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CAPTURING VALUE FROM SCIENCE

Exploring the Interface Between Science and Indigenous Knowledge

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ABSTRACT

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Indigenous knowledge cannot be verified by scientific criteria nor can science be adequately assessed according to the tenets of indigenous knowledge. Each is built on distinctive philosophies, methodologies and criteria. While there is considerable debate around their relative merits, contests about the validities of the two systems distract from explorations of the interface, and the subsequent opportunities for creating new knowledge that reflects the dual persuasions. An Interface Research Framework is described; it provides a basis for integrating the two persuasions at methodological, ethical and policy levels without compromising the integrity of either.

Exploring the Interface Between Science and Indigenous Knowledge

Mason Durie

Indigenous Peoples

AD 2004 represents an important milestone for indigenous peoples. It brings to a close the United Nations Decade of Indigenous Peoples 1995 – 2004 during which a Permanent Forum for Indigenous Issues was established at the United Nations and the Draft Declaration of the Rights of Indigenous Peoples was completed and referred to the UN for ratification.

There are significant differences in the circumstances of indigenous peoples in various parts of the world, manifest by varying degrees of dispossession, different health experiences[1] and diverse political relationships. However, there are also striking commonalities in experiences and world-views. These commonalities may be discussed according to a range of perspectives. For example five levels of argument that characterise indigenous peoples have been proposed, at least for legal purposes: human rights and non-discrimination, minority rights, self determination, historical sovereignty, indigenous rights.[2] Although consensus about universal human rights is sometimes seen as a rationale for regarding a 'rights-based' approach as the most important level, it has not been possible to prioritise them so that all five levels need to be considered.

For many first-nations peoples, a history of colonisation is regarded as the most significant experience that indigenous peoples share. Imperial might, whether emanating from Great Britain or America or France or Germany, arrogantly assumed a right, often on the basis of a claim to a higher order of civilisation, or simply on the authority of God, to dismiss, deconstruct, and subjugate the sovereign rights of native peoples. The results of colonisation were consistently cataclysmic. A common pattern emerged: loss of culture, loss of land, loss of voice, loss of population, loss of dignity, loss of health and loss of traditional methodologies. Centuries later, and for complex and varied reasons not unrelated to the earlier experiences, indigenous peoples were shown to endure high levels of socio-economic disadvantage compared to others in their countries.

In defining indigenous peoples in 1949, the United Nations General Assembly recapitulated several characteristics:

> 'Among the peoples of the earth, indigenous people constitute a vulnerable group which has long been neglected. Their social structures and lifestyles have suffered the repercussions of modern development. They have been subject to growing pressure to bring their languages, religions, knowledge, arts and oral traditions, and the other manifestations of their ways of life, into conformity with those of the majority social groups around them.'[3]

However, in 1949 the United Nation had misread indigenous aspirations. Although conforming to wider society was not irrelevant, the primary aim of indigenous peoples was to regain indigenous values and language and to exercise a degree of autonomy. Neither colonisation nor socio-economic disadvantage is considered to be the most defining element of indigeneity. Instead, most indigenous peoples believe that the fundamental starting point is a strong sense of unity with the environment.[4] This appears to be the most significant characteristic at least as defined by indigenous writers.[5, 6] 'People are the land and the land is the people.' 'We are the river, the river is us.'[7]

All indigenous peoples have a tradition of unity with the environment and the tradition is reflected in song, custom, subsistence, approaches to healing, birthing, and the rituals associated with death. The defining characteristic of indigenous peoples is therefore not necessarily premised on colonisation or sovereignty or a prior claim to settlement, but on a longstanding relationship with land, forests, waterways, oceans and the air.[8] In this sense, indigeneity can be conceptualised as a state of fusion between indigenous peoples and their accustomed environments and arising from that fusion a system of knowledge developed, along with clear understandings about territoriality, polities, and governance.

Indigenous Knowledge

The relationship between people and the environment therefore forms an important foundation for the organisation of indigenous knowledge, the categorisation of life

experiences, and the shaping of attitudes and patterns of thinking. Because human identity is regarded as an extension of the environment, there is an element of inseparability between people and the natural world. The individual is a part of all creation and the idea that the world or creation exists for the purpose of human domination and exploitation is absent from indigenous world-views.[9]

According to Vine Deloria, 'Most tribes were very reluctant to surrender their homelands to the whites because they knew that their ancestors were still spiritually alive on the land.'[10] His comments underline the link between the physical and social environments but also emphasise the significance of resources as collective and intergenerational, and the importance of land for health and wellbeing. Similarly the basis for knowledge creation is the dynamic relationships that arise from the interaction of people with the environment, generations with each other, and social and physical relationships. Relationships (whakapapa in Maori terms), form the substrate for indigenous knowledge[11] and the three most distinguishing features of indigenous knowledge are said to be that it is a product of a dynamic system, it is an integral part of the physical and social environment of communities, and it is a collective good.[12]

While it is often valued because of its traditional qualities, a creative and inventive capacity forms the core of an indigenous knowledge system. The perception of indigenous knowledge and culture as applicable only to the distant past misses the thrust for development that is part of the indigenous journey. Arising from the creative potential of indigenous knowledge is the prospect that it can be applied to modern times in parallel with other knowledge systems. The question arises, however, as to whether it can also be applied in association with other systems.

Indigenous Rights

Contemporary relevance of indigenous knowledge and culture is made explicit in the Draft Declaration on the Rights of Indigenous Peoples. The Declaration was presented to the United Nations for ratification in 1993,[13] though may never be formally endorsed. Opposition is expected from some states on the grounds that self determination (one of the 'rights') might be conceived as a right to secede, with the subsequent break up of a nation-state.[14] The Draft Declaration contains 45 articles covering cultural, spiritual,

economic, political and constitutional rights. It has major implications for the terms under which indigenous people will live within states and requires states to recognise indigeneity by reference to indigenous culture and knowledge, citizenship, the environment and indigenous autonomy. Article 14 for example focuses on the right to 'revitalise, use, develop and transmit to future generations' histories, language, philosophies and other intellectual pursuits. Article 15 spells out a right to access to all levels of education while in article 23 a right to development is noted. Article 24, contains a provision for a right to 'traditional medicines and health practices as well as protection of 'vital medicinal plants, animals and minerals.' Article 29 has particular implications for research and development. 'Indigenous peoples are entitled to the recognition of the full ownership, control and protection of their cultural and intellectual property. They have the right to special measures to control, develop and protect their sciences, technologies, and cultural manifestations, including human and other genetic resources, seeds, medicines, knowledge of the properties of fauna and flora, oral traditions, literatures, designs and visual performing arts.'

In effect the Declaration proposes that indigenous peoples should have access to the indigenous world with its values and resources, access to the wider society within which they live, access to a healthy environment, and a degree of autonomy over their own lives and properties. They look to the future as well as the past. and are as much about development as restoration.

Science and Indigenous Knowledge

Contests between indigenous peoples and states have been fought in a variety of sites, most obviously around territorial lands, waterways, and oceans. But increasingly the contests are shifting to intellectual and cultural sites and are about the terms under which indigenous knowledge can prevail in modern times for the benefit of indigenous peoples, if not all peoples. Much of the debate is between scientific research and indigenous knowledge and takes three distinct forms: opposition to the promotion of science as the only valid body of knowledge; the rejection of science in favour of indigenous knowledge; the misinterpretation of knowledge by the use of system-bound criteria.

Science has become a dominant global knowledge system and has often been accused of intolerance towards other persuasions. If a conclusion cannot be supported by empirical evidence, if practice is not evidence based, or if there is an inability to replicate results, then validity is in doubt. Method is all-important and objective measurement is the final arbiter. Systems of knowledge that do not subscribe to scientific principles are afforded lesser status and, if given any recognition at all, run the risk of being rationalised according to scientific principles.[15] While not totally discounted as extraneous, the non-science knowledge base may be scientifically unbundled and manipulated to coincide with science, even if it is thereby rendered meaningless because it is out of context with other components of the parent knowledge system.

Yet just as science has either ignored indigenous knowledge or reinterpreted it to fit in with scientific logic, indigenous people have in turn frequently dismissed science as a legitimate knowledge base because it seems incapable of explaining spiritual phenomena or even recognising the existence of nature as something more than a scientifically-observable construct.[16] Opposition to science and to scientific research is also linked to three other concerns. First the experience of some indigenous communities has been that scientific research has been used to characterise indigenous peoples in ways that reduce their standing in the eyes of other citizens, while second, not infrequently researchers have plundered indigenous knowledge, reconstructed its meaning and published findings as if they were their own. The third concern is linked especially to methodology. While analysis into smaller and smaller components is a standard scientific method, indigenous knowledge places greater emphasis on the construction of models where multiple strands can be accommodated to make up an interacting whole. Understanding comes not so much from an appreciation of component parts as from synthesis into a wider context.

Indigenous mistrust of science on the one hand and scientific disbelief in indigenous knowledge on the other, have in common a tendency to evaluate each other according to limited criteria. Yet despite the methodological gulf between the two, there is room for each system to find accommodation by the other without distorting the fundamental values and principles upon which each rests.[17] Science is one body of knowledge and indigenous knowledge is another. It is important that the tools of one are

not used to analyse and understand the foundations of another, or to conclude that a system of knowledge that cannot withstand scientific scrutiny, or alternately a body of knowledge that is incapable of locating people within the natural world, lacks credibility.[18]

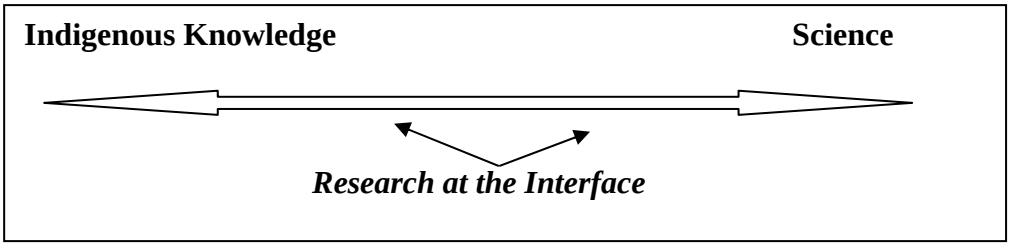
Exploring the Interface

Contests about the relative validity of science or indigenous knowledge are usually conducted on the assumption that one is inherently more relevant than the other. Seldom does such a polarised debate generate wisdom and less frequently does it lead to the generation of new knowledge or fresh insights. Instead positions become more entrenched as proponents defend their ideological positions.

In practice, however, it is not unusual for scientists or indigenous peoples to live comfortably with the contradictions of different bodies of knowledge. Many scientists subscribe to religious beliefs that cannot be explained by science, and many indigenous people use scientific principles and methods in everyday life while at the same time holding fast to indigenous values. Rather than contesting relative validities, there are an increasing number of indigenous researchers who use the interface between science and indigenous knowledge as a source of inventiveness. They have access to both systems and use the insights and methods of one to enhance the other. In this approach, the focus shifts from proving the superiority of one system over another to identifying opportunities for combining both.

In the New Zealand context, 'research at the interface' should be differentiated from mātauranga Māori research, i.e. research that is conducted entirely within the context of Māori knowledge and Māori methodological approaches. It also needs to be distinguished from scientific research that employs only those approaches consistent with empirical scientific principles. Interface research attempts to utilise two sets of values and methods not simply to bridge the benefits that might arise from each, but ultimately to produce gains for indigenous peoples most of whom live at the interface.

Figure 1 Research at the Interface



Research Outcomes

Essentially 'research at the interface' aims to utilise the energy that comes from two systems of understanding in order to create new knowledge that can then be used to further development. Development involves harnessing the new knowledge and may require different ways of conceptualising situations or even novel technologies that can transform research findings into practical applications. For all research, ultimately the outcomes of new knowledge are measured by gains in economic growth, environmental sustainability, social wellbeing, and cultural integrity. However, outcome measurements themselves are not always universal. While some indicators, such as life expectancy, can be applied with confidence to all populations, there are also specific outcomes (such as increased value of land) that can only be measured if Māori perspectives (such as land tenure, and the relationship of land to other resources) are afforded adequate recognition through specific indicators. Despite the difficulties in measuring outcomes, Māori specific outcome measures have been developed for health interventions[19] as well as wider developmental programmes that impact on the human domain and the resource domain.[20]

The link between research and measurable outcomes is not always apparent, partly because research may be only one factor that impacts on a particular outcome. However, a framework for assessing the contribution of research to Māori development, Te Ihu Waka has been developed. It contains four first-level principles (maximum benefit, empowerment, advancement, Māori integrity in a global society), thirteen second-level principles[21] and three research assessment platforms (process, outputs and outcomes). Although it has yet to be converted into a validated instrument, the

framework can be usefully applied within the research science and technology sector to policy-making, purchasing and provision of research.[22]

Principles

A number of principles underlie 'research at the interface' but based on the experience of Māori researchers, four have particular implications for both policy and practice.

Table 1 Principles

Mutual Respect	***Shared Benefits***	***Human Dignity***	***Discovery***
Recognition of the validity of each system of knowledge.	Indigenous communities share benefits of research including intellectual property and commercialisation	Cultural and spiritual beliefs and practices are reinforced by research. Indigenous world views are not compromised.	Innovation and exploration using indigenous methodologies and scientific methods.

The first, mutual respect has also been called 'mutual mana enhancement.[23] Essentially it is about researchers recognising the validity of both knowledge systems – indigenous knowledge and science – and accepting that each needs to be given its own space. Practitioners of one system are not necessarily equipped to interpret meanings that arise from the other but can agree to have a collaborative relationship whereby each adds original and different dimensions in order to jointly create a new construct. Mutual respect extends to recognising different levels of expertise and alternate credentialing processes as well as different appreciations of evidence and information transfer.

A second principle, shared benefits, reverses outmoded assumptions about research that often left indigenous peoples as passive respondents who derived little or no benefit from the research.[24] Regarding indigenous peoples as active participants in the research process, however, requires that short and long term benefits for their communities, arising from research are given explicit consideration. A major loss of confidence in science occurred when the benefits of research were not clear, except to the

researcher, and indigenous communities felt both exploited and devalued in a process that disregarded their own views and their own autonomy. A share in the benefits of research also has implications for the assignment of intellectual property and commercialisation of research findings.

Human dignity, 'aroha ki te tangata'[25] is an important principle for all research. While it is often discussed in connection with research participants, it can also be applied to relationships within and between research teams. Personal integrity, cultural identity and associated bodies of knowledge should not be devalued or lightly dismissed because they do not accord with the belief systems of some researchers.[26] The appropriation of personal markers such as DNA, spiritual beliefs and cultural institutions by patenting or simply in the name of research, has been a common experience in the past and continues to offend Māori sensibilities.[27] As a research principle, human dignity takes into account the world views of individuals and populations; it has ethical connotations and particular implications for the way projects are designed, implemented, and applied.

The principle of discovery, the fourth principle, emphasises both exploration and invention. Discovery of new knowledge is at the heart of all research. In 'research at the interface' however, discovery owes its innovation to insights drawn from two knowledge systems that have moved together in directions not possible by recourse to one system only. As well, in addition to the notion of breakthrough, discovery also carries the concept of future. Sometimes indigenous knowledge is regarded as unchanging and essentially relevant to the past. That view, however, is often a product of attempts to relegate first peoples to a pre-colonial era and overlooks the expansion of knowledge by indigenous peoples as they explored their environments, developed theories about social relationships and drew conclusions about the nature of the universe. No culture is static and indigenous knowledge systems, like science, carry a formula for exploring the future. Royal has described a research paradigm, Te Ao Marama, that employs a whakapapa methodology to develop new knowledge. Though based on Māori world views and not in his opinion readily transported out of a mātauranga Māori (Māori knowledge) context, it has potential for guiding the discovery of new knowledge and has application for understanding the nature and origin of phenomena, the connections and relationships between phenomena, and the trends that occur with phenomena.[28] Indigenous values and

world-views give some distinctiveness to the methodology but allow for innovation, discovery and findings that are relevant to contemporary and future times.

Research Parameters

Research at the interface has implications for methodologies, research ethics, and technology transfer. Cunningham has described four types of research, science and technology according to the methodological approach adopted and the ways in which they impact on Māori:

1 research not especially relevant to Māori (e.g. quantum chemistry);
2 research involving Māori (as participants or possibly junior members of a research team) (e.g. analysis of ethnic differentials in disease rates);
3 Māori centred research (Māori participants, largely Māori researchers, methods of analysis using mainstream standards for research);
4 kaupapa Māori research (Māori researchers and participants, analysis based on Māori knowledge systems).[29]

When these four types of research are seen along a continuum, interface research typically involves the second and third types. Although the incorporation of indigenous methods is variable, common to both types of research are active Māori participation, as researchers and respondents, and the use of mainstream as well as Māori tools for analysis.

However, rather than focussing on methodological processes some commentators have seen the politics of power as an important ingredient of Māori research.[30] In that perspective, the accountability of non-Māori researchers to a relevant Māori authority has been recommended as a transformative tool for reversing the usual power arrangements and for maximising the potential for new outcomes and new learning.[31]

Arising from controversy around genetic modification research an approach to research that shifts the focus of debate from a risk and harm paradigm to a 'paradigm of potential' has also been suggested. The essential question in the 'paradigm of potential' is not so much whether Māori values will be compromised by scientific research or whether scientific inquiry will be blocked by Māori opposition, but how Māori values and concepts can provide a basis for assessing the relevance and potential benefits of

research. Using key Māori concepts, a 'research potential framework', *Rangahau Painga,* was constructed around domains, values and research outcomes.[32]

A code of ethics has been suggested for researchers working at the interface in order to reduce opportunities for confusion about such issues as impartiality (a charge often made in connection with commissioned research), tribal intellectual property, the parameters of reasonable consultation, the reliability of given translations of Māori material.[33] It has also been recommended that, as an ethical requirement, researchers involved with Māori participants should be able to demonstrate sufficient background knowledge to undertake the task, have firm arrangements for guidance and support by cultural advisors, and be competent in the use of methods that are culturally congruent with Māori world-views.[34]

Capability

Indigenous researchers have a crucial role in straddling the divide between science and indigenous knowledge, acting as agents at the interface. Not only do they have access to indigenous populations, but they also have access to two systems of knowledge and subscribe to both. At the same time they face potential criticism from two fronts. Indigenous groups may feel that the indigenous component has simply been added on to standard scientific practice, without any fundamental shift in method. Researchers on the other hand may complain that unnecessary variables have been introduced which limit the scientific integrity of their studies. For their part Maori researchers have been encouraged by the possibilities that two world views, two bodies of knowledge, can be brought closer together. They have recognised that in developed countries, most indigenous peoples live at the interface i.e. they are informed by science and by indigenous knowledge. The challenge has been to afford each belief system its own integrity, while developing approaches that can incorporate aspects of both and lead to innovation, greater relevance, and additional opportunities for the creation of new knowledge.

Indigenous workforce development has been an important goal in New Zealand. Both the Health Research Council and the Foundation for Research Science and Technology as well as the Ministries of Health and of Science Research and Technology,

have devised various schemes to attract more Māori into science and research. While there is no guarantee that a Māori researcher will necessarily be wise in indigenous ways there is a greater likelihood of being part of indigenous networks and therefore able to both appreciate indigenous values and work comfortably with indigenous peoples as well as the scientific community.

Building capability, however, involves more than training individual researchers. Unless there is a critical mass of indigenous researchers in one team or one centre, it is unlikely that there will be a major commitment to the development of new methodologies, ethical processes, or interaction with indigenous communities. An important milestone for New Zealand research was the establishment of Ngā Pae o te Māramatanga, a centre for research excellence at the University of Auckland in 2002. The Centre provides a focus for interface research across a number of tertiary educational institutes and is encouraging universities to jointly aim for 500 new Māori Ph D graduates within five years. In addition to Ngā Pae o te Māramatanga there are several other Māori centres for research including Māori health research centres at the Universities of Auckland, Otago and Massey, and an Academy for Māori Research and Scholarship (Te Mata o te Tau) as well as a centre for Māori business research (Te Au Rangahau), also at Massey University. A centre for research into custom law at the University of Waikato (Te Mātāhauariki) plays an important role in bridging the legal and philosophical differences between systems of law in New Zealand.

Policies and Strategies

In addressing the position of Māori within New Zealand, governments since 1975 have increasingly been conscious of obligations arising from the 1840 Treaty of Waitangi. Under the Treaty, the Crown acquired sovereignty over New Zealand in exchange for guarantees that existing property rights would be actively protected and Māori individuals would not be unfairly disadvantaged compared to other New Zealand citizens. While the English version of the Treaty, tends to equate property with physical properties such as land, the Māori version recognises also cultural properties such as language. The Crown's response to the Treaty has not always been consistent and has fluctuated focussing sometimes on equality as between individuals and sometimes on the

recognition of Māori property rights. In the first approach, full Māori participation in society has been recognised as a key principle of the Treaty of Waitangi,[35] and in order to increase Māori participation in sectors such as RS & T where there is under-representation, a range of affirmative action programmes have been instituted for Māori individuals undertaking tertiary education and preparing for higher academic qualifications. While the policy can be seen as part of an equal opportunity agenda and in that sense is not confined to Māori, the Treaty undertaking adds a further dimension that does not apply to other groups.

In the second approach, because intellectual knowledge can be regarded as a property, the Crown has sensed some obligation to actively protect Māori custom and methodologies. That has led to an acceptance that Māori world-views have a legitimate place within the wider knowledge society and ought to be factored in to RS&T strategies. As a result, in 2003 the Ministry of Research Science and Technology initiated a project 'Supporting Māori Innovation and Research', which seeks to construct a creative Vote level policy framework for Māori involvement in the spectrum of activities conducted throughout Vote Research, Science and Technology (Vote RS&T).[36] The overall goal is to significantly increase and expand Māori participation and involvement in innovation and research generally by having more Māori involvement in science, advancing mātauranga Māori (and particularly its potential contribution to the sciences and innovation), growing the capacity and capability of Māori organisations and communities to conduct research and fostering coordination and synergy, both within the Māori research 'scene' and together with New Zealand's RS&T infrastructure.

The project expects to develop a clearer understanding of the types of Māori relevant research to be supported by Vote RS&T, a range of perspectives about Māori research and research relevant to Māori and greater coordination between research conducted by Māori, research of relevance to Māori, and research conducted elsewhere in the Vote.

Research at the interface reflects both approaches. There has been a deliberate government strategy to attract more Māori into science and research and there have also been opportunities for funding research involving Māori methods. Māori advancement and Māori development have sometimes been used as terms that draw a distinction between policies of inequality (disparities) and policies of affirmation (positive

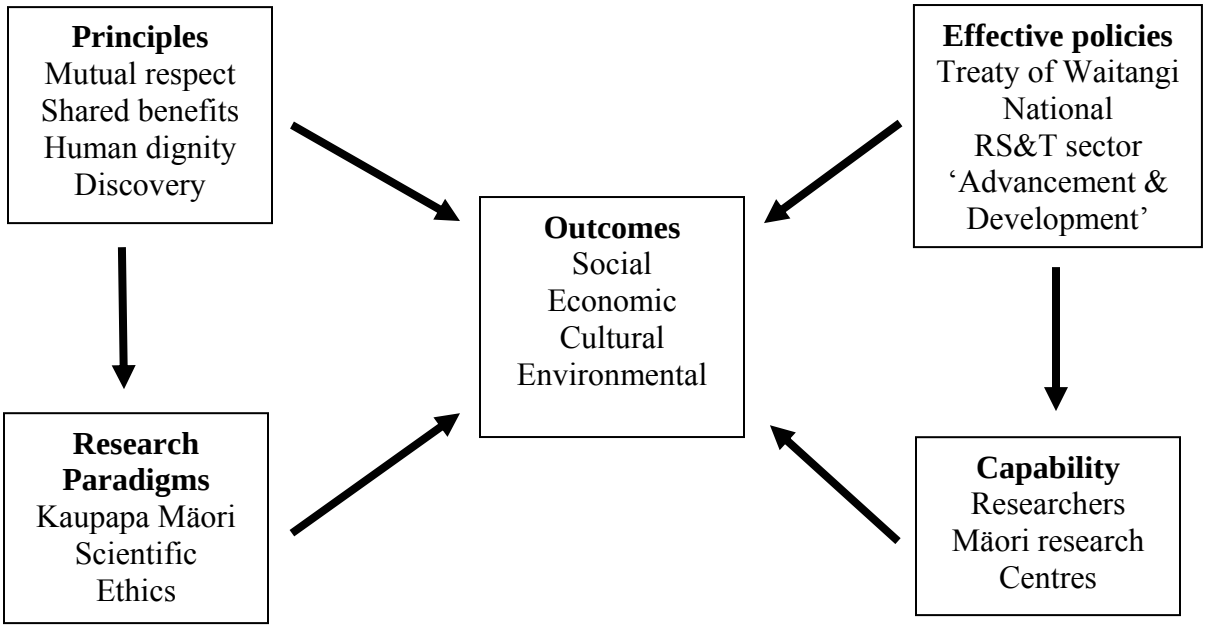
development). Advancement is about reducing inequalities between Māori and other New Zealanders while development is about the retention and development of a Māori identity and a Māori world-view. While both approaches can be justified under the Treaty of Waitangi, the active recruitment of Māori into science and technology is more closely aligned to equal opportunity arguments and in that respect is also relevant to other groups who are under-represented. The protection and development of Māori knowledge, however, is specific to Māori and arises more clearly from a Treaty undertaking to actively protect Māori property.

In a paper prepared for the Ministry of Research Science and Technology, Cunningham had recommended six key principles to guide the purchasing of research. A population approach (as distinct from a focus on Māori individuals) was necessary if the broad range of Māori circumstances were to be recognised; the dual gaols (of advancement and development) were both central to an RS&T strategy for Māori; research priorities ought to reflect Māori aspirations; research agencies need to have sufficient capacity to undertake a strategic Māori analysis; equivalent purchasing pathways; and improved information on Māori research.[37] The twin goals of Māori development and Māori advancement are now integral to the government's research strategy and form the basis of a Māori Knowledge and Development Research output class (MKDOC) with a specific portion of funds within Vote Research, Science and Technology (Vote RS&T). It provides funding to develop Māori research capability, evolve Māori knowledge and develop knowledge for the benefit of Māori. One portion of the fund is administered by FRST only and another by HRC only and there is also a joint fund which is administered by both the HRC and FRST jointly. The current value of the Māori Knowledge and Development Research output class is $5.5m for the 2003/2004 financial year.

A Framework for Considering 'Interface Research' and Implications for the RS&T Sector

A five part framework made up of outcomes, principles, research paradigms, capability, and effective policies, can provide a useful way of conceptualising the relationships between indigeneity, research, science and technology. The central component of the

framework is the outcome dimension; research should add to knowledge that will contribute to Māori economic, social, and cultural advancement and environmental sustainability and should be measured in ways that are consistent with Māori world-views. Four particular principles have been noted: mutual respect, shared benefits, human dignity and discovery. They acknowledge different perspectives, common aims, regard for people involved in research, and a future orientation. Research paradigms that encourage and enable interface research require balance between indigenous methodologies and conventional scientific approaches to research. While the paradigms themselves may be premised on different foundations, they can lead to more comprehensive discoveries than reliance on a single paradigm might produce. Capability has two levels of implication: a critical mass of Māori scientists and the development of research centres where the dual goals of advancement and development might be pursued. Finally, not only should the goals and policies of the RS&T sector be able to respond to Māori research needs, but they must be able to address the two broad issues of workforce disparities as well as positive Māori development.



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[21] Collective Mäori good, common Mäori good, mutual benefit, control, changes in power relationships, capacity building, knowledge generation, synergy, adaptation, value-added resources, global alliances, identity, diversity.

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