integrity. Careful attention to research design and methodology collaboratively across teams and stakeholders is therefore very important, including the definition of the actual research questions at the start of the project.

To achieve effective integration, the research journey has to make important decisions about how far this integration should go (e.g. across disciplines? across knowledges?). The journey is determined by the science and research teams involved, the research questions to be answered, and the stakeholders who should be engaged in the work. We have also alluded in the introduction section to the many barriers, risks, and complicating factors to the carrying out of expansive integrative research. The literature shows integrative research and transdisciplinary research are often time consuming, challenging, and resource intensive. As a result, researchers and participants need to be reflexive. A more integrative approach to working therefore requires a high level of skill and expertise. If this is desired support for those who want to improve their practices and expertise towards integrative research should be given (Duncan & Robson-Williams 2019).

Working in a negotiated space

It is important that non-Māori (e.g. scientists, planners, policy) and Māori (rangahau, iwi/hapū/whānau) work together in a 'negotiated space' or dialogue space when developing integrative research, integration, and transdisciplinary research. It may take time to build relationships, trust, understanding, and respect on both sides before developing any sense of what the research is about. This is also a space for bringing together science and mātauranga Māori in an equitable way, while retaining the integrity of the knowledge systems (e.g. not fitting or diluting one knowledge system into the other). A model for this negotiated space is shown in Figure 6 from Hudson et al. (2012). The Figure shows the way we build this knowledge exchange and perspectives together, and share contemporary experience. Before progressing further, it is important that tikanga and kaupapa (see integrative model from this report) are discussed in this negotiated space.

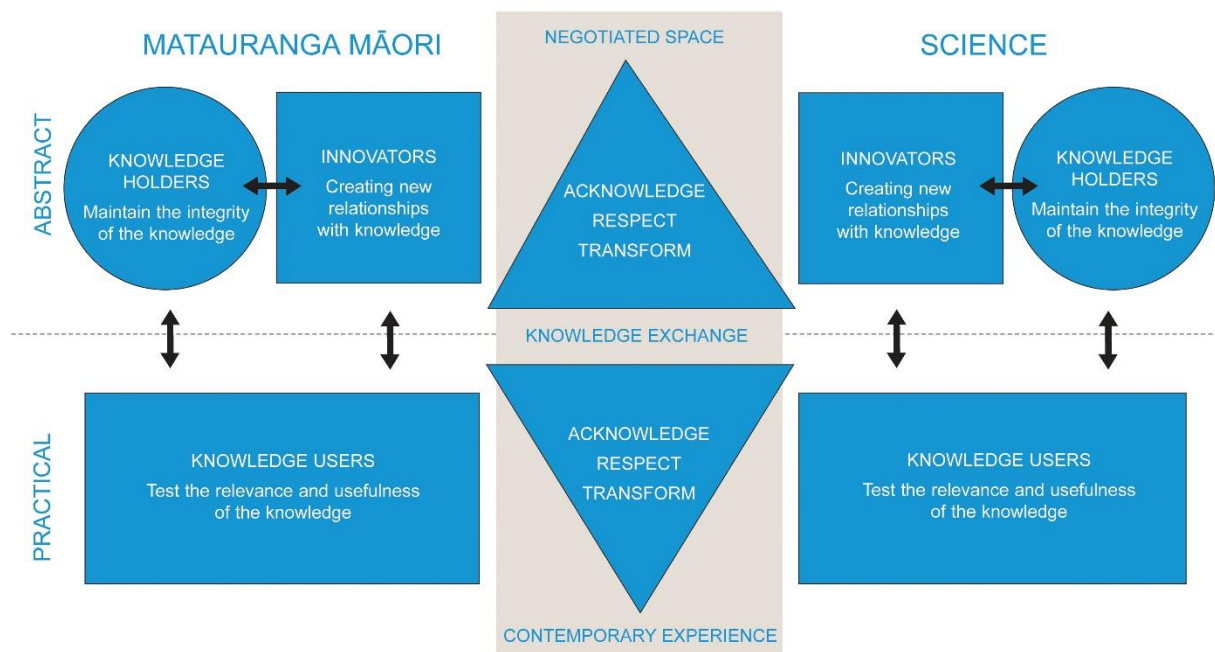


Figure 6. The negotiated space or dialogue space (source: Hudson et al. 2012).

Māori skillsets and expertise for integration and transdisciplinarity

A number of important skills, attributes and characteristics are essential for achieving effective engagement and collaboration with Māori. Some of the most important factors that produce successful integrative and collaborative research are that both parties should have a mutual respect for each other, an intent to cooperate, a high degree of trust, areas of shared interest, an ability to listen, communicate, and share understandings and learnings using each other's knowledge systems, perspectives and philosophies, and a willingness to complete research together for shared benefit and mutual goals. More specific and specialist skillsets are often required to extend this work when bridging indigenous research alongside science. We list some of the more important attributes required for undertaking effective long term collaborative research with Māori:

- an empathy towards Māori culture and strong desire to work with Māori
- respect and trust by the Māori community or iwi group
- an ability to listen and communicate effectively with iwi or hapū members
- some understanding of te reo and tikanga
- an ability to understand important Māori concepts
- an ability to understand Māori issues, and to be able to communicate them
- an ability to formulate research questions from a kaupapa Māori perspective and introduce them into mainstream science alongside important scientific concepts

- excellent communication skills
- high competence in their field of expertise and respect from their peers
- an ability to communicate their work to audiences in a non-technical way.

Appendix 4 provides a useful set of guidelines to instruct and guide an engagement process with Māori organisations (e.g. iwi/hapū/marae/authorities) from start to finish. Based on key principles, it can drive the research towards success by following correct (tikanga) process through a series of progressive steps. Important te reo Māori terms, translations, and explanations are given next to each principle.

Why is this useful?

Engagement is an essential part of integration. Most collaborative projects are driven or championed by key people from both sides, and these people form the essential link that makes for successful collaboration. These 'partner' attributes and characteristics can be used to help selection and alignment of partners.

5 A kaupapa Māori framework and model for integration and transdisciplinary research

The inclusion of Te Ao Māori in scientific research can deepen our collective understanding of connections, interdependencies, and long-term intergenerational perspectives. There is emerging evidence to suggest that the processes used in Māori science have an important role in removing the [walls between scientific disciplines](#) and helping teams of researchers and scientists with different areas of expertise to integrate their knowledge through [integrative research](#). This can help [transdisciplinary research teams](#) develop integrated methods to identify practical and sustainable solutions.

We believe that Māori values, knowledge, and societal norms can make unique and transformative contributions to solving some of our most complex or ‘wicked’ environmental and societal problems. Co-learning from mātauranga Māori and Western science (side by side) will result in a new wave of applied, integrated science that is distinctly designed for Aotearoa. It may be more problematic to achieve integrated knowledge systems, as we need to respect the integrity of those knowledge and knowledge systems that can be complementary to one another, rather than being fused or synthesised into one.

Towards a Māori integration framework and model

We used findings from our literature review and statistical summary, an internal kairangahau Māori hui, questionnaires and responses from senior staff, and an examination of existing frameworks and models, to develop and work towards a provisional kaupapa Māori integration framework and model. An understanding of Māori values and principles is distilled from the previous section to reduce and determine the key values and principles that can be used to guide integrative research and integration in Manaaki Whenua from a Māori perspective (Table 7). These were considered the most important values that can be used in combination for this framework and model. They are also important values for guiding engagement, collaboration and knowledge synthesis as key themes of transdisciplinarity.

Table 7. Key practice principles that have been determined in this SSIF for integrative research

Key values	Principle for integration
Āta	Growing Respectful Relationships. Specifically, for building and nurturing of relationships. It acts as a guide to the understanding of relationships and well-being when engaging with Māori. Āta focuses on our relationships, negotiating boundaries, working to create and hold safe space with corresponding behaviours.
Āwhinatanga	Āwhinatanga – care, help, support, stewardship, and assistance. We embrace the team and respect individual member’s expertise, competencies, knowledge, and the perspectives they bring to the table.
Kaupapa	Collective Philosophy – the collective vision, aspiration, and purpose of research. Integration needs to be based on kaupapa, and to have a clear understanding of what is to be achieved. Kaupapa also refers to the aspirations of the iwi/hapū/whānau and community.
Mātauranga Māori	Māori knowledge as a dominant knowledge form/system and perspective that is recognised within integration. Includes te reo and tikanga Māori.

Key values	Principle for integration
Pāhekoheko	Pāhekoheko – integration, cooperation, and interaction from a Māori perspective that drives interconnections and interdependencies across knowledge forms and disciplines
Te Ao Māori	Māori world view or (w)holistic perspective based on knowledge(s) consistent with kaupapa Māori.
Te Tiriti o Waitangi	The Treaty of Waitangi – working under a Treaty model of participation and partnership. This ensures trust and respect in the relationship towards integration.
Tikanga	Tikanga – correct cultural or customary protocols, process, rules are followed in the relationship. Tikanga ensures correct process and steps are followed from the onset to the end of a project, e.g. towards integration and collaboration.

A kaupapa Māori framework and model for integration and transdisciplinary research

A framework and model to guide integration from a Māori perspective is presented and was developed through iterative versions during the duration of this Māori flagship project 2019–2021. This framework has been contextualized within the paradigm of Te Haerenga Pāhekoheko (the collaborative journey). Te waka hourua (double-hulled waka) in this respect symbolises the indigenous and non-indigenous elements of the relationship/partnership, working together towards a common goal (te whāinga), which in this case is achieving integration and transdisciplinarity. Ngā ara poutama (the stages/steps) represent the stages (Table 7) being taken by both knowledge systems to acknowledge the appropriate (tika) way of making progress to ensure integration at all levels. Te rāwhara (the sails) represent the values (ngā whanonga pono) that are reinforced in-between te waka hourua to navigate us to the destination. Ngā whetū (the stars) offer us reflection along the way, and so that we look back and reflect once at te mutunga to evaluate our success at integration.

The model shows 6 main steps or stages (driven and guided by the values and principles presented in Table 6) to achieve integration and guide staff and research projects towards different levels of integration, depending on what the project aims are. This can be regarded as an important step towards transdisciplinarity. In the diagram, the model and framework are driven by tikanga or cultural process from above and built on knowledges such as mātauranga Māori and modern science from below. The kaupapa Māori values and principles in Table 7 drive every part of the model from start to finish. There must be an awareness of the responsibilities and principles under Te Tiriti o Waitangi (Table 5), which also guide the relationships and collaboration within the framework and the responsibilities required on both sides to ensure relationships are strong and are maintained, and to facilitate key Treaty principles of participation, partnership, and protection. These underpin the relationship between the Government and Māori under the Treaty of Waitangi. They are used to bridge the gap between the literal differences between Māori and English, and also serve to find a common language (in the negotiated space) in integrative research (Fig. 7). From left to right the model guides people towards working in an integrative fashion and can facilitate a transdisciplinary approach ‘fit for purpose’ for Aotearoa New Zealand (Fig. 8).

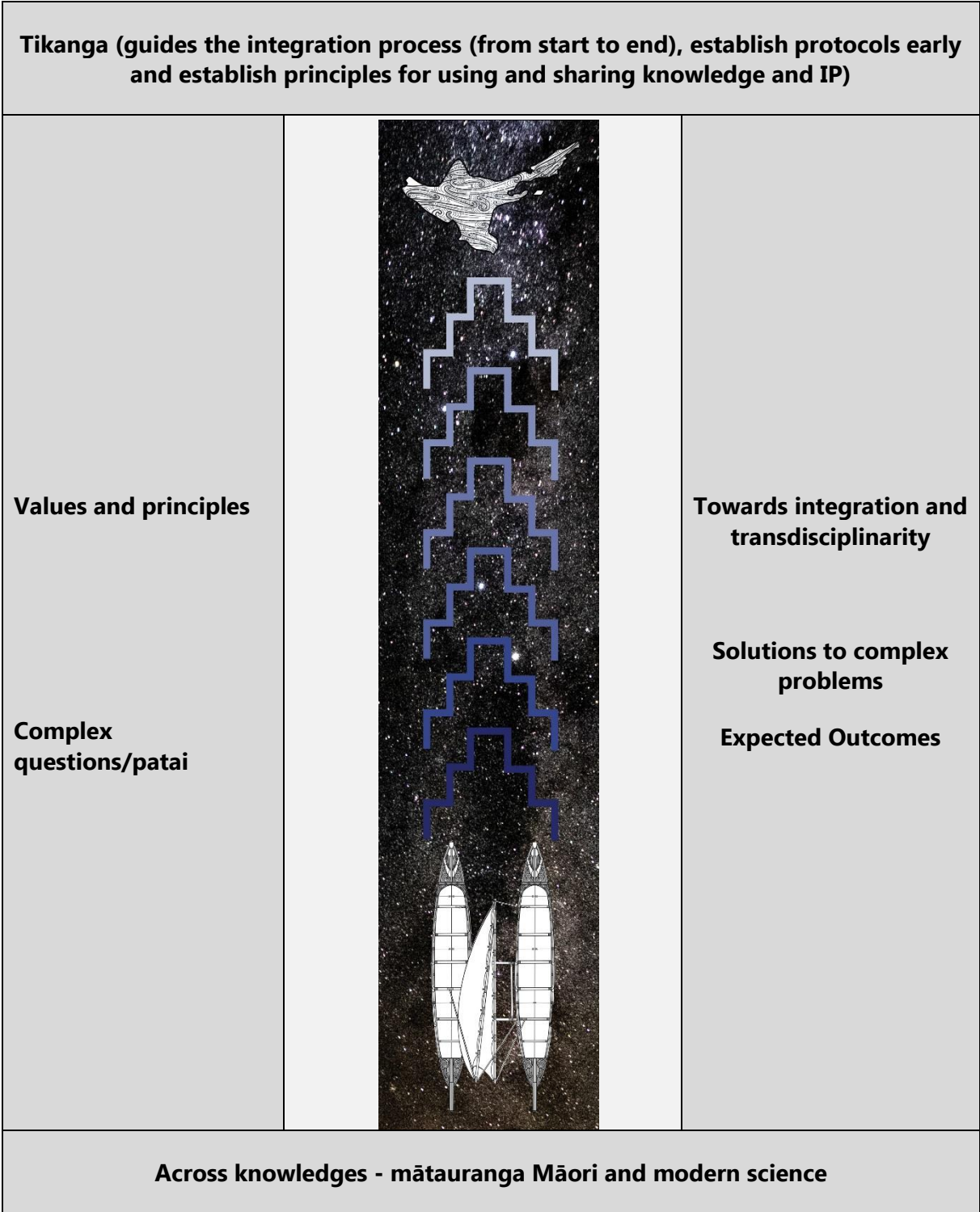


Figure 7. A Kaupapa Māori framework and model for integration and transdisciplinary research.

Table 8. Model development for integration (6 main steps or stages towards integration)

Stage	Main activities
1. Mana Whakahaere – Develop the Process	A Treaty-based framework is used to inform tikanga based trust, ethics, and respect for collaboration and integration
2. Whakamāramatia ngā Tikanga – Establish the Protocols	Establish cultural protocols and norms for integration, e.g. how knowledge is shared, and IP is considered
3. Whakamāramatia ngā Huānga – Establish the Purpose	Decide on the purpose of collaboration, topic, goals, objectives, and timeframe for integration
4. Whakamāramatia ngā Mahi – Establish the Work	Implement actions of working together
5. Whakaatu – Demonstrate Integration	Indigenous knowledge being used alongside the science to tackle complex problems
6. Whaiwhakaaro – Evaluate the Process	Evaluation and reflection of the process

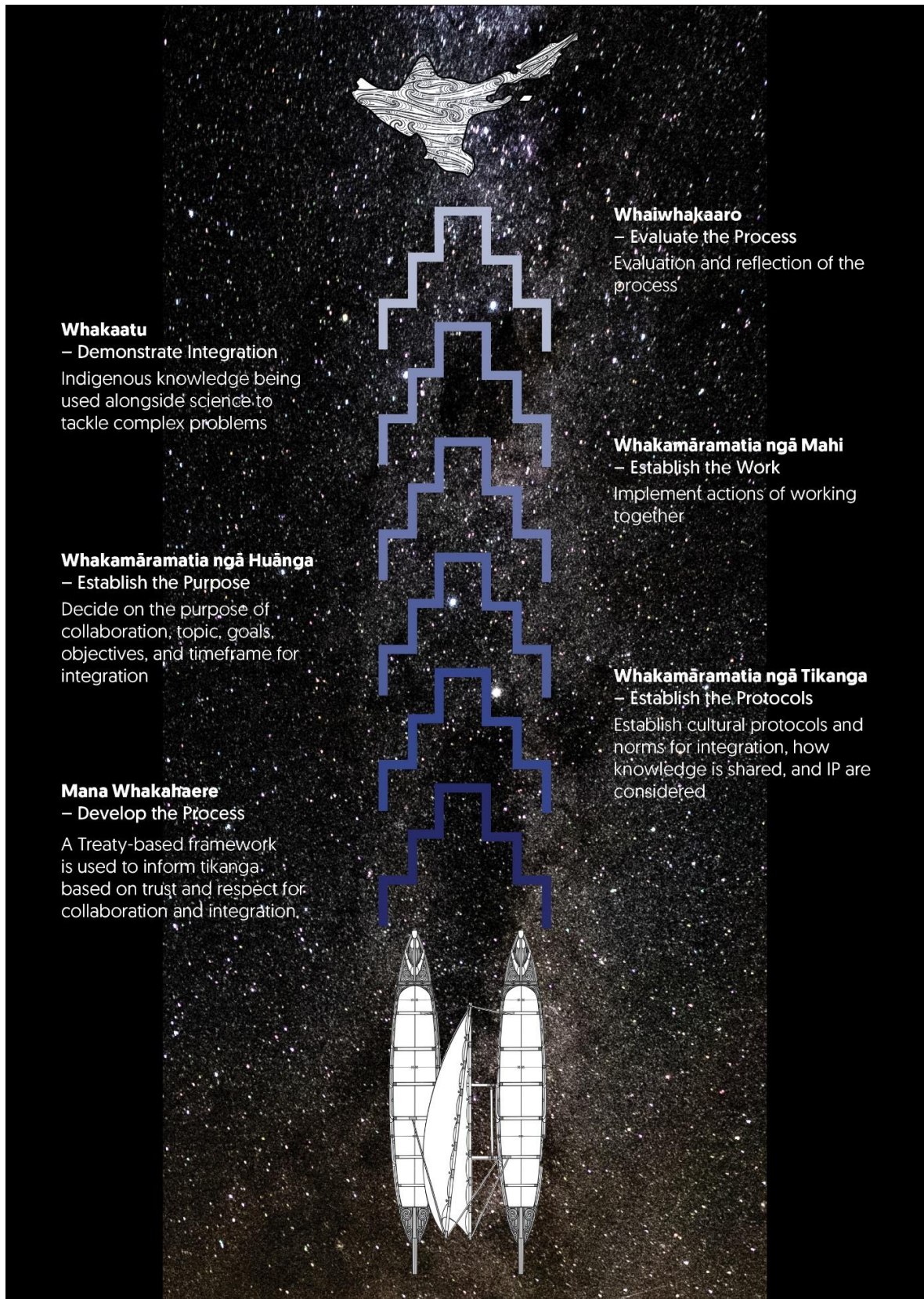


Figure 8. Te Haerenga Pāhekoheko: Manaaki Whenua – Landcare Research kaupapa Māori framework and model for integration and transdisciplinary research.

6 Conclusion and recommendations

Findings from the literature review, internal staff hui/workshops, and the MW statistics we acquired and analysed in the methods and results section of this report generally point to an increasing interest and need to incorporate Māori knowledge, values, and perspectives into all research and science to varying degrees. This, to a large extent, is being driven by Vision Mātauranga (MRST 2007; Rauika Māngai 2020) and the need to understand what this means and how VM can be more effectively incorporated into and demonstrated by our science in order to improve and maintain stakeholder relationships, build research and staff capacity, and achieve better science outcomes and impacts for Māori and Aotearoa New Zealand as a whole. Manaaki Whenua research statistics show that research responsive to Māori, involving Māori, and Māori led research have steadily grown over the last few years across research programmes and most portfolios with the growing need to include Māori. This research growth has led to new ways of working, innovative research that addresses complexity and Māori issues, research that leads to change, and increased collaborative and investment opportunities. This is increasingly exhibited in a move towards inter-disciplinary and across knowledge(s) research and away from silos. It is envisaged that the findings in this report will contribute to the understanding of what Māori knowledge (mātauranga Māori), values, and perspectives mean, what kaupapa Māori research is, and provide guidance for all staff in the way we work together towards some form of integration and transdisciplinarity within and across knowledge systems and disciplines, as outlined through the model and framework presented. Findings show much more work needs to be carried out to overcome the barriers and challenges that cause knowledge delineation and inequality, and inhibit inclusion, integration, and the creation of new knowledge.

There was general agreement throughout this research that we need to develop good integrative research practice, because of the increasingly complex issues we face both in Aotearoa New Zealand and globally and to find solutions that elicit a wider range of knowledge, values, and perspectives (e.g. Duncan & Robson-Williams 2019; Jones et al. 2020). There is also a need to develop research approaches that are interdisciplinary and transdisciplinary, can work across multi-dimensional areas, e.g. cultural, social, environmental, economic, political – often in the same research project – and can address issues and deliver impacts and outcomes across multiply complex areas (Angelstam et al. 2013; Cornell et al. 2017; Wolff et al. 2019; Harrison & Loring 2020). There are many incentives for change and transformation. It was generally agreed that it was important to include indigenous views, perspectives, and knowledge in all integrative and transdisciplinary research, especially in Aotearoa New Zealand. A number of integrative and transdisciplinary examples and case studies are needed to demonstrate this new way of working for delivering desired goals and outcomes.

Mātauranga Māori is highly transdisciplinary and integrative in its approach to building new knowledge, especially through the organising and hierarchical principle of whakapapa (literally meaning 'layers' or 'to layer'). The concepts and systems of whakapapa and whakaturanga (across generations) mean that many Māori take an intergenerational view of the desired short- and long-term goals and outcomes and the right kind of activities, change, and impacts that will lead to stated or agreed outcomes. This long-term belief and

view (sometimes, a hundred to a thousand years) is an important frame of reference when working with Māori for all science and integrated projects.

This report demonstrates that Māori values, principles, and knowledge can make unique and transformative contributions to solving some of our most 'wicked' environmental and societal problems. Already this transformation is starting to occur with moves towards co-management of resources using wider sets of knowledge, including indigenous knowledge and values, and transformative change in governance examples (e.g. Lyver et al. 2018b). Our legal system has recognised the personhood of Te Urewera National Park and Te Awa Tupua (Whanganui River), placing the environment as a legal entity to be served by human-beings (e.g. Ruru et al. 2017; Ruru 2018). The research, science, and innovation sector is increasingly accepting its Te Tiriti o Waitangi obligations to partner, participate, and protect Māori interests and values (NZAS 2019, 2020). All over Aotearoa New Zealand, the rapid growth of te reo Māori education is increasing people's understanding of the way Māori see and make sense of the world (Black 2014).

The Māori world view (Te Ao Māori) acknowledges the interconnectedness and interrelationship of all living and non-living things. Māori values are centred on the obligation to foster reciprocal relationships with all aspects of the environment, living and non-living. This (w)holistic approach, which seeks to understand the total system, not just parts of it, is necessary to create solutions to 'wicked' problems that minimise negative repercussions in other parts of the system. The inclusion of Te Ao Māori in scientific research can deepen our collective understanding of connections, interdependencies, and long-term intergenerational perspectives. Opening up science research to include Māori values and [mātauranga Māori](#) (Māori knowledge) is part of a transformative evolution in our science sector and society as a whole.

There is much alignment between Te Ao Māori and transdisciplinarity for working across values, knowledge, and diverse perspectives, and to give recognition, respect, and understanding for these. Māori believe transdisciplinarity is a useful concept and approach that can support and enhance the use of mātauranga Māori, under certain circumstances and safeguards, within a nurturing and enabling collaborative research or science environment. Māori have already used great amounts of science, mātauranga Māori, and other forms of knowledge and perspectives in their work and are used to working and operating in a collaborative and integrative fashion. There is already a high amount of integration in kaupapa Māori research, and Māori research by nature is underpinned by high degrees of participation and inclusion. Integrative, collaborative methodologies (e.g. hui, wānanga) have long been hallmarks of indigenous-led research, providing insights for Western science.

We have provided a Māori Integration framework and model to guide integrative research in future.

This work is contributing to the Manaaki Whenua i³ interface (integration × innovation × implementation) web site, which is focused on supporting integrated research. Wānanga, hui, staff surveys, literature reviews, and research on kaupapa Māori frameworks and principles have all provided essential information to contribute to how integrative research can be best carried out in Manaaki Whenua, and we intend to provide some internal tools, resources, and guidance from a Te Ao Māori perspective to help navigate these integrative research

pathways and journeys. The integrative framework and model from this report is one part of this; however, it will be essential to put this into practice through actual integrative and transdisciplinary research examples and case studies.

Recommendations

A number of recommendations are made for continued support of this work and demonstration of integrative projects and transdisciplinary research. We believe following these examples and new ways of working and thinking, which are typically multi-dimensional and multi-faceted, will lead to more integrative research and better investment in science opportunities. When followed, these approaches have the ability to tackle increasingly challenging complex issues and problems. Recommendations include:

- Promote the Māori values and principles given in this report, to provide in depth understanding and learning, to support the establishment of integrative research and collaboration.
- Use the kaupapa Māori framework and model produced in this work, as a process tool to guide the development of future collaborative Māori research that embraces indigenous knowledge and science, alongside other useful frameworks and guidelines, to achieve effective integration and transdisciplinary research.
- A template developed as part of this work, is used to provide a range of 'best practice' project examples that demonstrate various degrees of integration and transdisciplinarity in completed MWLR projects. We recommend continuing to add these real examples, as they come to hand, as important learnings for developing best practice especially from a Māori kaupapa lens, enabling project leaders to learn approaches that add value to their projects, and to better implement indigenous research alongside science. These guides, resources and case studies are given on the i3 website and to date include:
 - Guide: Te Haerenga Pāhekoheko [Integrated Research Toolkit – Guide: Te Haerenga Pāhekoheko \(landcareresearch.co.nz\)](https://landcareresearch.co.nz/integrated-research-toolkit-guide-te-haerenga-pahekoheko)
 - Case study: Ngā Whāinga Kaitiaki o Waiapū [Integrated Research Toolkit – Case study: Ngā Whāinga Kaitiaki o Waiapu \(landcareresearch.co.nz\)](https://landcareresearch.co.nz/integrated-research-toolkit-case-study-ngā-whāinga-kaitiaki-o-waiapu)
 - Case study: Te Reo o Te Repo [Integrated Research Toolkit – Case study: Te Reo o Te Repo \(landcareresearch.co.nz\)](https://landcareresearch.co.nz/integrated-research-toolkit-case-study-te-reo-o-te-repo)
 - Resource: The Ake Ake Model [Integrated Research Toolkit – The Ake Ake Model \(landcareresearch.co.nz\)](https://landcareresearch.co.nz/integrated-research-toolkit-the-ake-ake-model)
 - Resource: Sharing a Kapū Ti [Integrated Research Toolkit – Sharing a Kapu Ti \(landcareresearch.co.nz\)](https://landcareresearch.co.nz/integrated-research-toolkit-sharing-a-kapu-ti)
- Further funding should be made available to further explore testing the framework with researchers from across portfolios. To enable bringing together an interdisciplinary team to demonstrate the effectiveness of the Te Haerenga Pāhekoheko framework.

7 Glossary of terms

Āhua – form; approach

Ako torowhānui – holistic learning/thinking

Āta – growing respectful relationships

Āwhingātanga – care; help; support

Kaitiakitanga – resource management

Kaupapa Māori – Māori-centred and Māori led

Kete – toolkit; basket

Kotahitanga – unity

Mahitahi/Ngatahi – Working together

Mātauranga Māori – Māori knowledge, values and perspectives

Ngākau tapatahi – integrity; genuine

Pāhekoheko – integration; cooperation

Tau uta uta – reciprocity; reinforcing relationships

Te Ao Māori – the Māori worldview

Tiaki - to care for', 'look after' acknowledgement of important things to our partners

Tikanga – ethics; protocols and customs

Tūhono – establishing bonds, connections

Urutaunga – Adaptation, resilience

Wairuatanga – spirituality

Wānanga – workshop

Whakaaroaro – logic

Whakamana – empowerment, to give authority

Whakaponotanga – epistemology

Whakatupuranga – intergenerational

Whanaungātanga – building strong connections and relationships

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Appendix 1 – MWLR Vision Mātauranga statistic summary

Analysis period over the 3 years 2018–2020.

Manaaki Whenua number of Vision Mātauranga jobs score 2–5.

		19/20	18/19	17/18
2	Research specifically relevant to Māori	23	23	22
3	Research involving Māori	31	24	25
4	Māori-related research	50	49	46
5	Kaupapa Māori research	92	86	96

Manaaki Whenua revenue tagged to Vision Mātauranga research score 2–5.

VM=2, 3, 4, 5

VM Rating	(Multiple Items)				
Core Funding Type	(All)				
Row Labels	Sum of 2018	Sum of 2019	Sum of 2020		
22 Biota	3,110,157	3,687,014	3,094,163		
23 Plant Biodiversity & Biosecurity	7,827,842	8,395,708	7,615,743		
28 Wildlife Management & Conservation EC	4,125,209	4,850,136	5,609,928		
29 Society, Culture & Policy	4,126,862	4,335,463	3,786,360		
35 Climate Change Adaption & Mitigation	9,000	1,000			
37 Characterising Land Resources	3,722,700	4,294,409	4,323,702		
38 Managing Land and Water	3,163,843	5,063,157	4,730,089		
44 NSC - NZ BIO Heritage	853,233	710,480	49,232		VM2,3,4,5
Grand Total	26,938,845	31,337,367	29,209,217	87,485,429	37%

Percentage funding of each investment source of Vision Mātauranga research score 3–5.

Investment activities: SSIF, Contestable (e.g. NSCs, Endeavour, Smart Ideas, Partnership programmes etc), and commercial.

	2018	2019	2020
SSIF	19%	20%	20%
Contestable	68%	64%	67%
Commercial	13%	16%	13%

Appendix 2 – Internal Māori staff wānanga September 2019.

Wānanga Exercise

Focused Conversation Session Plan for Towards developing a Māori Integration framework.

FOCUS QUESTION: What does your experience tell us about Māori-centred and kaupapa Māori approaches to knowledge integration?

PRACTICAL RESULT: Co-develop description of what Māori-centred or kaupapa Māori knowledge integration looks like in Manaaki Whenua science.

RATIONAL AIM: Identify themes in research/project practices and their implications.

EXPERIENTIAL AIM: To have engaged a group enquiry and awakened curiosity for future work/integration.

OBJECTIVE THINKING:

What type of research do you do where you integrate knowledge?

What values/principles do you use?

REFLECTIVE:

What is a project/example/experience where integration helped/hindered the outcome/outputs/impacts?

What values/principles do you love/hate?

INTERPRETIVE:

What's the value of integration in science projects?

What is it that makes an integration principle helpful or a hindrance?

What patterns have you seen in terms of who uses what?

DECISIONAL:

What should we consider when selecting/describing integration for Manaaki Whenua science/projects at the project level? What are the red flags?

MAHITAHĪ – THEMES:

BARRIERS + OPPORTUNITIES

Appendix 3 – Staff questionnaire: Towards a Māori integration framework and model

From your perspective as a senior staff member of Manaaki Whenua (portfolio leader, senior manager, senior science leader) please provide a few paragraphs for each of the following questions. If you require some additional resources about integrated research, you can find comprehensive information about [Integrative Research within Manaaki Whenua](#) on Staffroom.

- 1 What is your understanding of integration in research? And what does integration look like in your portfolio/programme area?
- 2 How does Māori research (e.g. kaupapa Māori, Māori-centred, mātauranga Māori/Māori knowledge) fit into this integration and your portfolio/programme goals/strategy?
- 3 Is Māori research, and building Māori capacity in your portfolio/programme important?
- 4 What does interdisciplinarity and transdisciplinarity look like? What does it mean in your portfolio/programme?
- 5 Does Māori research and increasing Māori staff capacity help us achieve 'integration' and 'science' goals for Manaaki Whenua? Impacts? Science excellence? Science outcomes for Aotearoa New Zealand?
- 6 What's required to increase Māori research, Māori research excellence, and Māori research capacity in/across Manaaki Whenua?

Appendix 3.1. What is your understanding of integration in research? And what does integration look like in your portfolio/programme area?

Respondent 101: For me, integration is about combining knowledge from multiple sources to solve bigger problems than could be solved through use of a single knowledge source. For Manaaki Whenua this could include integrating across disciplines as well as framing issues through the aspirations of stakeholders and partners. To me, mātauranga Māori is an integrative framework in its own right and can also provide input to other integrative frameworks that are working either in inter-disciplinary or trans-disciplinary ways.

Although I am the SLT sponsor for the integration strategy for the organisation, I get little opportunity to practice this in a research context. Right now I'm working across public and private sector groups on issues of carbon and biodiversity (again) which touches on building a common understanding from diverse perspectives and aspirations. I do think a lot though about the incentives (at organisation-scale and beyond) for researchers to integrate. I'm thinking about what it would mean for Lincoln staff on a redeveloped site to be more integrative. I think a lot about Lincoln's apparent divide between support and science staff and how to build a deeper respect for different forms of expertise.

Respondent 102: Combining multiple lines of information to provide knowledge that would lead to a more inclusive understanding of the problem or issue to be addressed. Integration is also dependant on the type of issue you may be exploring. Determination of the approach and methodology will drive how inclusive in nature the information sources may be. In some instances the degree of integration of knowledge may be limited where accepted approaches are followed (tending within disciplinary issues).

Respondent 103: The environmental issues facing New Zealanders in managing our natural resources are complex and understanding problems can be just as difficult as finding solutions. These two aspects of a project cannot be considered as distinct phases, but rather different kinds of conversations that need to be woven together from beginning to end. Therefore, a linear approach is unlikely to give a lasting solution. The social complexity of managing natural resources means that you have different stakeholders with strongly held beliefs about what the problems are. Dealing with the problems is not at all about coming up with the best answer; rather it is about engaging stakeholders to make sense of the problem's dimensions and then seeking win-win scenarios, drawing upon the full range of our expertise and knowledge.

This leads to a generalisation: it is very rare for a single research project to deliver all the knowledge / tools needed to solve complex problems affecting multiple stakeholders in different ways. For such issues, multiple disciplines need to be brought together in an integrated package that can be combined with insights from other knowledge domains (such as indigenous knowledge), in order to deliver adoptable solutions. Although we undertake research across biophysical, social, economic and cultural perspectives, we have seldom integrated across research activities as well as we could have. This requires a new way of working in a truly interdisciplinary (or transdisciplinary) fashion. If we can achieve this integration, we can increase the impact of our research and potentially: (i) influence the future direction of research funding (by developing a market niche for ourselves), (ii) open the door to new revenue streams, such as philanthropic funding and , (iii) further increase the

impact of our research. Integration, therefore, becomes a key value of our research for our stakeholders and a key value internally for us.

Respondent 104: I think of integration as being fit for purpose and depends on the questions you are looking at and the context. In some instances, it may be bringing a range of different stakeholders together within the research, or it may be bringing different disciplines together within a certain type of science (e.g. an ecologist with a soil scientist) or different disciplines together from across the sciences (e.g. an ecologist with an economist with a social scientist with a Māori values researcher) or some different mix/aggregation of the above.

I think that desire for integration (or greater integration) is often curtailed by 2 key things – amount of funding and/or timeframe of the research. The more ambitious the integration (i.e. more disciplines, stakeholder groups, partners) the more \$ and time you need. Folks forgot the time it takes to actually get people understanding each other before the real research and advances can be made.

In SCP I would say the majority of projects involve some degree of integration – and this is along the spectrum of the possible types of integration outlined above. Almost always is the integration of social, economic and/or MM science with the biophysical sciences (not that often it is not all 3 of the social, economic and MM). The extent to which stakeholders are bought in or perhaps how many stakeholders are bought in is quite mixed. Both the extent of stakeholders and mix of social, economic and MM and range of different relevant biophysical sciences involved in a project is constrained primarily due by the \$ and time constraints side of things. However, I find most staff do try to be cognisant of the different viewpoints they should be considering (even if they are not involved in the project).

Respondent 105: I believe I have a reasonable understanding of what integration is in relation to the research environment. This comes from being involved in many projects over the years that have spanned the various definitions of integrative research – inter, multi, and trans disciplinary. Currently our MBIE programme on erosion and sediment sits in the inter and multidisciplinary space with some sub-projects taking a stronger trans-disciplinary approach. Not all projects or research questions require an integrated approach and generally our approach is to pick the approach most suited to the problem, the client, and the amount of resource available. Short-term projects do not generally lend themselves to integration as we know from experience that taking an integrated research approach is more time consuming and hence more costly.

Respondent 106: Research in CLR has become increasingly integrated over a number of years. S-map has been the driver for this out of necessity across its multi-domain development workflow – soil surveyors collect the data, labs measure different attributes, database engineers develop and maintain the database platforms, spatial analysts help create GIS layers, data scientists with soil scientists model attributes and information, and various informatics staff develop and run different delivery platforms. Business development staff contribute through data licencing, client liaison and new contract development. Integration is not just confined to MWLR, we have a number of agencies, tools and services that work closely with us on integration of our data.

Increasingly I have been implementing a strategy of expanding this type of integration to across the different workstreams we have in CLR. A key thing to recognise is that this 'version' of integration is based around national land environmental spatial data – so is very much data generation and management focussed.

I recognise this is a different take on others views of more socially driven integration in research, which I think is great, but just need to recognise that there are different ways to implement the integrative research cake.

Respondent 107: My understanding and previous practice of integration: (1) co-design research questions and where possible process methods with all involved (multiple disciplines, multiple stakeholders); (2) where relevant co-produce data collection and analysis; (3) co-interpret results and (4) co-communicate outcomes.

From experience a lot of effort goes into (2) and (3), (1) is often hardest, and (4) should not be forgotten about.

Respondent 108: Looking at the models, I'd say we fall between Multidisciplinary and Transdisciplinary research. I think we start out with the best of intentions and we have all of the players involved and "bits of integration" occur between the groups, but it isn't consistent or prolonged.

- We have jobs and programmes that cut across MW teams and with other research organisations
- We have advisory groups consisting of stakeholders and end-users
- We try to do consultation as inclusively as we can
- We try to think about and establish mechanisms by which information can flow out of our research and have impact

Respondent 109:

- = bringing together knowledge and perspectives from different disciplines and/or world views to form a deeper understanding of a subject
- A wide variety of projects in the portfolio encompass >1 discipline, particularly social research-ecological management and western science-Te Ao Māori

Respondent 110: I see integration as involvement of people with more than one area of expertise in a research project – both for projects led by team members, and for team members participating in projects led by other research teams or portfolios. Integration in my research area is often driven by funding imperatives where bids are considered more likely to succeed if other research providers can be integrated – but I think the need and opportunity is greater for better integration within Manaaki Whenua, especially for Mātauranga Māori.

Appendix 3.2: How does Māori research (e.g. kaupapa Māori, Māori-centred, mātauranga Māori/Māori knowledge) fit into this integration and your portfolio/programme goals/strategy?

Respondent 101: Well, I'm very interested in where this SSIF project is going to lead! I still keep a distant eye on whether MfE is actually going to manage to do anything substantive within its reporting framework to honour its Treaty obligations. I'm working with the Systematics team on a strategic refresh of their approach and I think the Treaty partnership will be a cornerstone of how the Collections are developed. I'm not entirely sure what this will mean for broader integration, however, with mātauranga Māori. I like what Chris Smith is trying to establish in partnership with some iwi, but I think setting the Collections up with proper co-governance arrangements would be a real watershed!

Respondent 102: It depends on the nature and the type of issue/understanding that is needed. Where we are lending to more complex issues and a broader understanding of all knowledges that could lead to a better understanding/solution/outcome is needed then the more integrative the research needs to be (integrative within the context of all knowledge being considered within the world view that exists for that knowledge)

Māori research in this context can be invaluable in understanding the nature of the complexity and approaches that may lead to better solutions or pathways to an approach that leads to solutions.

Respondent 103: Many, but not all, issues that we research will have cultural aspects that if we embrace, will lead to a greater impact from the work through greater adoption of better, more enduring solutions. We also have a responsibility to be a good Treaty partner. So, Māori research should be central to much that we do, not just an 'add on'.

Respondent 104: I believe most projects aspire to have a Māori research component and the portfolio. This is for a whole range of reasons including but limited to:

- Recognition of partnership principles
- Desire to be inclusive of all views when finding solutions
- Recognition of desire of Māori peoples to reconnect and protect their heritage
- Recognition that all people are part of the solution so need to include all people
- Recognition that Māori are increasing empowered and are integral to any solutions.
- Genuine science interest in different epistemologies
- Māori worldview thinking resonates with the ethos of many of the researchers whose projects sit within SCP
- (And quite ruthlessly) it is a requirement of so many RFPs (however, I don't think this is what drives the inclusion to be honest).

Respondent 105: It fits where appropriate – i.e. not every project needs involvement by Māori, though at the broadest level we should, as a Treaty obligation, consider whether such involvement would add value. Inevitably it is the amount of resource available that governs whether the project lead seeks to do this. In the MBIR programme referred to above, it clearly fits and was a key component that was included from the start. To date, the actual practice of

integration of Māori research within all components of the programme is less than might have been desired, though there are some elements where this is more important than others. There are several projects that tend to be run as Māori-centred research with Māori stakeholders but these tend to be limited in terms of the other disciplines involved.

Respondent 106: Good question and one I have been asking the RPAL's. To be honest they and me have struggled, and we have struggled to generate revenue to support advancement. There is scope with SSIF, but this is difficult as much of this is linked to long-term research programmes and a strong degree of leveraged commercial funding. There is also a lot of demands on SIFF to support a wide range of staff capabilities, so I have found substantial moves are difficult. However, when planning for CLR back in January I have asked for some SIFF to be allocated next year for briefing paper to be prepared on this exact topic.

Respondent 107: We have engaged with Holden + co-identified relevant Māori scientists (Shaun, Nikki; there are likely to be more) in the first step of co-production of the CAM portfolio's strategy, i.e. core research questions identified through a 30 MWLR participants workshop. From the workshop discussions it was clear that all scientists are extremely keen for engagement with Māori knowledge, questions and needs. Needs were clearly expressed by the Māori group. Holden and Shaun have suggested a contact for starting to engage with national-level actors. My sense is we need more engagement for insuring our research is really co-designed, with ideas coming bottom-up to the portfolio, not just looking for CAM research to deliver to Māori needs.

Respondent 108: As above but it is very haphazard because we don't have a strategy and we spend too much time trying to fit into other peoples' strategy. As a result, the impact of what we do is probably less than it could be but, no one is measuring it so, we don't know.

There was a discussion on Yammer see

https://www.yammer.com/landcareresearch.co.nz/#/Threads/show?threadId=576859477229568&search_origin=global&scoring=linear1Y-prankie-group-private-higher&match=any-exact&search_sort=relevance&page=1&search=%22natural%20philosophy Let me know if you can't find it. Essential my thinking is that scientists are struggling and don't know what they are doing in this area.

Respondent 109:

- It is a significant component of the portfolio with a Research Priority Area dedicated to it and a number of high-profile jobs in other RPAs focussed on working with and for Māori
- I would support much more Māori research, but we are limited in capacity (see below). It is, though, a constant in any strategic thinking. Another factor may be the priorities of post-Treaty entities that frequently, and understandably, deal with socio-economic support for communities in the short term. Whilst SSIF funding helps, a significant commercially funded job from a Māori corporate, for example, in the biological sciences/conservation/restoration area would allow us to do much more than SSIF can support

Respondent 110: Māori research is highly relevant to the Systematics Team and Biota Portfolio, as we are primarily researching taonga – and yet integration tends to be compartmentalised and often limited to team and portfolio staff members rather than involving engagement with MWLR experts from other teams. How can this be improved?

Examples of Māori research in the team include:

- Kaupapa Māori research: Management of NZ Flax collection *Te Kohinga Harakeke o Aotearoa* and kumara trial, Lincoln; servicing weaving community; hosting visits (e.g. SYS team member Katarina Tawiri)
- Research relevant to Māori: Most research on NZ biota can be included here, although with little direct integration. Collection of material often involves approval from iwi as landowners. Major publications (e.g. Fauna and Flora publication series) may include abstract and/or popular summary in Te Reo – translator mostly sourced outside MWLR. (e.g. Biota RPALs Thomas Buckley, Rob Smissen, Bevan Weir)
- Māori-centred research: Unlocking Curious Minds projects to provide education resource on fungi for kura kaupapa and in-house training for kaiako – integrated with external translator (from Otaki), training operator (Haemata Group), and pūtaiao educationalist (from AUT). (e.g. SYS team member Peter Buchanan)

An example of potential opportunity for integration concerns the 2020 funding round for MBIE's Unlocking Curious Minds funding (concept bids likely due in July?). In mycology, we have had 2 projects funded (as above) to bring knowledge of biology and traditional uses of fungi to kura kaupapa and kaiako nationwide. I welcome discussions of how we might partner to expand on our work to date and/or extend this to other groups of organisms, especially insects & other invertebrates, and to plants.

Appendix 3.3. Is Māori research, and building Māori capacity in your portfolio/programme important?

Respondent 101: Building Māori capacity/capability is – yes.

Respondent 102: Māori research is important as it can provide an approach that is more appropriate to the type of issue/question that is being proposed. The role of different knowledge systems would ideally be assessed in the initial understanding of the question that is to be explored. The initial step is crucial to understand what knowledge will be necessary and at what stage.

Respondent 103: Yes, Māori research should be important across most, or all, of our Portfolios. However, as we are capacity constrained, we need to be quite strategic about how we use the resources we have. Unfortunately, not all projects that would benefit from an input of Māori research will be able to realise these benefits. We probably need to think of a range of solutions, such as building capacity for Māori research in some more of our non-Māori staff.

Respondent 104: Yes, it is. Not sure what else you wanted here.

Respondent 105: The simple answer is yes. However, since the consolidation of the kairangahau into a grouping that sits within a team that is strongly linked to one portfolio my personal view is that the focus of work has narrowed. This may mean that for some elements of research (e.g. kaupapa Māori, Māori-centred, mātauranga Māori/Māori knowledge) capacity may be being deepened rather than broadened. Maybe because this group is over capacity their ability to become involved in a broader range of projects where the capability could be widened is limiting individual researchers to focus only on what interests them or on say kaupapa Māori research. It is hard to generalise but that seems to be the perception.

Respondent 106: Yes we would think so – although its also important to recognise where CLR sits as a base data generator portfolio. A strong message we have received in past consultation is that our major value is in quantification of the land environment data, from which a lot of research, services and tools are built from – which we have recognised (and been told essentially) that other groups and agencies are better placed to do. So in that perspective the challenge is to make sure we scope the type of Māori research which is the best fit for our brief – or we partner better with that various Māori users who will pick up our data and apply it.

Respondent 107: Yes, including Māori research would be an important component for CAM. This may in particular regard (though not exclusively):

- Māori knowledge regarding potential new values and uses around changing ecosystems (from direct climate impacts or from land use / management responses for, e.g. climate mitigation like retiring land from agriculture)
- Māori values around future landscapes

Ultimately building Māori capacity on climate adaptation would be an outstanding outcome. According to the principles for integrated research I outlined above the process for this

needs to start sooner than later when we start designing our research, and especially our case studies within regions.

Respondent 108: We have escalating issues around data sovereignty, and what might come out of WAI 262 and the Convention on Biodiversity – Nagoya Protocol. Just about everything we do is affected so we need to have a strong partnership with Māori. But we are struggling with insufficient staffing and finding the right people who can help us connect in a meaningful and sustainable way.

Respondent 109:

- Absolutely critical. I would love to have another Māori ecologist with a PhD. Integrated approaches are vital in managing biodiversity/pests/supporting cultural harvests and kaitiakitanga and in collaborating with all stakeholders. So much of our work involves working with communities and we need to be able to engage with *all* communities in NZ equally in managing to achieve what *they* want.
- In recent years it has been heartening to see some established scientists engage with Māori and to watch the change in their heavily western science-oriented perspectives. The more we can facilitate such exposure, the more we can support integrated research, but this isn't about going on cultural awareness courses – it needs genuine opportunities to co-develop research.

Respondent 110: Yes, our Science Team capability plan includes the intention to appoint a Māori researcher in systematics, or in aligned ecological or biosecurity research. But failing that, due to funding constraints, I welcome discussion about how we could align our research more effectively with one or more Māori staff members to then explore opportunities arising from this alignment.

A discussion document that arrived a week ago is a current example where aligned discussion and an integrated response would be highly valued: The "DRAFT Te Nohonga Kaitiaki Guidelines for Genomic Research on Taonga Species" was commissioned by Genomics Aotearoa, and prepared by Te Nohonga Kaitiaki research team led by Maui Hudson (U. Waikato). Feedback is requested by 22 May. Adoption of recommendations, aimed at compliance with the Nagoya Protocol and Wai262 recommendations, could have significant impact on current practices in research on taonga species (= ANZ's biota, plus). Our response to date has been to send it to Holden, but if there was already a Māori scientist aligned with the team or portfolio we would welcome collegial discussion. (I can supply a copy of the document if you don't have access to it and are interested).

Appendix 3.4. What does interdisciplinarity and transdisciplinarity look like? What does it mean in your portfolio/programme?

Respondent 101: For me interdisciplinarity is about building between disciplines to leverage the different types of knowledge. Transdisciplinarity to me is about asking different questions, based on the integration with practitioners/policy makers/community members etc. The questions should transcend the disciplines and shape the entire research agenda.

Little opportunity to practice except for in some of these strange groups I end up in.

Respondent 102: From what I have seen the predominant use of multiple science disciplines usage in providing a better understanding or solution tends towards multidisciplinary research with the occasional use of an interdisciplinary design. However, the right tool needs to be used for the type of issue that is being addressed so it is not appropriate to use interdisciplinary or transdisciplinary approaches for simple or even complicated issues.

Our use of complex methods to enable complex problem solving which may enable the usage of transdisciplinary design or research is weak. This is in part driven by a lack of understanding externally of the value of these approaches and an expediency in solution finding.

Respondent 103: Interdisciplinary research involves multiple disciplines or perspectives coming together to collaborate and, through integration, create solutions. Transdisciplinary work is wider still and involves taking stakeholders and end-users on the journey with you, to maximise the range of perspectives considered and increase chances of adoption once the work is finished. We also need to be mindful that working in either of these ways can take considerably longer than classic, single discipline reductionist science. Not all the work we do needs this approach, but in my opinion more does.

Respondent 104: We have both interdisciplinary and transdisciplinary research in the portfolio and projects sits along a spectrum. I will say though that truly transdisciplinary projects are hard to achieve.... just because of the time taken to develop, fund and undertake a truly transdisciplinary project.

Some questions, of course, don't need interdisciplinary or transdisciplinary research and research should be fit-for-purpose.

Respondent 105: In many ways I have answered this in question 1. Many of our so-called integrated projects are multi or interdisciplinary and only a few are really transdisciplinary where the research agenda is truly co-developed with stakeholders who sit within the research team. As pointed out, not all research questions require these approaches and much of what we do can be dealt with in a mono-disciplinary or multi-disciplinary way.

Respondent 106: I've largely set that out in question one. An important thing is that CLR has had to put bounds around its scope to generate and manage core land environment datasets for NZ. In that context, and the funding bounds we have, the breadth of trans / interdisciplinary is limited to technical domains within our portfolio. My view is other portfolios should be where the application of underpinning CLR data occurs, so in that context have an opportunity for bringing together a wider range of disciplines. I've also

strongly argued for a while now that the company needs to have some key 'big topics' which it is targeting to integrate at a pan company level, where the portfolio's co-ordinate activities to make a collective big impact. That also creates some really interesting opportunities for many disciplines to work together.

Respondent 107: Interdisciplinarity = true collaboration across scientific disciplines with sharing of concepts, language and some methods, along with complementary disciplinary research around common questions and objects. It needs to result in some common, integrated outputs and outcomes that would not have been possible for any of the disciplinary approaches / scientists alone. Note that excellent interdisciplinary research can be done about social actors / stakeholders (e.g. through interviews, workshops, surveys, etc.) without being transdisciplinarity being achieved – or sometimes desirable.

Transdisciplinarity= the definition I gave for integrated research above. The key addition to interdisciplinarity is that stakeholders are tightly involved. This research tends to be strongly place-based. Note that not all research needs or can be transdisciplinary depending on research questions or context.

Respondent 108: As noted in question one I believe most of what we do is transdisciplinary but, we struggle to maintain the integration. The disciplines tend to silo despite the best of intentions.

The Yammer discussion got started as I was trying to start to pull together some thinking about how Biota might approach this issue and I was drawing on the example of natural philosophy/natural history and modern Citizen science. I have a 2-pager draft think piece "Biota science and mātauranga Māori" trying to sort this out.

Respondent 109: To be honest, I don't ever think in labels when working to develop new projects or programmes. It's about finding the best approach or mix of approaches to address the research question or to support stakeholder/end-user needs. I will always encourage staff to consider widening their perspectives on what might be effective.

Respondent 110: I needed to consult Ronlyn and Melissa's report for an understanding, and the diagrams are very helpful. One aspect that I don't understand, however, is the absence in the Interdisciplinary model diagram of Mātauranga Māori; I assume that this could be an active component in many cases?

Effective planning of new initiatives needs to take a transdisciplinary approach to ensure that potential collaborators, stakeholders, and end users are all engaged from an early stage – resulting in a more robust research proposal and greater chance for developments that lead to funding success. A limitation in achieving this can be the effort and time required (especially for a smaller initiative), as well as having access to and relationships with relevant representatives to secure their willing involvement. Capacity issues with over-stretched Māori scientists and representatives are often mentioned as a limitation.

I recall some past efforts in this regard where it has seemed easier to build on previous Māori contacts outside of MWLR. While this may not have necessarily jeopardised the outcome, it has unintentionally delayed integration within MWLR. I think our team needs to catch up in this regard – hence the wish that there be more alignment between the team and MWLR's Māori expertise and staff.

Appendix 3.5. Does Māori research and increasing Māori staff capacity help us achieve 'integration' and 'science' goals for Manaaki Whenua? Impacts? Science excellence? Science outcomes for Aotearoa New Zealand?

Respondent 101: For me, absolutely yes to help achieve both integration and science goals. I wonder if a kaupapa-Māori approach can also resolve the traditional trade-offs associated with land use planning at catchment scale. (Shaun's research suggests that it may be able to.) If the aspirations can sit outside traditional opposites (such as conservation vs extractive use; scenic value vs production etc), the integrative framework may be a more enduring form of decision making that a larger proportion of a catchment's population can agree/adhere to.

No question for me about the ability to have/increase impact both with Māori research and capacity. There's heaps of scope for excellence but can be tricky to convince some of the traditionalists (of science) about this. Probably the way forward is to lean on some of the knowledge of the Māori researchers who have learned to walk in both worlds – traditional (science) journals AND making a real impact for Māori communities. I don't know if this feels like selling your soul or not? (I'm probably not the best person to know this!)

Respondent 102: It could, but an understanding of what is needed to be addressed is the first step where a deliberate approach to determining the knowledge that would be necessary to address the question at hand. In some instances, utilising a Kaupapa Māori approach may be the only appropriate approach.

Having a greater understanding of when and where different knowledge systems could lead to better outcomes is not well known. There is a tendency for expedience to override the need to appropriately explore the issue needing to be addressed. And although this is not always necessary it can in many instances be critical. Generally Māori research/staff capacity is limited and consequently the use of a mātauranga Māori either independently or in combination of other knowledge systems limits the benefits this may provide. Recognising the different time dimensions to work within each knowledge system is also not well understood.

Yes, it could help achieve better integration, science goal delivery and outcomes for Aotearoa New Zealand and depending on how science excellence is defined then that could also be achieved (this goes into the need to adequately recognise science excellence that does not just sit within the biophysical definitions)

Respondent 103: There is no right or wrong answer to this question. Overall, there is no doubt that we are capacity constrained at present. Just having more staff, though, won't solve the issue, they need to be doing the right things, as more staff by itself will not help us achieve further integration in our work. My view is that as we are not a university, we should frame science excellence in terms of impact, so clearly Māori research has an important role to play here. While we focus on outcomes and impacts, rather than just outputs, increasing our capacity for Māori research should help. Clearly one issue is fragmentation of effort - having staff 'smeared' across multiple projects making a minor contribution to each is far from ideal, for the individuals or the quality of the research. However, that is a classic situation when 'demand' outstrips 'supply'.

Respondent 104: It depends on what the research is and is for. In some instances it will but in others it may not be necessary.

I do think there should be a greater ability for non-Māori folks to work with Māori. It doesn't just have to be Māori researchers that work with Māori stakeholders. There are certain aspects of research where that would be the case, e.g. Kaupapa Māori research. But again holistic solutions require holistic skillsets so we should be envisaging that a range of skills, including Kaupapa Māori skills are brought together to solve problems.

I do struggle with the science excellence side as I don't see our Māori researchers developing a lot of academic papers. I think this is a real gap in our Māori research. So, I don't know really how "excellent" our Kaupapa Māori research is. There are an increasingly number of indigenous focused publications in the literature and it would be good to see more based on our research.

If that is not a desire of MWLR to go down this route, then it should be a conscious decision to not focus on the science excellence side.

In terms of Māori sitting alongside/within/however you want to describe it other research in solving a problem then yes, it is likely to be an important component of many solutions we would like to see and implement in NZ.

Respondent 105: The answer is both yes and no and it very much depends on your philosophical stance, i.e. at one level everything should have a Māori perspective to honour the Treaty, but the reality is not everything will. In the natural resources sector where most of MWLR work is focused, increasingly Māori research should become an integral part of much of what we do, particularly in the bigger projects. It is only in the bigger projects where there is usually enough resourcing to take a more integrated and transdisciplinary approach. Whether "integration" is achieved just by including Māori research is debatable. There is also the issue of the 'selfish scientist' that is commonplace in the science system, i.e. most scientists are driven by the pursuit of 'their' favourite subject rather than thinking more broadly about "what should I focus on to achieve the best outcome for Aotearoa". There are people who operate in a more 'selfless' way, but these tend to be the minority. If given the chance (and the resources), most researchers if pressed to answer honestly would rather work on 'their' thing than somebody else's, and I venture to suggest that goes for kairangahau as well.

Respondent 106: Yes absolutely

Respondent 107: I can't reply to this at this stage, sorry.

Respondent 108: I can only talk about Biota but I'm not seeing it. Hence the think piece I have been trying to do. Where we really need a hand is the connecting to iwi all over the country and maintaining that relationship. Our scientists are too stretched in finding funding and doing the science to also maintain the relationships.

Respondent 109:

- Science excellence comes from having good scientists with adequate resources, irrespective of race, culture or nationality. In saying that, if we could find a good scientist who is also Māori, we should grab them.
- Integration comes from a willingness to work alongside other skill sets/disciplines, part of which comes from being open-minded about what those different approaches can bring to a project. That comes from encouraging folks to think outside of their field.
- Impacts and outcomes – absolutely! Otherwise we are delivering research that serves the needs of only part of Aotearoa New Zealand.

Respondent 110: Yes, for all aspects. It is appropriate to address commitments under Te Tiriti o Waitangi, and because current capacity appears to be inadequate to meet demand. Funding agencies are also rewarding such integration in their decision-making. For national outcome, partnering could also be considered with Māori researchers in collaborating CRIs in addition to MWLR, if capacity is available there and inter-CRI competition can be overcome.

A new initiative developed at a recent workshop on Emerging Opportunities, involving SYS team members, is to establish a MWLR interdisciplinary discussion forum. This is being led by a cross-team steering group and will promote pan-MWLR video discussions of selected broad research areas, e.g. the beech forest ecosystem. Māori research expertise will be an essential component of any such forum, likely to be kicked off later in May.

Appendix 3.6. What's required to increase Māori research, Māori research excellence, and Māori research capacity in/across Manaaki Whenua?

Respondent 101: More Māori staff and a pakeha staff confident to manage their own interactions/hui/"research with/for Māori". Kaupapa Māori research should be done by Māori staff. We probably need to look to the funding model – should we be more strategic about landing bigger pieces of work – should these be central-Government funded or not? I do think learning from our experts on how to walk in both worlds has promise, but what would I know?

Respondent 102: This is as much an external issue as it is an internal, building trust and confidence in new approaches where the tendency is solution first, methodology later is difficult. Increasing internal capacity may provide the ability to work with more Māori but still may not provide better solution for Aotearoa New Zealand where the view may be for a more "usual" approach.

Internally a greater understanding of the value of other knowledge systems in providing an integrative approach or preferred approach is needed. The current understanding lends more to enclosing Māori research into a classical science approach rather than the recognition of a bona fide solution.

Shifting any system takes time and commitment and is a journey especially when the benefits are not readily identifiable. Ensuring the right approach at the onset is crucial rather than everything having a necessary inclusion.

Respondent 103: We need a steady pipeline of talent with the right skills and interests to be able to work as described above, coupled with revenue streams which will allow it to happen. The latter will become easier the more successful we are seen to be in working in this way.

Respondent 104: There are a few things:

- Desire of Māori researchers to publish in the academic literature...and do it. It is very mixed in this organisation with some Māori researchers being incredibly active publishers, but most are not.
- Māori researchers being part of projects and staying with that project. Everyone in projects need to recognise the budgetary constraints around a project and therefore scope the different elements more effectively.
- Create a work ethic that not everything that involves Māori needs a Māori researcher involved. I think increasingly non-Māori staff are not wanting to do this for fear of being criticised by their peers (which I often hear is from within MWLR). However, from my limited experience Māori stakeholders are more than willing to work with folks who are there to help support their aspirations for their rohe. Just like anything else it comes down to relationships.
- Build a community of trust within MWLR. I often feel that there is not much trust between non-Māori and Māori researchers and this can hinder fruitful relationships. This is a generalisation and a perception based on conversations I have been part of and what I have seen in some instances. Again, it is not universal.

Respondent 105: As I indicated earlier, I believe that the consolidation of the kairangahau has been a double edged sword – it has created a cohesive ‘team’ or community of practice for Māori focused work but it may have reduced its effectiveness in being able to be involved in a much wider range of projects. This may entirely be due to a lack of capacity and individuals spread to thinly or not. Obviously, if there was more capacity, and it was available, it would likely get used more. For many project leads, if they do not get what they need because of capacity constraints they look elsewhere or abandon that part of the project. Once they have had that experience a few times they don’t tend to come looking again for assistance/input for the next project (this happens across all discipline areas and is not just confined to Māori research). Project leads typically work with people they know, are comfortable with, know that the individual can deliver and so on. Again, it is generally only in the very large M\$, multi-year projects where the project teams can tend to involve a wider range of disciplines and thus individuals. So capacity, availability, willingness to be engaged in things outside a karangahau’s immediate area of expertise may all be factors that will contribute to whether Māori research and Māori research excellence can be increased.

Respondent 106: Wider breadth and depth in different domains e.g. we need data science driven people with domain expertise in CLR, but we struggle to find those people out of NZ universities. A closer partnership with the Universities would help us develop people with the right mix of skills we need for the breadth of science we do e.g. we could train and target development of people in the soil / remote sensing / data science domains. The challenge I’ve found from past experience is that requires a medium-term view (3-10 yrs) and our funding is predominantly on short-term cycles.

More support by having specific Māori research leads aligned to portfolios would make a big help – we have relied on Garth, but this has put really unfair workloads and pressure on him at multiple times.

Somehow we also need to have a clear plan for generating external revenue, as without solid funding from clients we will really struggle.

Respondent 107: I can’t reply to this at this stage, sorry.

Respondent 108: This question exemplifies the confusion that re-ins. What is Māori research and what is it in relationship to mātauranga Māori and Māori science? I don’t know!

Respondent 109:

- Easy one: more Māori scientists
- Harder question – where do we find them? Perhaps a scholarship in a relevant biological science discipline to support a PhD with a pathway to a post-doc or even a straight post-doc fellowship in a priority area (mine, of course 😊)
- Unless universities (and possibly some component of schools/communities) support young Māori to develop science careers, we will be complaining about the lack of good Māori scientists for years to come.
- I’ve focussed on scientists as opposed to social researchers as I think we’ve got a really good core team in that area already (you know who you are, so don’t blush!). we’re short in the bio-sciences though.

- The only negative I've noticed is a *perception* that Māori researchers are uncomfortable with facilitating research links between stakeholders and non- Māori scientists. I've been made aware of this from a number of sources so it's something we need to change. My perception (easy to say – I'm an introduced pest) is that Māori communities have been, without fail, interested to talk with and listen to a science perspective. We shouldn't pre-suppose that one set of research techniques is intrinsically better for a community's needs without allowing that community to have their say.

Respondent 110: Because our team does not have direct alignment with a Māori researcher, I suggest that consideration might be given to some formalisation of alignment to a team and/or portfolio. In this way, there could be greater awareness of current research and plans for new initiatives, enabling integration at an earlier stage of planning and involvement with one or more MWLR Māori staff members becoming the norm rather than the exception. To achieve this, however, I would anticipate that additional resourcing would be required, possibly involving an additional appointment(s).

Appendix 4 – Māori collaboration principles and guidelines for engagement.

Principle	Why does this matter	Putting this into practice	Principle applied? <input checked="" type="checkbox"/>
1 Kanohi ki te kanohi – face to face	<ul style="list-style-type: none"> • It is a cultural preference for Māori to meet face to face • This reflects the oral and often local tradition • Trust is built by personal contact 	<ul style="list-style-type: none"> • Meet in person, wherever possible. This does not mean you should never use the phone or email, but significant issues are best discussed face to face • Discuss and seek agreement on where to meet • Be prepared to go out to Māori communities – meet people on their own ground, place 	
2 Rangatira ki te rangatira – chief to chief	<ul style="list-style-type: none"> • Māori have confidence in the people they are dealing /collaborating/consulting with • People should have the mana (status) at the other side of the table at the beginning (this is largely to do with tikanga process) and starts with '<i>Chief to Chief</i>' and then progresses down to more junior staff or membership. 	<ul style="list-style-type: none"> • Involve the right people • Involve people at an equal level • Involve the decision-makers/those who can answer the questions then and there • Then progress to wider collaboration/engagement 	
3 Nā te kākano – from the seed	<ul style="list-style-type: none"> • This reflects the Māori life cycle: from seed to plant to flower • Early involvement shapes the final result • Māori have a different world view and different view of time, issues, and priorities. Your priority and timelines may not be the same as the Māori community's. • Your issue or research agenda may also be new to Māori, who need time to absorb the issue, seek knowledge, form their opinion, and identify and develop their position and response (e.g., water quality, NPS limits, resource allocation, genetic modification) 	<ul style="list-style-type: none"> • Involve Māori from the start • Be genuine, honest, and respectful • Be prepared for a slow process based on tikanga and consensus • Clarify the kaupapa and objectives from the start - what do you want to achieve? • Don't expect Māori to slot into your agenda or within limited time frames • Many Māori have jobs in addition to their community responsibilities • Māori representatives are likely to need time to consult with their communities too: many Māori organisations only meet once a month • Be guided by Memoranda of Understanding or other agreements, if these exist 	

Principle	Why does this matter	Putting this into practice	Principle applied? <input checked="" type="checkbox"/>
4 Kei moumou taima – open and meaningful	<ul style="list-style-type: none"> • This phrase literally means ‘waste of time’ • It’s important not to waste people’s time – Māori are seeking meaningful engagement and desired goals and outcomes from collaboration • What meaningful things will come out of the collaborative exercise? 	<ul style="list-style-type: none"> • Collaborate/consult with a clear purpose • Create a caring and trusting environment • Don’t use collaboration just to tell Māori what is happening – think about what you can get from their involvement and what its value could be • Don’t waste the Māori community’s time – explain why you are there and what collectively you hope to achieve (clarify the kaupapa). Sometimes Māori are not interested in collaborating with you. • Don’t have a predetermined outcome • Ask Māori if they wish to discuss a specific issue? rather than assuming or expecting they do 	
5 Ki tai wiwī, ki tai wāwā – flexible	<ul style="list-style-type: none"> • This phrase refers to moving from side to side to change direction in your waka when you become stuck or are heading the wrong way and need to change direction. You need to be open to different pathways or prepared to achieve different objectives on your way to the bigger objective or outcome. • The Māori community has its own processes and structures, which need to be taken into account. • They also have to juggle lots of issues and responsibilities. 	<ul style="list-style-type: none"> • During collaboration, be prepared to discuss several times, as many times as required, often at different levels • Allow for an organic or iterative process to emerge and proceed • There is a need for balance and a two-way relationship and trust to develop • Involve Māori and seek agreement on key topics/ discussion areas, decisions, etc. e.g. when, where, what, how, who’s involved etc. 	
6 Tikanga Māori – the correct Māori way of doing things	<ul style="list-style-type: none"> • Māori have their own protocols, customs and ways of doing things • Recognising these is a sign of respect towards and acknowledgement of the people you are meeting – they are willing to go with your process, and this is a two-way relationship 	<ul style="list-style-type: none"> • Recognise, respect, and use Māori protocols, customs, and ways of doing things (tikanga) • Use the language (terms) and te reo Māori in the right way • Respect and understand mātauranga Māori and other Te Ao Māori views • Within a collaborative environment sharing and co-learning is important • Tikanga or customary Māori hui/training sessions may be useful 	

Principle	Why does this matter	Putting this into practice	Principle applied? <input checked="" type="checkbox"/>
7 Ko te tūmanako – transparent	<ul style="list-style-type: none"> Literally means ‘good faith’, ‘good will’ or ‘good heart’, i.e. not hiding anything It is important for Māori to know who is involved They need to know they have been invited in good faith Also, if they are unable to attend an event, they will know who else can represent their views 	<ul style="list-style-type: none"> Be open and honest about: <ul style="list-style-type: none"> who’s been invited to participate, who the participants/audience are, and how they all fit in Explain at the start what the agenda, purpose, or kaupapa is? Determine early what the right or appropriate membership should be? Who should be at the table? Determine the right process to be used for the collaboration (e.g. number of hui,time-frame, speakers) how information will be used, and IP considered who’s leading discussions? making decisions, and what is their level of authority in the process Don’t have a hidden agenda – be upfront Explain your collaborative process well to others – include regard/recognition for mātauranga Māori? Te Ao Māori? How will you collaboratively achieve collective desired outcomes and decisions? 	
8 Mahia te whare – foster capacity	<ul style="list-style-type: none"> Literally ‘build the house’ Good consultation should help foster Māori capacity and capability, rather than building from scratch every time 	<ul style="list-style-type: none"> Ensure Māori have the capacity, resource, interest, and desire to participate You may not necessarily remunerate individuals, but it shouldn’t cost people anything to participate, so you should at least cover costs (e.g. venue, food, key individuals) and include a koha Most Māori organisations don’t have paid staff – and some don’t have any staff Budget/resourcing for Māori participation in the collaborative practice should be considered 	

Principle	Why does this matter	Putting this into practice	Principle applied? <input checked="" type="checkbox"/>
9 Whakatika te he – accountability	<ul style="list-style-type: none"> • Literally '<i>right the wrongs</i>', or '<i>find the right way through the confusion</i>' • Māori believe we should learn from the past and look to the future • This means not continuing past mistakes and injustices, taking responsibility for our actions, keeping our promises and listening to and valuing what Māori say 	<ul style="list-style-type: none"> • Whoever is leading the hui or kaupapa, be accountable and take responsibility • Feed-back what Māori have told you before (e.g. provide and be generous with previous collaboration hui results) • Feed-back what was decided and why? – close the loop and show what the outcome was • Do some research – you may be able to get a sense of Māori perspectives/views of an issue from Māori or other priorities they wish to discuss – be prepared to go off tangent sometimes 	<input checked="" type="checkbox"/>
10 Kia tika te reo – use appropriate language	<ul style="list-style-type: none"> • Use clear and appropriate communication and language to ensure Māori understand and can engage with the consultation issue and process 	<ul style="list-style-type: none"> • Be aware of language and terminology • Think about communication • Basic lessons/understanding of te reo Māori may be useful within collaborative environments • Learn Māori pronunciation • Change the language and terms you use depending on the situation and audience – make it easy and embracing to understand • Don't use terms of words people don't understand such as highly technical or too many science terms – try to retain a balance of terminology • Explain terminology and technical language in plain language • Try not to use unexplained acronyms 	<input type="checkbox"/>