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# Dancing at the Interfaces: Ways of Doing

## **The Interfaces between Indigenous Knowledges and Western Science**

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# Abstract

An opportunity exists for Māori to lead the development of a new way of knowledge production in Aotearoa New Zealand that acknowledges and capitalises on the rich traditions of both mātauranga māori and western science. Research at the mātauranga māori and western science interface has the potential to contribute to the preservation and evolution of mātauranga māori and for the creation of new knowledge of benefit to Aotearoa New Zealand society.

Dancing at the interfaces is the title for this thesis. The title encapsulated how I see the interactions and relations between mātauranga māori and western science. A primary focus of this thesis is the interfaces between branches of knowledge mainly indigenous knowledges, for example mātauranga māori, and western science. The research begins by exploring the national and international literature for harms done to indigenous knowledges and mātauranga māori since colonisation. A profile of harms was compiled from this literature and based on interviews with four Māori scientists regarding their own impressions and experiences of the interfaces. From this data five themes at the interfaces emerged: activity, passion, challenge, uncertainty and deficit. These themes are used to describe characteristics of the interfaces and develop recommendations for developing a new way of knowledge production at the interfaces. The research concluded that there are several issues and three key elements that must be addressed at the interfaces to facilitate the collaboration of mātauranga māori and western science as a transformative force for Māori development. The key elements were: ways of doing literacy; rangatiratanga and leadership; and innovation and productivity.

# Acknowledgements

*He mihi aroha tēnei ki a koutou i tautoko ai ki ahau ia rā, ia rā, ia rā ka whakaoti tēnei tuhituhinga. Ka tae mai te wā whakamutunga mō tēnei mahi ēngari kei te mōhio ahau, kei te mōhio koutou hoki, ko tēnei te timatanga kē mō ētahi atu mahi nunui hei tautoko te haerenga a Ngai Tātou te iwi Māori ki te ao mārama, tērā wāhi tika mā tātou e tū kahikatea.*

*Tēnā koutou, tēnā koutou, tēnā anō tātou*

The most important people to me in the world at the moment include my wife Elaine, my mother, Gloria and my extended whānau who must have thought I was never going to finish this thesis.

The interviewees who willingly contributed their time and whakaaro to enable me to complete this research, also contribute their efforts day in day out to support the development of new ways of doing at the interfaces with and between mātauranga māori and western science. Only those of us who work in this field can fully understand the difficulties and pressures that are on Māori at the interfaces and I have nothing but respect for you.

My supervisor Margaret Forster has probably endured one of the most difficult Masters candidates she has encountered for quite a while. Yet she has stood by me and enabled me to venture off on several tangents while pulling back into line when required. There are also many others who have supported me, pushed me, nagged me, ordered me and provided me with motivation when I needed it.

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*Heoi anō, ki ngā tūpuna kua wehe atu kē kite pō, i whakatakoto ai koutou tērā huarahi māku e hikoi ki te ao māori, ki te pūtaiao hoki. Ahakoa kei te taumaha ngā mahi mō ētahi o ngā wā, nā koutou au i homai te kaha me te matau ka haere tonu ki runga i tēnei ara tika.*

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# 1.0 Introduction: Dancing at the Interfaces

This thesis explores the interface between indigenous knowledges, for example mātauranga māori<sup>1</sup>, and western science. I have chosen to call this thesis *Dancing at the Interfaces* as this phrase encapsulates how I picture events at the interface. There are multiple events and exchanges occurring at the interface just as there are multiple styles of dance – some popular and others not. Dancing is also a collaborative activity. As a scientist and a person of Māori descent I am extremely interested in the benefits for Aotearoa New Zealand (Aotearoa NZ) that can emerge from collaboration between mātauranga māori, and western science. This is a prime motivation behind undertaking this research project.

## Hypothesis and Aims

This thesis explores the relationship between indigenous knowledges and western science. Issues of validity and authority of different knowledge systems are a key focus. A second focus is the implications of issues of validity and authority for collaboration at the interface.

The intent of this research is to consider strategies that promote the sincere integration of mātauranga māori principles, values and ways of doing into the practice of knowledge production in Aotearoa NZ to identify opportunities for the transformation of Aotearoa NZ communities through research, science and technology (RS&T). Furthermore since the research draws on the experiences of scientists of Māori descent at the workplace, this research provides an opportunity to explore some of the challenges and possible responses for blending

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<sup>1</sup> I am using the word māori in this case to qualify something, for example knowledge, as native. The word is only capitalised in this thesis when it is used to refer to people, for example in the terms Māori individuals, Māori communities or Māori society.

mātauranga māori and western science in a manner consistent with a Māori worldview.

## **Indigenous Knowledges**

Some definitions of indigenous knowledge and western science are necessary in order to understand and locate the interfaces between these two systems of knowledge. Indigenous knowledge is interpreted in this thesis as technological know-how while western science is interpreted as a combination of techne – western technology or a western way of doing – and episteme, a theory of knowledge. Technology can be defined as the application of knowledge. While there is little distinction made between knowledge and its application from a mātauranga māori perspective, western science makes a sharp distinction between the two. The concept of ways of doing upholds this interpretation and enables us to treat the interfaces between mātauranga māori and western science as spaces between two comparable systems of knowledge. This phrase – ways of doing, has been adopted in this thesis as it is a closer fit (than the more common concept ways of knowing) for how I intend to discuss the interfaces between mātauranga māori and western science.

This thesis discusses knowledges as opposed to knowledge. Pluralising the word follows an established convention of referring to indigenous peoples or cultures in the plural rather than in the singular (Daes, 1995:10). This recognises the diversity of cultures, languages, knowledges and peoples throughout the world that can be described as indigenous while also recognising their shared histories. The subtle use of a plural also avoids approaching the subject of indigenous knowledges with any preconceived, harmful and essentialistic ideas of uniformity (Githaiga, 1998). Daes gave the following definition of indigenous cultural heritage which incorporated many different kinds of knowledges claimed by indigenous peoples:

*The heritage of indigenous peoples is comprised of all objects, sites and knowledge the nature and use of which has been transmitted from generation to generation, and which is regarded as pertaining to a particular people or its territory. The heritage of an indigenous peoples' also includes objects, knowledge and literary or artistic works... All movable cultural property as defined by the relevant conventions of UNESCO, all kinds of literary and artistic works such as music, dance, song, ceremonies, symbols and designs, narratives and poetry; all kinds of scientific, agricultural, technical and ecological knowledge, including cultigens, medicines and the rational use of sacred sites, sites of historical significance, and burials, and documentation of indigenous peoples' heritage on film, photographs, videotape, or audiotape. (Daes, 1995)*

Indigenous knowledges are often defined by some commentators according to what they cannot be which often amounts to a claim that indigenous knowledges cannot be scientific (Semali & Kincheloe, 1996:29). This assumption is more a statement of ideology than one about knowledge. Western science is allegedly free of such value statements while mātauranga māori has never claimed to be value-free. This ideology promotes the idea that knowledge is somehow owned and that western science has a monopoly over it. As a result western science and society also assume a monopoly over the cultural generation, transmission, protection and use of knowledge including mātauranga māori (Mead, A., 1997). Implicit in this assumption is the idea that western scientific knowledge is somehow superior to other ways of doing. Prakash refers to the efforts of feminists, ecologists and various post-colonialists who resile against this notion by distancing themselves and their activities even from the word or the phrase western science (Prakash, 1996:157-178; Henry & Pene, 2001:234-242).

Commentators who have been influenced chiefly by a western scientific background with limited knowledge or contact with mātauranga māori (like this author) consider that the future of knowledge if it is not western science must be

modern science (Prakash, 1996:157-178), as though changing the terminology also changes the ideology. The use of the qualifier modern speaks to the assumed post-colonial motives of modern science. It implies that in the future knowledge may remain rooted in western scientific tradition and continue to be controlled by western science advocates and adherents. Mātauranga māori and other ways of doing would remain on the margins of future knowledge. This scenario is promised by Cetto et.al. (2001) who claim that indigenous knowledge systems are on the verge of extinction. The difference in these visions is subtle, what these commentators refer to as modern science may turn out to be nothing more than western science MARK II, the leopard does not necessarily change its spots. If this is the case then Māori and other indigenous communities and their knowledges will continue to be harmed by ongoing marginalisation. Opportunities for transformation and development will be compromised and potentially lost for some Māori communities.

## **Reductionism**

When writing about knowledges it is often difficult to avoid using the term reductionism which over the years has become a loaded and often maligned descriptor of western science (Smith, 1999). Reductionism is not peculiar to western science despite this branch of knowledge having a well-known reductionist bent:

*Many scientific explanations are reductionist: that is, an explanation of the behaviour of a system is sought in terms of its components and the laws governing their behaviour. In a reductionist research strategy, systems are analysed into their components, their configurations, and their interactions in order to understand the system as a whole. (Hoyningen-Huene et.al., 1999)*

The term reductionism is in sharp contrast to the sometimes romantic ideal of the holistic, ecological or systems thinking embodied within mātauranga māori and other indigenous ways of doing (Ellen, 1986:8-12). One of the ways Māori and

other indigenous commentators employ to describe western science is often through reference to reductionism:

*Mechanist science is a reductionist ideology, in that natural objects have to 'fit' within the external world. They expressed concern this ideology would help cause the loss of belief systems and traditional knowledge of how to care for the ecosystems.*  
([http://www.rsnz.org/topics/boil/gene/submis/ngai\\_tahu.php](http://www.rsnz.org/topics/boil/gene/submis/ngai_tahu.php)).

This kind of approach to western science is itself reductionist and essential because it simplistically characterises western science according to a single feature. The danger of doing this is that potential participants including Māori can easily be dissuaded from studying, working or even discussing western science and its offerings by both a misinterpretation and sometimes over-zealous representation of the implications of the reductionist approach by western science to knowledge. In much the same way some Māori commentators suggest mātauranga māori is misinterpreted and harmed by non-Māori (Mutu, M., 1994; Durie, M., 1996). A constructive conversation demands a recognition of the harm these characterisations do to all ways of doing, and the ubiquitous opportunity and transformative potential bound up in them, as opposed to direct harm done to seemingly remote branches of knowledge such as mātauranga māori or western science.

Smith is well known for her comments regarding the colonial history of research on Māori, "*The word itself... conjures up bad memories,... raises a smile that is both knowing and distrustful*" (Smith, 1999). Akabogu said that, "*It has never made sense to throw the baby out with the bathwater, and it cannot start now*" (Akabogu, 2002). This thesis acknowledges the potential downsides for Māori society of integration at the interfaces though also acknowledges the contingency of keeping reductionism in the methodological toolbox, "*... confrontation with difference out of necessity demands some degree of epistemological*

*contingency*" (Semali & Kincheloe, 1999:17). For mātauranga māori to ignore reductionism would be to throw it out with the bathwater.

## **Essentialism**

Semali and Kincheloe (1999:16-17) discuss the essentialistic tendency of indigenous as well as non-indigenous peoples to cluster indigenous cultures according to a single stereotype. This practice reduces indigenous peoples, cultures and knowledges to a single essence and minimises the contribution of a range of other factors to these fundamental tenets, for example the contribution of extramural socio-cultural influences. Essentialism also minimises the validity of indigenous ways of doing by promoting the assumption that western rationality is the only legitimate epistemology, denying everyday indigenous realities and marginalising indigenous peoples, cultures and knowledges. Apfell-Marglin says that western science has been considered for centuries to be "... *the privileged mode of thought for attaining certain knowledge*" (Apfell-Marglin, 1996a:145; Harker, 1993):

*there is no problem examining indigenous peoples or knowledge as a discrete category (but) we must always be careful to avoid racial or ethnic designations that fail to discern the differences between people included in a specific category.* (Semali & Kincheloe, 1999:22)

Essentialism may also be perpetuated by indigenous peoples on their own cultures. Alvares (1992:1-32) and Apfell-Marglin criticise the tendency of newly emancipated indigenous leaders to make the same mistakes as their former colonial overlords, "*Political decolonisation has changed the ethnic composition of the teams but not the game itself*" (Apfell-Marglin, 1996b:11). A domestic example is the implicit assumption by some New Zealanders that Māori culture is better than others including western culture/s and other cultures should emulate or at least measure themselves against it.

This approach is particularly harmful when Māori and other indigenous peoples are engaged in cross-indigenous dialogues. Recent fervour, described almost ubiquitously as a Māori renaissance (Walker, 1990:255), has seen some iwi preferring to define their own cultures within the wider context of Māoridom and by doing so distinguish themselves, their deeds, ancestry and culture and even their knowledge from the rest of Māori society. As if to underline tribal nationalism the word Māoritanga to describe Māori culture has gone out of vogue in recent times, perhaps a non-conscious response to internal or tribal essentialism by Māori (Henare, 1998). Māori still seek and focus on similarities that draw distinct Māori peoples and communities together, celebrating their differences though almost always in a context of familiarity that is often emphasised by whakapapa.

While the title of this thesis encapsulates indigenous knowledges the focus is on interfaces between mātauranga māori and western science. The discussion has been informed by reading about the experiences at the interfaces of other indigenous peoples including African (Emeagwali, 1999; Akabogu, 2002; Hoppers, 2002; Emeagwali, 2003), Native American Indian (Harry, 1995; Harry et.al., 1998; Harry, 2001) and Aboriginal Australian (Michie, 1998). Sources also include a mix of well known polemicists and pro-indigenous knowledge advocates (Harry, 1995; Mead, A., 1997; Harry et.al., 1998; Hutchings et.al., 1998). Some commentators may refer to a number of these sources as anti-science, though as alternative as these viewpoints may be it would be wrong for them to be silenced in this thesis. These sources are cited to expose an alternative viewpoint to authors such as Salmond (1982), Verran & Turnbull (1995), Roberts (1997), Roberts & Wills (1998), Verran (2001) and Nabobo-Baba (2006).

This background reading has been complemented by speaking to a subset of the few Māori scientists at work at the bench-face of science in Aotearoa NZ (Chapter 6). This thesis explores how mātauranga māori can become a more significant feature of the Aotearoa NZ knowledge-scape so that Māori

communities can assert greater control over what happens to their knowledges - an expression of rangatiratanga. If mātauranga māori perspectives and ways of doing are to continue to gain credibility in contemporary Aotearoa NZ society, then the Aotearoa NZ knowledge-scape must be developed with an eye to the international community including indigenous and non-indigenous knowledge systems and players. This thesis proposes that for this purpose and the emancipation of knowledge it is critical that mātauranga māori be allowed to make its mark on how not just science but knowledge is defined and generated in Aotearoa NZ.

### **Branches of Knowledge**

The Oxford English Dictionary defines science as a branch of knowledge, suggesting that there is more than one 'science' out there (Thompson, 1996:814). Out there are other branches of knowledge that have historically been overlooked not only by the practitioners of western science (Jackson, 2001) but also by philosophers, anthropologists, ethnographers and other communities of like-minded individuals<sup>2</sup> (Harker, 1993; Apfell-Marglin, 1996:2-3). This points toward the failure of western science gatekeepers to acknowledge the existence of alternative ways of doing. Semali and Kincheloe (1999:17) refer to this failure as a lack of epistemological contingency<sup>3</sup>. It is a sin of omission, a failure to plan ahead and consider the advantages of difference that an alternative way of doing

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<sup>2</sup> The notion of a community of like-minded individuals transcends any individual culture. While individuals with science and rationality at the heart of their discourse are those alluded to in this phrase as it is used by Harker, tohunga and other Māori experts can also be considered a community of like-minded individuals with knowledge or mātauranga māori at the heart of their wānanga.

<sup>3</sup> As knowledge becomes more commoditised under the doctrine of eminent domain (Mead, A., 1997; Shiva, 2002) knowledge systems begin to lack epistemological contingency. Colonisation and the domination of western science are negative stressors on the ability of indigenous peoples to make contingencies for the recovery, maintenance, transfer and development of indigenous knowledges. Indigenous peoples may be left with no choice but to supersede their cultural heritage in favour of the dominant paradigm, western science. To an extent this is already occurring in Aotearoa NZ, Māori students are trained about knowledge in a foreign paradigm (western science) devoid of a context (for example mātauranga māori). Young Māori grow up as we would like them to with knowledge though having learnt and conceived of that knowledge in a foreign paradigm without the benefits of other, broader perspectives. This undisputed benefit to Māori, being able to receive the wisdom of western science, may therefore also do considerable harm to mātauranga māori.

can bring. It would be essential if we were to consider the interfaces between mātauranga māori and western science as a simple septum between two supposedly discrete branches of knowledge.

I intend to treat western science as something other than knowledge notwithstanding its worth as a vital source of innovation and creativity helpful for assisting peoples to interpret and understand the world. Chambers (2000:221) says that all cultures have developed their own means for understanding the world they live in. Indigenous peoples have developed their own ways of doing that prior to colonisation and assimilation enabled them to effectively participate in and understand their world (Sahtouris, 1992; Salat, 1998):

*The lessons they have learned through millenia of accumulated experience and survival are invaluable to a modern world in much need of rediscovering its ecological and humanistic roots. (Warren, 1992).*

Western society is also such a culture, though as with indigenous peoples the label western society describes not a single culture but a homogenising phenomenon that reaches across cultures (Harker, 1993). It is one of the commonalities that bind western society together.

## **Multiple Interfaces**

An interface can be described as a surface that forms a division or boundary between two parts and this is how it has historically been treated (Summers & Holmes, 2006:625) in the science sector. In electronics or computer science an interface is regarded as the meeting point that enables inter-operability between a computer and something outside of it. Physical scientists such as chemists also define an interface as the common boundary between two substances, for example water and oil. Neither of these definitions acknowledges the inherent permeability of some interfaces nor do they deny it. More recently amateur and professional philosophers, scientists and indigenous peoples among them have begun to consider the interfaces as spaces (Edwards, 2003). For indigenous

peoples these spaces are analogous to their historical sanctuary on the margin and here options present themselves for development and transformation (Semali & Kincheloe, 1999:15). It is a fallacy to assume that the answer to issues at the margin and supposedly on the fringe of society, for example poverty (Nature Materials, 2005), are solvable through the exclusive application of western science (Apfell-Marglin, 1996; Cetto et.al., 2000).

The interfaces with and between mātauranga māori and western science are complex. They incorporate layers of interaction and sometimes divergent values between two apparently dissimilar systems of knowledge and between Māori and scientific communities; Māori and scientific peoples,<sup>4</sup> and Māori and non-Māori, non-scientific peoples. There is a further interface between those Māori who do interact at the interfaces and those Māori who do not. This interface can be a source of tension, challenging peoples who would otherwise share the same values and sets of beliefs.

To discuss a simple interface between mātauranga māori and western science neglects to acknowledge the everyday realities of a diverse group of peoples. For example: the person at the lab-bench (who is western science literate); the active consumer (who may have some western science literacy), and the passive consumer (who may have little western science literacy and is indifferent about western science's influence on his or her life). In the 21<sup>st</sup> century it is comforting to know that Māori are represented in all groups, as opposed to only one or two, even if they are somewhat unevenly distributed.

Hoyningen-Huene et.al. (2001) claim that a key feature of western science is its universality. The existence and corresponding characteristics of the above groups and their marginalisation tends against this description of western science as universal. A further group are those who are highly suspicious of western science, whether they have experience of it or not, under the illusion that they

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<sup>4</sup> individuals who could be Māori or non-Māori (indigenous or non-indigenous).

can simply deny its utility in their everyday lives. Therefore, the interfaces can be regarded as a collection of frontiers and hence the phraseology of the title – Dancing at the Interfaces: Ways of Doing - the interfaces between mātauranga māori and western science.

## **Ways of Doing**

The concept of ways of doing enables people to view knowledge as ever present and available at the interfaces. A way of doing is something that some peoples have access to and others do not, often as a result of mitigating circumstances including: historical (e.g. colonisation), cultural, social (e.g. protectionism), economic (e.g. resource availability) (Chambers, 2000) and even intellectual factors (e.g. education). Some commentators argue that it is simply not good enough for western science to include only some mātauranga māori perspectives in its methods (or vice-versa) (Jane Davis, 2000; Murray Parsons, 2000). For the interfaces to be capitalised on effectively for development purposes all individuals and communities must participate as much as possible.

Ways of Doing is a relatively unconventional conception of the knowledges of a diverse group of indigenous and non-indigenous (including western) societies. A different and popular conception refers to ways of knowing (Bishop, 1998; Tapine, 2000; Harris, 2007; Jacobs, 2008) which is similar though perhaps less suitable as a way to conceive of a diversity of indigenous knowledges. The term is used to reflect the physical doing and experiencing of knowledge by indigenous peoples according to what is known, as well as the intellectual, spiritual, physical and emotional features of knowledge. For the purposes of this thesis ways of doing was settled on because it is more appropriate to express the physical and hands-on techniques that are critical to the survival of indigenous ways of doing and to underline the polarity between episteme and techne (Alvares, 1980; Apfell-Marglin, 1996). Githaiga (1998) described two methodologies employed in most indigenous ways of doing that reflect this characteristic: generational repetition and functional adaptation. Functional

adaptation alludes to the activity of manipulating knowledge to fit. Generational repetition acknowledges the antiquity of indigenous knowledges as 'ngā taonga tuku iho nō ngā tupuna', and the notion of intergenerational transfer of indigenous ways of doing as an effective mechanism for its long term transmission and survival.

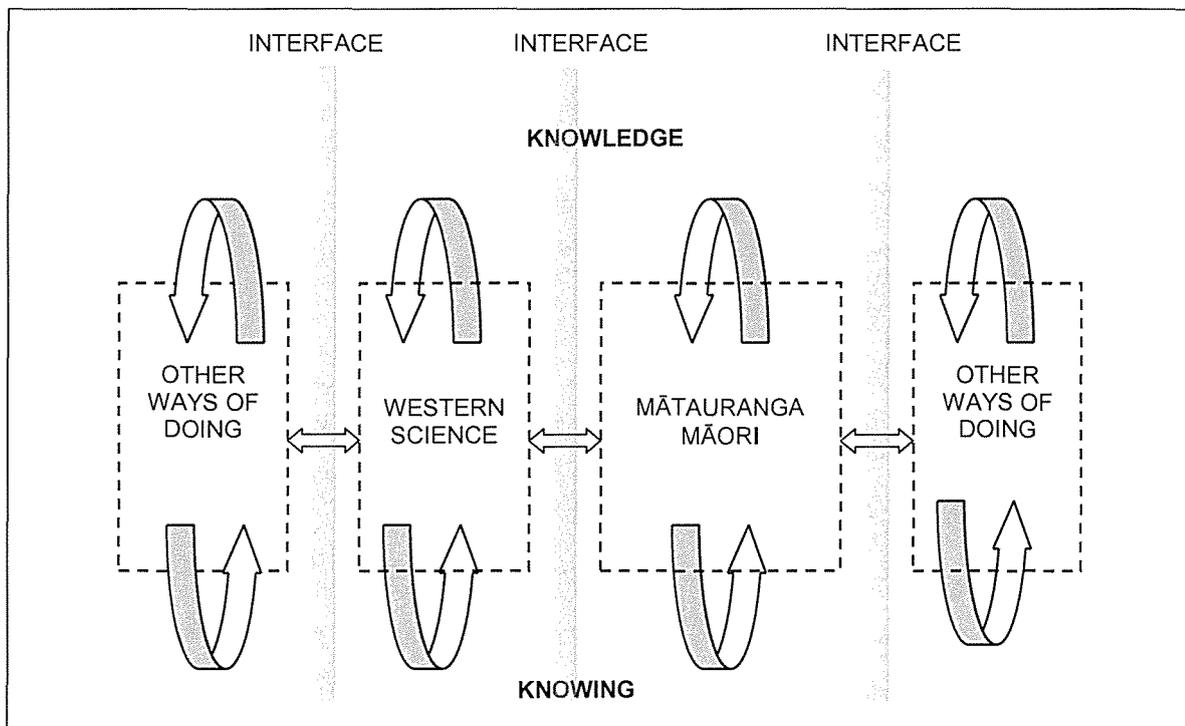
These mechanisms suggest indigenous knowledges are not the inflexible and unyielding structures that western science for example may be perceived to be. Often the scientific fraternity will survey sectors of society to gain an independent evaluation of their own scientific activities and the social palatability of their rational approach to knowledge (Allen et.al., 2001; Meylan, 2002; Hipkins et.al., 2002; May, 2002). This rigid characteristic of western scientific knowledge is one of the features that challenges western science as it seeks to become more relevant to society in the 21<sup>st</sup> century (Hoyningen-Huene et.al., 2001), incidentally it is also often cited as a source of discomfort when non-scientists are asked for their views on western science.

### **Flow of Knowledge**

The universe was once conceived of as ether (Lloyd, 1925; Swenson, 1972)<sup>5</sup> with planets, satellites and stars occupying discrete orbits around the earth, at the time the centre of the universe (Asimov, 1971). If we conceptualise knowledge similarly as an ether-like network then different ways of doing (e.g. mātauranga māori and western science) can be designated as nodes – discrete though interconnected in the ether. These nodal interconnections are vital to sustain the flow of information or knowledge. This conception is consistent with the view of science as a branch of knowledge. Indigenous knowledges can also be considered in this model as branches of knowledge. By treating mātauranga māori and western science as ways of doing this thesis seeks to give them their own mana (Durie, 2005).

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<sup>5</sup> This idea has not been completely discredited (Merali, 2006).



**Figure 1.** Ways of doing at the interfaces between mātauranga māori, western science and other ways of doing. Neither mātauranga māori nor western science is the sole appropriate way of doing at the interfaces.

In the above analogy ways of doing are represented as nodes, without which access to knowledges by all peoples, and the vibrancy of the interfaces would be compromised. Epistemological contingency has been discussed briefly above (Semali and Kincheloe, 1999:17) as a means to support the explanations of one way of doing with those of another. Suzuki also discussed the difficulties of removing knowledge from its context and its resulting apparent irrelevance to the people:

*Modern science ... contributes to fragmentation by the very methodology of focusing on a part of nature, isolating it, controlling all outside forces, and measuring the result. In the process, we acquire powerful insights into the properties of that fragment, but it is gained at the expense of the rhythms, cycles, and patterns that are crucial to our understanding of it.* (Suzuki, 2003)

The strength of mātauranga māori may be in being able to sustain the relationships (flow) between branches of knowledge, the networks that allow innovation to occur. Māori were found in 2003 to be the third most entrepreneurial people in the world (Howard, 2006) and this characteristic may be a reflection of how well this network is nurtured (ka hao te rangatahi) by Māori. Without denying the scientific-ness of mātauranga māori it is difficult to define it as reductively and as unambiguously as science without acknowledging the other rich branches of knowledge that contribute to it via these interconnections or nodes. Learned commentators have also been at pains to point out that mātauranga māori and western science are two different perspectives (Warren, 1992; Parsons, 1995; Durie, 2004) or ways of doing of many:

*If science is the study of the world around us using a hypo-thetico deductive process (the scientific method) then this is not exclusive to western or European derived cultural traditions but is also found in the cultures of all indigenous peoples. (Parsons, 1995)*

By treating western science, mātauranga māori and other indigenous knowledges as ways of doing we concur with their use by Māori and others to manipulate or 'do' knowledge. This approach to analyses of indigenous knowledges has been referred to by Emeagwali (2003) as methodological pluralism. In terms of Māori development it is useful to think of mātauranga māori in this way because it embraces opportunities for knowledge generation, development and transmission. The Māori way of doing – mātauranga māori – remains distinctively Māori and ownership or control of knowledge becomes non-exclusive. Hoyningen-Huene et.al.'s claim on behalf of western science to its alleged universality begins to sound more accurate (Cetto et.al., 2000).

In this framework ways of doing are survival necessities (Henry & Pene, 2001) for every culture and it is therefore important that indigenous and non-indigenous peoples capitalise on their ways of doing as resourcefully and effectively as

possible. Indigenous peoples have been in survival mode for millennia in the face of seemingly insurmountable odds (Warren, 1992) while western science as a way of doing has only been in service for about 4-500 years.<sup>6</sup> The way of doing of western science has been to historically convince the world of its universality and the applicability of its methods to every possible situation (Apfell-Marglin, 1996). This tactic is incompatible with indigenous cultures, indeed with any culture because it assumes a certain homogeneity that is false and perpetuates harmful outcomes for indigenous peoples:

*The perception of indigenous knowledge and culture as applicable only to the distant past misses the thrust for development that is a 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. (Durie, 2004)*

Chapter 2 focuses on harms at the interfaces with and between mātauranga māori and western science. Harms is a unifying factor that reaches across indigenous peoples and knowledges around the world. Chapter 2 proposes a move towards a more inclusive way of doing that incorporates aspects of both mātauranga māori and western science. This thesis refers to this new way of doing as mātauranga Aotearoa. Chapter 2 discusses the transformative potential of this model for Māori and Aotearoa NZ development, effectively proposing a shift from a confrontational model of engagement between mātauranga māori and western science to a more inclusive model with demonstrable benefits for all participants. Chapter 3 describes the research methodology then goes on to present the results from interviews with Māori scientists actually working or

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<sup>6</sup> Prior to the 16<sup>th</sup> century western science was not yet born though a similar field known as natural philosophy later became natural science. Science itself was not consistently defined or articulated until the 19<sup>th</sup> century when scholars such as Sir Francis Bacon and William Whewell contributed their ideas to these discussions. Whewell is responsible for coining the term scientist in 1834 (Porter, 1993:18; Porter, 1997). While it is arguable that 'western' science as we would define it in the 21<sup>st</sup> century existed prior to the 16<sup>th</sup> century, this thesis considers that in history knowledge (which could sometimes be described as scientific) was 'local' (as opposed to 'western') in countries where it was not western but Greek, African, Indian, Arabic, Polynesian or of any other origin.

attempting to participate at the interfaces with and between mātauranga māori and western science. The results are presented in Chapter 4 according to the questions that were asked during interviews with Māori scientists at the interfaces with and between mātauranga māori and western science. The results indicated themes and characteristics of the interfaces between mātauranga māori that are linked to the harms framework in Chapter 5. Finally the thesis concludes with some comments on harms at the interfaces; discussion on two pathways forward for knowledge in Aotearoa NZ and 3 keystone challenges at the interfaces with and between mātauranga māori and western science.

## 2.0 Harms at the Interfaces – Past and Present

### **A Commonality of Domination**

In setting a justification for this discussion I introduce the idea of harm as a unifying factor, a context within which indigenous and Māori experiences of western science have taken place. It is used in this thesis to capture the adverse influence of a number of experiences on the development and survival of indigenous knowledges, in particular mātauranga māori. A lot of the influences noted as harms are well known and discussed in the national and international literature in relation to indigenous knowledges, western science and the interfaces with and between these two knowledge systems.

Harm is the concept that unites most if not every indigenous person's experience of the interfaces and has been used to grasp the significance of those experiences for ways of doing at the interfaces between mātauranga māori and western science. This is supported by Semali & Kincheloe's (1999) contention that there is a commonality of domination throughout the indigenous world. Indigenous peoples have and continue to be impacted by similar experiences of colonisation, assimilation and protectionism. While these harms have been well documented periodic reinterpretation of them is important especially for enabling us to predict their impact on indigenous participation in RS&T. This exercise informs the development of a harms framework (based on the national and international literature) presented later in this chapter (Figure 2, p.40). Applying the concept of harm to the question of indigenous knowledges allows us to recognise their connectivity and cumulative impact and the commonality of the resulting experiences of indigenous peoples throughout the world.

It is the author's suggestion that harms represent the common historical legacy of indigenous peoples and their knowledge systems, and disproportionately impacts on the ability of Māori and other indigenous peoples to participate at the interfaces. Recognising that mātauranga māori remains relevant today is important despite being undermined and subverted at almost every turn throughout Aotearoa NZ's short history. This needs to be stated explicitly to recognise the mana of mātauranga māori and the tupuna who generated it, transmitted it and nurtured it prior to colonisation and those who have continued this role on behalf of Māori communities. The expression of rangatiratanga in the context of this discussion is an effort to bring mātauranga māori back to a position of prominence and activity not only in the lives of Māori but in the lives of all New Zealanders.

It is still possible for indigenous peoples to revel in their shared commonality of domination and by doing so draw strength from adversity. Note the array of costumes that are worn by indigenous peoples in a spirit of unity and harmony during cross cultural or international gatherings, and sometimes romanticised (or lampooned) by international politicians at forums such as the Asia Pacific Economic Community (APEC) Summit ([http://english.people.com.cn/200210/28/eng20021028\\_1057\\_671.shtml](http://english.people.com.cn/200210/28/eng20021028_1057_671.shtml)). Another example is the way that indigenous peoples continue to gather in conferences, workshops, seminars, hui and other traditional forums to discuss strategies and plan ways forward for indigenous peoples, cultures, knowledges and rights. As much as indigenous peoples desire to celebrate their differences they have found strength in numbers that derives from a commonality of domination (Semali & Kincheloe, 1999), shared experiences of harm caused directly to themselves and insidiously to their cultures and knowledges.

## **Mātauranga Aotearoa**

While harm at the interfaces is emphasised it is not done so in an attempt to vilify western science or to discourage Māori from engaging with it or its practitioners. This would simply reinforce the negative stereotypes some Māori already have of western science and do nothing to advance knowledge in Aotearoa NZ. Increased participation in the science sector is the driving force that motivated the author in the first instance to write on the interfaces and suggest that new, innovative, creative and more inclusive ways of doing should be developed to support the generation, transmission and advancement of Aotearoa NZ knowledge.

The authors own experiences as a Māori scientist suggests three things:

- There are large numbers of Māori out there who do appreciate the significance of knowledge as it is presented by western science and the value it can add to Māori lives.
- In Māori communities there is a large pool of 'untapped wisdom'<sup>7</sup> that can be harnessed to provide development solutions for Māori, and
- Some Māori already have the basic skill set necessary to succeed at some level in western science.

The talent and human resources at least are clearly available to facilitate a strong, sustainable and capable Māori scientific workforce and develop a world-class level of scientific literacy within Māori communities. Aotearoa NZ's leadership is obliged to facilitate a process whereby the interfaces can be better explored and further capitalised on to produce genuine mātauranga Aotearoa solutions and opportunities for development. Such a process will go some way towards unlocking the benefits of the interfaces for all Aotearoa NZers with a strong influence by this country's indigenous peoples and their knowledges.

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<sup>7</sup> As Nakashima refers to it (2000:11-15).

Akabogu said:

*It has never made sense to throw the baby out with the bath water, and it cannot start now. Schemes for the coexistence of methods are of the utmost importance... Commonality is promoted by acknowledging to each other what it is due. (Akabogu, 2002)*

The convergence of two methods - each with their own strengths and weaknesses - can lead to a new unified knowledge system, one that in Aotearoa NZ we might call mātauranga Aotearoa. Mātauranga Aotearoa is something new, energised and exciting, where new knowledge and with it new opportunities for development are generated. It is at this juncture where potential energy is greatest. The message in the Akabogu quote is as pertinent for indigenous peoples as it is for non-indigenous peoples.

Often it is left to social scientists and commentators to widely criticise the notions of science as western and of western science as the only way of doing. Counter to this flow of criticism from without, this thesis is authored by a practicing Māori scientist to:

- encourage self-examination by scientists and others who operate within a western science dominated paradigm;
- promote discussion of the potential to integrate two seemingly divergent ways of doing;
- and expose opportunities for the transformation of Aotearoa NZ communities.

As research has come to be regarded as a dirty word (Smith, 1999:1) among Māori and other indigenous peoples, science as an associated activity has also come to be regarded as undesirable:

*this spread of rationalisation is, has become 'unreasonableness', irrational', 'political domination', 'discipline and surveillance', 'a powerful ideological fiction', or 'morally bankrupt'. (Apfell-Marglin; 1996:12)*

The result of the integration of western science and mātauranga māori, mātauranga Aotearoa, may be positioned to promote the participation of all New Zealanders in an Aotearoa-focused way of doing and allow policy makers such as the Ministry of Research Science and Technology to claim a measure of leadership in indigenous knowledge research.

## **A Trinity of Harm**

It is recognised by almost every commentator on indigenous issues that indigenous peoples have expended energy in overcoming the challenges of colonisation and assimilation, dancing at the interfaces in order to challenge the authority of the system that produced those harms (Durie, 1998, 1999). A third element of harm kindled even prior to colonisation and assimilation is protectionism. While the effects of colonisation and assimilation on indigenous peoples and knowledges are well known, the influence of protectionism may be less explicit. Some commentators have described protectionism as a survival response to colonisation (Smith, C.W. 2000:48; Henry & Pene, 2001). Protectionism has always existed in some form or another in Māori society, for example the keeping and recitation of whakapapa, mōteatea (Black, 2000) and other verbal expressions of culture within a tribal group (by tohunga or within a formal wānanga system of learning) are regarded as traditions, customs handed down to safeguard mātauranga māori; safeguard individuals from inappropriately accessing it (Parsons, 1995; Durie, 1996; Royal, 1998), and to safely transmit it to future generations.

Protectionism as a response to colonisation suggests an underground movement (Harris & Mercier, 2006) where mātauranga māori could develop, albeit slowly and still hindered by a dominating system of knowledge protected from the prying, speculative and sometimes unscrupulous eyes of non-Māori. For example the Tohunga Suppression Act 1907 (Williams, 2001a; Williams, 2001b) prohibited tohunga from practicing and suppressed mātauranga māori:

*The government's claim that this was designed simply to eliminate quackery differs significantly from popular opinion that the Act was specifically designed to annihilate their traditional practices and knowledge in order to assist Māori to obtain what the government considered a 'civilised state' or to become more Europeanised. (Harris & Mercier, 2006:142)*

For these reasons and the estimation that other harms affecting indigenous peoples and knowledges stem largely from them protectionism, colonisation and assimilation are considered in this thesis to form a trinity of harm.

This thesis also goes beyond this trinity of harm and suggests that since colonisation, protectionism may have intensified to an unsustainable level due to the challenges of colonisation and assimilation. For example the use of te reo Māori by a group of speakers to exclude non-Māori and presumably to protect the space (wherever it may be and for whatever reason) incidentally also excludes Māori who are not conversant in te reo Māori:

*During colonisation we have developed quite complex codes to protect knowledge from appropriation including traditional sanctions ... we have coded our beliefs and we divide our talk into appropriate forums to speak and inappropriate forums to speak. (Smith, C.W., 2000:48)*

In a rapidly changing world where some Māori grow up without te reo Māori as their first language or without knowledge of or even an opportunity to know their whakapapa, iwi history or marae kawa it is important that the gatekeepers of mātauranga māori accept some responsibility for allowing mātauranga māori to evolve to meet the needs of these individuals, whānau, hapū, iwi and other Māori organisations. An opportunity exists for mātauranga māori perspectives, values and ways of doing to impact on the generation and transmission of a distinctive

Aotearoa-focused knowledge. This includes a contribution to the philosophical and ethical direction and how beneficial outcomes for as many of Aotearoa NZ's population as possible can be maximised from what we know or can know. Protectionism, or the kind of behaviour referred to in the quote by Smith can be counterproductive in our efforts to grow or evolve mātauranga māori.

## **Protectionism**

The term protectionism is used to refer to the treatment of mātauranga māori by Māori prior to colonisation as well as the reactive approach Māori have traditionally taken to protect what is claimed to be mātauranga māori from corruption. Protectionism ultimately added to the forced retreat of mātauranga māori to the fringes, from the knowledge-scape and into what was in effect a hibernation (Davis, 2006) during the 19<sup>th</sup> and early to mid 20<sup>th</sup> centuries. This approach may have been necessary in order to safeguard mātauranga māori, however anecdotal evidence concerning the dissemination and retention of mātauranga māori by current generations of Māori suggests that this approach may be flawed. Mātauranga māori, traditional methodologies, beliefs and ways of doing instead of being maintained and protected may be beginning to erode when confronted with new, foreign and apparently more attractive (to new generations of Māori) ways of doing. Some commentators suggest that an unintended consequence of this practice is the imminent extinction of some indigenous knowledges (Cetto et.al., 2000).

Mātauranga māori can and has been contained within whakapapa lines; by religious or spiritual classes; by various interest groups, or captured by academia within universities, modern wānanga and other educational settings (Mead, H.M. 2003:312-320). How much these practices are motivated by traditional needs or forced protectionism is complex and probably a matter of opinion. Figure 2 (p.40) includes capture by academia and documentation as harms perpetrated against mātauranga māori. These may be tools of forced protectionism claimed to safeguard and preserve mātauranga māori, that also restrict access to it and

facilitate exploitation of it by other groups as well as Māori. It may be possible that in some instances the sequestration of mātauranga māori into an archive is motivated by both.

Sui generis is a term used around the world and in United Nations circles to refer to intellectual property regimes that are of their own kind (Summers & Holmes, 2006:1207). In some respects protectionism has served Māori well as a sui generis method for the preservation and protection of knowledge, potentially being a feature of Māori society prior to colonisation. It is the authors opinion that a perfectly good sui generis system of intellectual property protection for mātauranga māori existed prior to the United Nations adoption of this term. Oral tradition has served Māori society very well over the generations. One of the laments of some indigenous advocates is to decry the loss of indigenous values systems (Akabogu, 2003; Githaiga, 2003). Oral tradition as well as preserving, transmitting and allowing indigenous knowledges to develop have and may continue to be an excellent vehicle to assist indigenous peoples to preserve, maintain and protect their knowledges. It does not escape the authors notice that this is in fact a clandestine but perhaps more culturally appropriate version of protectionism. There is a fine line between the traditional approach to protectionism and the intensified form found necessary since colonisation. Protectionism may be partially responsible for the lack of understanding some Māori, who may or may not be familiar with their own culture and who may even be more comfortable on the margin, now have of some simple cultural norms and practices.

## The Transformative Potential of Mātauranga Māori

Smith stresses that the kind of behaviours inherent in protectionism are survival strategies (Smith, C.W., 2000:49) and the position of this thesis is similar. Protectionism as a survival strategy may have inadvertently separated some mātauranga māori from some of the Māori population (whānau, hapū, iwi and other communities). This practice has contributed to reducing the transformative potential (Semali & Kincheloe, 1999) of mātauranga māori, effectively placing that knowledge out of the reach of those not considered to be worthy of its receipt whether through a perceived lack of whakapapa, te reo, extant knowledge or other determinants.

Mātauranga māori has enormous transformative potential to lead Māori people out of dependency (Hui Taumata, 2005c) and into an era where they are truly able to self-determine.<sup>8</sup> Tā Apirana Ngata left the following ōhākī (parting wish) petitioning his grand-daughter and iwi Māori to hold fast to their tikanga and use the tools of the pākehā, *ngā rākau a te Pākehā* to advance Māori aspirations:

*E tipu e rea, mō ngā rā o tō ao, ko tō ringa ki ngā rākau a te Pākehā hei ara mō tō Tinana, ko tō ngakau ki ngā tikanga a ō tupuna Māori hei tikitiki mō tō mahuna, ko tō wairua ki tō atua nānā nei ngā mea katoa.*  
(Brougham, 1992:379)

Ngata foresaw the potential of the interfaces for Māori development.

Other commentators refer to the transformative potential of indigenous knowledge systems to transform western society (Warren, 1992; Ulluwishewa, 1993). This thesis argues as Ngata suggested that the true transformative

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<sup>8</sup> We can observe the numbers of young, innovative, entrepreneurial Māori growing up in a māori environment learning as much as possible within a māori paradigm while also taking up the knowledge of the Pākehā and becoming successful within te ao hurihuri, the ever changing world in which we live. The term, determine, is significant because it alludes to the idea of self-determination that can and will probably only be achieved when Māori pull themselves out from under the cloak of assimilation. It is not an accident that it has been used here, rather than allow government or other bureaucracies to determine the growth and development of mātauranga māori into the 21<sup>st</sup> century, some Māori choose self-determination as a more comfortable option.

potential of indigenous knowledges is in their potential for indigenous development both within and without western society. While mātauranga māori does have undisputed benefits for western society its greatest transformative potential is for Māori development.<sup>9</sup> This is especially significant if access to mātauranga māori is a factor in determining the success of Māori individuals and communities in post-colonial Aotearoa NZ.

The author is well aware of the argument that suggests that mātauranga māori should remain or be sequestered at least in part in Māori customary spaces. Royal (1998) debates whether certain types of mātauranga māori can be taught in forums other than wānanga and suggests that restrictions on access to mātauranga māori should remain in order to protect esoteric knowledge and those who might receive it. Traditional protectionism is a practice handed down from generation to generation in order to achieve this. How much this restricts the ability of all Māori to capitalise on the transformative potential of mātauranga māori in contemporary Aotearoa NZ society is unresolved. There is a very fine line between protectionism that is traditional or customary, and protectionism that is forced on Māori by colonisation and assimilation.

## **Colonisation**

The non-Māori colonisation of Aotearoa NZ is generally accepted to have begun with the arrival of Captain James Cook during the latter stages of the 18<sup>th</sup> century, and mainly European settlers (including: whalers; sealers; traders; missionaries; escaped convicts etc.) in greater numbers during the early stages

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<sup>9</sup> What was once a customary tradition, practiced by Māori to control access to mātauranga māori and protect it and Māori users from inappropriately accessing it (Royal, 1998) may have become a tool in contemporary society wielded no longer exclusively by Māori, and used to restrict access to and claim ownership of it. For example Debra Harry and others (Harry, 1995; Harry & Dukepoo, 1998; Harry, 2001) have repeatedly warned against the capture of whakapapa by non-indigenous peoples and labelled it as biocolonialism (Henare, 2003). The Waitangi Tribunal in Aotearoa NZ is currently hearing the Wai 262 claim which in one respect debates the capture of indigenous flora and fauna by non-Māori entities who aim to access it chiefly for their own benefit. The author believes that in order for Māori to maximise its potential for transformative Māori development, Māori must begin to reclaim protectionism as a tradition, promote mātauranga māori as relevant to modern society and staunchly defend their rangatiratanga over it.

of the 19<sup>th</sup> century. Scientific evidence based on archaeology, radio-carbon dating and volcanic deposits increasingly supports the first arrival of the Eastern Polynesian ancestors of Māori in Aotearoa about 700 years ago (Howe, 2003; 176-177), although traditional histories have led some to suggest an even earlier date of 750 AD (Howe, 2003; 160-161). The relationship between Māori and non-Māori in Aotearoa has sometimes been characterised by tensions caused by disputes about access to land and other resources and sometimes leading to conflict. While this tension remains, further tension is generated at the interfaces between mātauranga māori and western science. In Aotearoa NZ this is perhaps best exemplified in current discussions regarding indigenous flora and fauna. Durie (2004) suggested that the frontline for tensions at the interfaces has shifted from these physical resources to resources of the mind including mātauranga māori:

*Contests between indigenous peoples and states have been fought in a variety of sites, most obviously around territorial lands, waterways and oceans. But interestingly 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. (Durie, 2004:6)*

In a context of suppression and sometimes hostility, where often it is not even socially acceptable for Māori to publicly acknowledge the harm done to Māori society or mātauranga māori since 1<sup>st</sup> contact by non-Māori,<sup>10</sup> Māori and other

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<sup>10</sup> I refer somewhat tongue in cheek to the reference made by the Right Honourable Tariana Turia in 2000 to the holocaust, "... suffered by indigenous people, including Māori as a result of colonial contact and behaviour" (Turia, 2000). Danny Keenan wrote in a column in the New Zealand Herald that the response Tariana Turia got was nothing short of incredible (Keenan, 2000). Many non-Māori got the opportunity to deride Māori feelings about colonisation as something that happened in the distant past and of no relevance to the present generation. Many New Zealanders were so enraged by the likening of the Taranaki Land Wars and the colonisation suffered by Taranaki Whanui to the Jewish 'holocaust' during World War II that the Prime Minister was forced to admonish Tariana Turia for her comments. Magically Holocaust with a capital 'h' also began to mean something different to holocaust with a small 'h'. This is a perfect example of the inability of New Zealanders to remain level headed and reasonable when Māori express their feelings about colonisation, perhaps it is also a reminder of the long way we (Māori and non-Māori) still have yet to go to reach some measure of maturity as a country.

indigenous peoples often describe colonisation in unfavourable terms (Hoppers, 2002; Durie, 2005). Because of its ongoing impact in Aotearoa NZ society and its infiltration into every aspect of indigenous reality it has been written about, dissected and manipulated to various ends by numerous commentators. Indigenous peoples at one time or another, especially those who live lifestyles that reflect their heritage and that are sympathetic to indigenous issues have derided it:

*The results of colonisation were consistently disastrous, and 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. (Durie, 2005:136)*

This quote describes the impact of colonisation on what at that moment in history may have, despite their own turbulent history of whawhai and raupatu (war or conquest), been an unsuspecting Māori population. Durie goes further and links colonisation to harm caused through the loss of tangibles such as land, population, health and culture and intangibles such as dignity and voice. Usefully he and others (Royal, 1998) also link colonisation to the loss of traditional methodologies, giving loss of knowledges and ways of doing the dubious distinction of inclusion as a disastrous consequence of colonisation. It has already been stated that the non-Māori colonisation of Aotearoa NZ was a factor in the intensification of protectionism of mātauranga māori. With a nod to its undisputed status as a cause of harm, colonisation is implicated to a large degree in the contemporary circumstances of Māori peoples.

## **Assimilation**

A key feature of colonisation is assimilation, a policy or group of policies used in Aotearoa NZ (Mead, H.M., 2003:232) and other colonised countries<sup>11</sup> that facilitated the subjugation of the local peoples and indigenes:

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<sup>11</sup> For example South Africa (Hoppers, 2002).

*There are many explanations... including the general view that these figures are one of the consequences of assimilation policies. These policies contributed to a long period of successive undermining of the traditional system, and of chronic neglect and underfunding of iwi.*

(Mead, H.M., 2003:212)

Assimilation is based on European norms and theories of culture that assume societies naturally progress through a series of states (for example: primitive; industrial; modern) (Ward, 1974; Armitage, 1995; Hoppers, 2002). In the Aotearoa NZ context assimilation alludes to the use of power and policy at government and other bureaucratic levels to determine the growth and development of Māori individuals and communities.

There was an inherent assumption that assimilation policies would lead Māori to eventually adopt allegedly superior non-Māori culture and ways of doing. So convinced were the colonists of the mid-late 19<sup>th</sup> century that Māori whakapapa was destined to be absorbed into the stronger white population, that assimilation was seen as a way to ease this transition for Māori:

*A barbarous and coloured race must inevitably die out by mere contact with the civilised white; our business, therefore, and all we can do is to smooth the pillow of the dying Māori race. (Orsmann & Moore, 1988)*

Little did 19<sup>th</sup> century European New Zealanders know of the resilience and determination of Māori people. Faced with expending valuable resources to attempt to halt the decline of the Māori population, assimilation was seen as an expeditious and politically correct strategy for the colonisation of Aotearoa NZ (Mead, H.M, 2003:232):

*Deliberate racist policies based on social Darwinism were implemented to assimilate Māori into the general Pākehā population. I think Māori were meant to be grateful for these efforts. History, however, has proved that the assimilation policy was doomed to failure. (Whaitiri, 1999)*

## Dancing at the Interfaces

The combined struggle to overcome colonisation, assimilation and protectionism represents harm because it negatively influences the available energy Māori have to expend on other priorities and on remedying their participation in the Aotearoa NZ RS&T system. These harms have converged to distract Māori, and this convergence is a key reason why Māori individuals do not feature as prominently as they could in the statistics when it comes to participation in western science (Harris & Mercier, 2006:141-144):

*Māori science never re-established itself after the time of colonisation when assimilation and the advances of the European system of education dominated the curriculum for all races. (Love, 1992)*

This is significant harm not only to indigenous knowledges and peoples but also to non-indigenous peoples, western science, Aotearoa NZ science and Aotearoa NZ society. This is especially the case if we accept the alleged ability and role of western science to sustain our futures.

Harris and Mercier say in the opening lines of their chapter in State of the Māori Nation that:

*In 2005, Māori are under-represented in mainstream science education and research, and at the same time are battling to retain and recover their own traditional knowledge. (Harris & Mercier, 2006:141)*

It is the basic and perhaps naïve position of this thesis that no indigenous person should have to battle (dance) to recover their traditional knowledge. The energy expended in dancing at the interfaces is a key reason why western science lags behind other areas of societal significance in Aotearoa NZ, for example in health<sup>12</sup>, education<sup>13</sup> and employment<sup>14</sup> in responding to Māori aspirations<sup>15</sup>. This

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<sup>12</sup>[www.maorihealth.govt.nz](http://www.maorihealth.govt.nz) list 130 Māori health providers contracted to district health boards in Aotearoa NZ. The distinguishing feature of these services is that the “*kaupapa and delivery framework are distinctly Māori*” which is ambiguous and the figures include those health providers

is often despite prodding from Aotearoa NZ's RS&T policy providers ([www.morst.govt.nz/current-work/vision-matauranga/](http://www.morst.govt.nz/current-work/vision-matauranga/)) and is also why I and others (Harris & Mercier, 2006) hypothesise that Māori scientists are uncomfortable in this paradigm:

*Māori responsiveness is a policy designed to increase Māori participation within Vote RS&T and ensure that it responds to Māori issues, needs and aspirations (outcomes for Māori). Vote RS&T will remain responsive to Māori particularly where there are distinctive issues, needs and challenges that must be addressed. Vision Mātauranga supplements this approach by exploring the contribution that Māori knowledge, people and resources might make to Vote RS&T as a whole. Māori knowledge, people and resources have much to offer Aotearoa NZ, and Vision Mātauranga is concerned to realise this innovation potential. ([www.morst.govt.nz/current-work/vision-matauranga/](http://www.morst.govt.nz/current-work/vision-matauranga/))*

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who deliver predominantly but not exclusively to Māori clients. This may mean this figure is artificially inflated.

<sup>13</sup>Ministry of Education figures prepared for Hui Taumata 2005 show that the Māori tertiary education participation rate increased from 6% in 1994 to 20% in 2003 (Ministry of Education, 2005). Te Puni Kōkiri figures say that Māori who gained tertiary qualifications also increased from about 6491 in 1997 to 16446 in 2003. 12% of these graduates were from universities. (Te Puni Kōkiri, 2006).

<sup>14</sup>The Department of Labour issued figures for Hui Taumata 2005 that showed a decrease in the overall Māori Unemployment rate from 25.4% in 1992 to 15.2% in 1996 to 10.2% in 2003 (Department of Labour, 2005). At the writing of this thesis and as a stark reminder of the vulnerability of the unskilled Māori worker to recession and global depression the unemployment rate for Māori currently stands at 9.6% and rising (compared to 4.6% nationally, due to global recession).

<sup>15</sup>There appears to be a serious lack of data concerning the numbers of Māori scientists both working in Crown Research Institutes and graduating in science from Universities in Aotearoa NZ. Attempts were made to gather statistics regarding these parameters (which would allow us to compare Māori responsiveness across education, employment and science) from: Department of Statistics; Te Puni Kōkiri; the Association of Crown Research Institutes; and the Ministry of Research Science and Technology. Anecdotal and experiential evidence suggests the numbers of Māori working in Crown Research Institutes is low. The experience of the researcher in attempting to gather this information indicates that much work still needs to be done to establish the facts regarding Māori participation in western science, only once this has been done will we be able to confidently embark on improving the situation and be able to measure our success. Perhaps the lack of data indicates the lack of seriousness with which these organisations regard Māori participation in science, an attitude that would seem to be at odds with the governments' policy of creating a knowledge society and economy in Aotearoa NZ.

## The Knowledge Economy Beckons

Despite the inevitable negative connotations that arise when writing about harm, especially harm that has allegedly been perpetrated either intentionally or not against Māori, the fact is that the situation of Māori in the latter part of the 20<sup>th</sup> and the early part of the 21<sup>st</sup> century has arguably never been better at least within living memory (Durie, 2005:1). Māori individuals and as a result Māori society, are now fast approaching a point where they are not only able to, but are also invited to play a more crucial and significant role in Aotearoa NZ society (Hui Taumata, 2005c) and Aotearoa NZ RS&T. The knowledge economy beckons:

*National wellbeing and the wellbeing of Māori are inseparable. The more youthful and fertile nature of the Māori population, and the older and less fertile nature of the Pākehā population means that Māori will be an increasing proportion of young and working age New Zealanders in the twenty-first century. Māori culture is unique to New Zealand. Māori participation in the knowledge economy provides an opportunity for New Zealand not only to promote Māori enterprises in the global economy but also to explore how this uniqueness can be used to distinguish New Zealand from other “western” societies and economies. (Minister for Information Technology’s IT Advisory Group, 1999:20)*

Years of neglect and indifference to those who have been regarded as among the less fortunate of Aotearoa NZ society (Bishop, 2003) means Māori are also not as well equipped as the ageing non-Māori population to be able to capitalise on this new knowledge role for the benefit of all Aotearoa NZ. This fact is well recognised by Māori themselves<sup>16</sup> as well as by government departments. The Ministry of Education’s Statement of Intent for the period 2003-2008 includes a commitment to the development of iwi partnerships, including with Ngai Tahu; Ngāti Porou; Ngāti Whatua, and Ngai Tuhoe. Goals include: restoration of a learning culture to iwi; quality education that supports Māori participation in iwi,

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<sup>16</sup> Examples include Ngai Tahu 2025 (Te Rūnanga O Ngai Tahu, 2004; Te Runanga O Ngai Tahu, 2005) and Whakatupuranga Waikato-Tainui 2050 (Waikato Raupatu Lands Trust, 2008).

hapū, Aotearoa NZ and global society; and mātauranga-a-iwi as the key to raising Māori achievement (Ministry of Education, 2003).

It is often described as a shortfall in Māori capacity. That is iwi, hapū, whānau or other Māori organisations not having the workforce or the numbers on the ground to be able to execute even small projects. It may also be interpreted as a shortfall in Māori capability, that is iwi, hapū, whānau or other Māori organisations having the people but not necessarily the right skill sets needed to execute projects efficiently or of a high standard. Some iwi have developed education strategies, for example Te Rūnanga O Ngai Tahu launched an education strategy in January 2006, in order to develop their own human capital to address these shortfalls:

*Ngai Tahu economic, social and cultural aspirations will continue to form and reshape our foundations in the 21<sup>st</sup> century. These expectations require us to reinforce our capability to organise, to be decisive and to be successful individuals, whānau, hapū and iwi. We strive to enable Ngai Tahu whānui – to live long and live well; to be culturally enriched; and to lead the future. This is exemplified in our whakataukī, “Mō tātou, ā, mō kā uri a muri ake nei. (Te Rūnanga O Ngai Tahu, 2006:1)*

Universities and students associations have also responded to the Māori renaissance by developing science support networks and structures for Māori science students. For example the Te Rōpu Awhina Pūtaiao Māori and Pacific Island science support network at Victoria University has been operating for about 9 years and has steadily increased the number of Māori science students in that time ([www.vuw.ac.nz/science/awhina](http://www.vuw.ac.nz/science/awhina)). Massey University and other tertiary institutions run similar programs. The Foundation of Research Science and Technology also administers fellowships and other awards that are available in some cases to Māori specifically (<http://www.frst.govt.nz/funding/students/TTP>) and in other cases across the entire research science and technology cohort to develop the Māori science workforce. While growth in the Māori scientific

workforce has been steady it is by no means growing at a rate that suggests great progress in this area.

Te Puni Kōkiri (The Ministry of Māori Development) have also had a capacity building initiative running for some years ([www.tpk.govt.nz/en/about/mpa/](http://www.tpk.govt.nz/en/about/mpa/) ) though this initiative is targeted more at building the capacity of Māori communities than specifically targeting Māori involvement in western science. This evidence may suggest that in the RS&T space Māori still need to develop a critical mass in terms of the numbers of Māori scientists and technicians (see footnotes 5 & 7, page 28). For the sake of a strong and capable Māori (and Aotearoa NZ) society in the 21<sup>st</sup> century and beyond, the Māori community in general must become not just knowledgeable but western science literate.

Since the inaugural Hui Taumata in 1984 Māori have steadfastly been developing capacity in some areas of apparent societal significance - health, employment, education, economy. Twenty years on and Hui Taumata 2005 emphasised that the priority for Māori should now shift to ensuring that Māori are also capable of participating and competing at the highest level (Hui Taumata, 2005a:16):

*while access to education and other endeavours must remain an important goal for Māori so that benefits can be felt across all marae and in all communities, access by itself will not be a sufficient measure of quality for 2025. Increasingly the emphasis will shift from access and participation to quality and high achievement. (Durie., 2005. p9)*

## **A Legacy of Harm**

Warren (1992) refers to indigenous knowledges as the wisdom of generations, a romantic description of the knowledges of indigenous peoples. Nakashima et.al. (2000:11-15) suggest that western scientists should aim to tap the wisdom of the world's indigenous peoples. These sentiments underscore both the antiquity of

indigenous knowledges and the stamina of their influence on indigenous peoples, and non-indigenous desires and efforts to capture indigenous ways of doing.

Modern Māori individuals, communities and systems of knowledge have developed over millennia and generations in a context of sometimes extreme difficulty. Just as the challenge was great for Māori to overcome the physical circumstances they encountered when they landed in Aotearoa NZ the intellectual challenge of developing new ways of doing in an alien environment must have proven equally as difficult. Confrontation with non-Māori during the colonisation of Aotearoa NZ in the late 18<sup>th</sup> and early 19<sup>th</sup> centuries also presented challenges for Māori and required them to think not only about their own way of doing and its survival, but also about how to capitalise on the challenging new paradigm - cartesian rationality or western science - that brought non-Māori to these islands. Since these times the struggle has been to express mātauranga māori at the interfaces.

Early in this chapter it was suggested that this more often than not lead to the forced withdrawal of mātauranga māori and māori ways of doing from the knowledge-scape - protectionism. The impact of this struggle, framed in this thesis as harm and intensified by colonisation and assimilation (Figure 2, p. 40), on the ability of Māori to engage, participate and feel comfortable at the interfaces may have lead to;

- a lack of participation by Māori in western science education, training and employment;
- a lack of representation by Māori in western science as: scientists; technicians; policy providers; teachers and in other technical roles;
- a lack of achievement by Māori in western science, notwithstanding the high achievements of some Māori individuals in this field<sup>17</sup>. This may lead

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<sup>17</sup> For example Dr Ross Ihaka, statistics; Professor Michael Walker and Dr Shane Wright, biological sciences; and Dr Mark Laws, Computing and Information Sciences.

to disenchantment with the interfaces and further alienation from the opportunities that it has to offer for Māori development;

- a lack of scientific literacy; sometimes among Māori who do participate at the interfaces, and more importantly by Māori individuals and communities who do not.

In many cases western science literacy may not be a priority for Māori individuals, community's or organisations as they struggle to respond to more critical issues such as the education needs or health circumstances of their community's. Figure 2 presents the four circumstances listed above as the result of accumulated harms done to mātauranga māori throughout the centuries.

Notwithstanding the facts, the public of Aotearoa NZ often considers the accumulated harms at the interfaces to have little or no relation to the colonisation of Aotearoa (North Island), Te Waka a Māui/Te Wa'i Pounamu (South Island) and Te Ura a Te Rakitamau (Rakiura, Stewart Island) in the 18<sup>th</sup> and 19<sup>th</sup> centuries. The current challenge for Māori is to mitigate there impacts on the future of mātauranga māori. The author considers Māori scientific literacy to be a keystone challenge for the 21<sup>st</sup> century. Not just for those Māori who choose to participate at the interfaces as scientists, technicians or policy providers but more importantly for those who currently engage only passively western science.

### **The Marginalisation of Mātauranga Māori**

Harms done to mātauranga māori are often minimised and marginalised to the fringes of Aotearoa NZ society and in the context of this discussion, the Aotearoa NZ knowledge-scape. This has done little to encourage Māori to engage and participate at the interfaces. Some efforts have been made within the Aotearoa NZ research science and technology system to overcome these attitudes. While Māori perspectives, values and ways of doing may be taken account of in some cases, especially in environmental science and research utilising Aotearoa NZ's natural resources, they still often come second to commercial considerations.

These are probably incompatible with the goals and objectives of most Māori communities at the interfaces in contemporary times. The goals and objectives of Māori communities and organisations may currently revolve around the recovery and protection of mātauranga māori rather than its potential commercial exploitation by either themselves or non-Māori. RS&T is still often driven chiefly from the perspective of the research provider or by political motives, and a large proportion of the Māori population remains wary.

The interfaces have been harmed by the general reluctance of western science in Aotearoa NZ and some western trained scientists to overcome the belief that western science exists in a vacuum (Apfell-Marglin, 1996a; Semali & Kincheloe., 1999). Today western science is even promoted as universal (Apfell-Marglin, 1996a). This not only appears to signal an intent to smother or disregard the existence of other ways of doing, as if a way of doing was somehow anthropomorphised into a living breathing being, but to also perpetuate the myth that western science is the only system of knowledge that counts. This notion has been extensively challenged and Apfell-Marglin suggests that western science is now being described as ideologically driven, morally bankrupt<sup>18</sup> and irrational (Apfell-Marglin, 1996a:12).

10 years ago Prakash referred to the result of this myopic view of nature and knowledge as the objective view from nowhere of modern scientists:

*modern scientists are taught to transcend their cultural/personal idiosyncracies and peculiarities in order to be able to take the objective 'view from nowhere' and, being from 'nowhere', the scientific view may also be characterised as being the view from 'everywhere': universal.*  
(Prakash, 1999)

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<sup>18</sup>This description resonates quite well with the interviews where some Interviewees suggested that Māori brought a greater ethical dimension to the interfaces.

The popular notion is that scientists are divorced from subjective reality in an effort to focus and objectively study nature. The notion of a modern scientific objective view from nowhere, the term nowhere reflecting the isolation of a modern scientist oblivious to the real world, can be exposed as a myth. In contemporary times western science has also often been politically motivated (especially in a time where big ticket issues such as climate change/global warming, the SARS virus and avian influenza (H5N1, the bird flu) are headline news) and directed by funding agencies and corporate sponsors (Cetto et.al., 2000). This further exposes the folly of the idea of an objective view from nowhere.

Mātauranga māori and other indigenous ways of doing take a subjective view from everywhere, a holistic approach that includes strong ethical and philosophical grounding in Te Ao Māori (the Māori world) that supports understanding and management of relationships at the interfaces, including those with western science.

There are however still elements in Aotearoa NZ society and western science that seek to marginalise mātauranga māori and diminish both its historical importance and the future significance of its role for Aotearoa NZ knowledge growth and development (Dickinson, 1996; Jackson, 2001). For example Professor Penny in giving evidence to the Royal Commission on Genetic Modification, assumed the position on behalf of the New Zealand Association of Scientists that the arguments produced by Māori against genetic modification had no firm scientific basis (Jackson, 2001). As well as denying the validity of the Māori intellectual tradition, it is becoming increasingly evident that this also has implications for the continued growth and development of Aotearoa NZ people, economy and society:<sup>19</sup>

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<sup>19</sup>Strong opinions expressed by individuals in positions of relative power, scientists for example, are often regurgitated by less powerful though more widely read sources (for example newspapers) which may have a negative influence on the average persons perception of mātauranga māori. These individuals have a responsibility to be careful with their opinions,

*People with closed minds see Māori knowledge as different, they feel threatened, and put up road blocks to exclude it. The most recent exponent of this line of thought is Mike Dickinson, a researcher at Victoria University. Dickinson denies that Māori were capable of scientific thought and the application of the scientific method. (Walker, 1996)*

## An Accumulation of Harm at the Interfaces

		Epistemological tyranny	Challenges to the integrity of mātauranga māori	Primitivism	Lack of scientific literacy
	Colonisation	Erosion of indigenous values	Exclusion of mātauranga māori principles	False analysis of mātauranga māori	Under-representation by Māori in western science
Traditional protectionism	Forced protectionism	Loss of mana	Scientific method/rules of evidence	Documentation of mātauranga māori	Lack of mātauranga māori literacy
	Assimilation	Loss of context	Lack of recognition of mātauranga māori	Capture of mātauranga māori by academia	Under-achievement by māori in western science
		Loss of rangatiratanga	Loss of tools of conviviality	Essentialism	Lack of participation by Māori in western science

**Figure 2.** A profile of accumulated harm at the interfaces with and between indigenous knowledges (mātauranga māori) and western science. The figure should be read from left to right. In the far right column criticism of Māori performance or participation in western science could as easily and correctly refer to under-representation, under-achievement and lack of participation at the interfaces.

especially in a democratic society where every person is able to be influenced rightly or wrongly and has the right to exert a vote that carries with it the potential to unfairly derail mātauranga māori. One interviewee noted how she thought some Māori were stuck on the traditionality of mātauranga māori (Interviewee 2). The same could be said for some scientists who continue to insist that mātauranga māori is nothing more than a curiosity, and who endlessly argue that it is. This thesis takes the view that in both cases harm is done to the interfaces and the chance to reconcile mātauranga māori and western science. It has already been intimated in this thesis that endless arguments over the validity and scientific-ness of mātauranga māori are damaging to Māori vitality and energy that could be better spent on for example, developing better tools for a new way of doing at the interfaces with and between mātauranga māori and western science.

Figure 2 is a visual representation of all the issues and 'harms' discussed in this and the previous chapter. This framework will be applied to the data collected from interviews to assist with the analysis and interpretation of the results from this research. Harm is shown in Figure 2 to be an accumulation of circumstances beginning even before colonisation (protectionism). Colonisation, assimilation and protectionism are so closely interconnected that they are often difficult to distinguish. They are shown in Figure 2 to be introducing harm into the profile. Subsequent colonial ideas of the inferior, primitive and insignificant status of mātauranga māori fed behaviours that lead to resistance to and disrespect for mātauranga māori. Such behaviours prompted an equal reaction from other Māori and lead to disrespect by some for western science. This intellectual backlash has contributed to a contemporary situation where few Māori enter western science either as an academic option or as a career choice.

Resistance to mātauranga māori was promoted in areas that included philosophy (resistance to the truth that mātauranga māori is a system of knowledge and a valid way of doing) and education. Resistance to the inclusion of mātauranga māori perspectives, values and ways of doing<sup>20</sup> betrays an underlying reluctance to operate at the interfaces with and between mātauranga māori and western science that is similar to that hinted at by both Dickinson (1996) and Penny (Jackson, 2001). The harm referred to in Figure 2 as challenges to the integrity of mātauranga māori speaks to its lack of acceptance as a valid and valuable way of doing.

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<sup>20</sup> The resistance referred to does not necessarily refer to that from policy makers but to the willingness of teachers and other frontline staff (who are role models) to accept these initiatives. Recent developments in the past two years and their unfortunate publication by the Aotearoa NZ media suggest a recurring reluctance within small pockets of the teaching profession and beyond to accept programmes aimed at Māori educational achievement (McKenzie-Minifie, 2007; Houlihan, 2006). The nursing profession has also experienced ongoing episodes where trainees have resisted then reluctantly accepted attempts to have cultural sensitivity training included as a part of their training programmes. These episodes betray a lack of responsiveness not by the policy provider but by the trainee professional which does not give confidence that resistance to mātauranga māori by the scientist or the laboratory worker is no longer a feature of the interfaces.

Challenging the integrity of mātauranga māori is also often a comment on its ability to determine truth. Apfell-Marglin (1996) said that western science operated in such a way as to set itself up as the determiner of truth throughout the western world at that time, and now throughout the known world. This subsequently downgraded mātauranga māori and other indigenous knowledges in the eyes of the civilised world, and amounted to what Semali and Kincheloe have called epistemological tyranny (1999). Disregard for mātauranga māori alienated it as an inferior, primitive way of knowing and therefore a system of knowledge not worth pursuing. Consequently Māori individuals, communities and society in general became disengaged from the knowledge generating and determining industry.

These harms may have contributed to a lack of Māori leadership in this important sphere of activity in Aotearoa NZ. The tragedy of this situation is that both Māori and non-Māori have missed out on the benefits of strong Māori leadership at the interfaces to integrate mātauranga māori with western science. Māori individuals and communities, especially in some of today's older generations, came to resent western science and have little respect for it. This even despite the indisputable influence western science has had on their everyday lives. This thesis considers that this has hindered Aotearoa NZ's progress towards an Aotearoa-focused way of doing, or mātauranga Aotearoa.

Resistance to mātauranga māori in the education sector increases the risk that mātauranga māori perspectives, values and ways of doing will be excluded. Exclusion of mātauranga māori perspectives, values and ways of doing may ultimately and inevitably lead to occasions where mātauranga māori is misinterpreted (Durie, 1996; Mutu, 1985) by novices and 'experts', or even purposefully by Māori and non-Māori to achieve a political end. Durie notes that it is becoming increasingly trendy to incorporate more and more mātauranga māori into non-Māori frameworks and there is potential for Māori viewpoints to be subsumed beneath dominating western assumptions of power and authority. This

represents harm done to mātauranga māori which accepts and perpetuates the notion that somehow western scientific rationality is superior to indigenous rationality or ways of doing. Mutu also highlights the difficulties faced when interpreting indigenous knowledges, in this case Māori culture and tikanga in purely western terms.

Indigenous knowledges are already to a large extent documented and stored in archives, databases and stores as a national heritage (Ulluwishewa, 1993; Warren, 1992; Emeagwali, 1989). At least one Māori academic (Mead, A., 1997) has stated that it cannot be taken for granted that mātauranga māori is a national heritage and others are also taking up this position. The nationalisation of mātauranga māori fails to acknowledge rangatiratanga over that knowledge, restrict access to it either intentionally or incidentally and erode the ability of Māori individuals, communities and organisations to access it and capitalise on it for their own development (<http://www.waitangi-tribunal.govt.nz/inquiries/floraandfaunawai262/default.asp>). The ultimate capture of mātauranga māori by the public domain (Mead, A., 1997) may lead to the subsequent disenfranchisement of Māori individuals and communities.

### **The Extinction and Survival of Mātauranga Māori**

Harms presented in Figure 2 can also be interpreted as threats to the survival of indigenous ways of doing (mātauranga māori) and add fuel to the claim by some commentators that some indigenous knowledges are on the brink of extinction (Cetto et.al., 2000). In the opinion of the author this is as pressing a reason as any to advocate for greater integration of mātauranga māori and western science and to advocate for more effective utilisation of the space between them, the interfaces, for the benefit of all Aotearoa NZers. It is also an argument for greater determination of knowledge generation, transmission and use by Māori. Māori must begin to take these roles back. Not to dispossess non-Māori from their roles as generators, transmitters or users of knowledge but to work cooperatively in these roles to create opportunity, innovation and development that can and

probably will feature significantly on the world's knowledge-scape as Aotearoa NZ progresses into the 21<sup>st</sup> century and beyond.

Cetto et.al (2000) and others (Warren, 1992) have warned that indigenous knowledges are threatened with extinction. This is a debatable assertion in a context where indigenous knowledges, including mātauranga māori are increasingly being applied in new contexts (for example resource management). This seemingly dramatic proposition is premised on three characteristics of western science that indigenous knowledge systems apparently do not have. The concepts are transmission, generation and self-correction. Regarding transmission of indigenous knowledges, the assumption is that recording knowledge in a written form is the only efficient means of transmitting it to the next generation. This selectively ignores the fact that oral tradition for many generations has been a satisfactory method of choice by indigenous peoples for achieving just that (Nakashima, 2002; Duffield, 2000; Semali & Kincheloe, 1999; Sahtouris, 1992):

*Where the tradition of indigenous peoples values rich contextual detail, the law excludes large parts of the story as irrelevant. Where indigenous people seek to convey the full range of depth and feeling, the law asks them to disregard emotions. Where indigenous peoples celebrate the special and personal, the law tells stories about disembodied 'reasonable men'. Where the tradition of indigenous peoples is oral, anticipating that the story will change with each new teller and listener the law gives primacy to the words within the four corners of the contract, making time stand still and silencing the story teller who comes with news of events or understandings that preceded or followed the written word. (Penetito, 1996)*

Two cornerstones of western scientific methodology used to generate new knowledge and test theories are observation and experimentation (Russell, 1959:15; Cetto et.al., 2000). Indigenous knowledges are no different, observation

has been a cornerstone of mātauranga māori for many generations (Hutchings & Tipene, 1998) and while some authors seek to deny that mātauranga māori used experimentation (Dickinson, 1994; Jackson, 2001) in the generation of new knowledge others strongly refute this denial (Parsons, 1995). The final claim, that indigenous knowledges do not have a mechanism for self-correction can be argued against by referring to the extensive use of karakia, tapu and other institutions associated with wānanga by Māori as mechanisms that functioned to encourage the accurate transmission of knowledge from one generation to the next (Mead, H.M., 2003:311). The application of customary knowledge to new situations also argues against this claim.

Warren (1992) and Ulluwishewa (1993) advocated for indigenous knowledge resource centres allegedly to allay the threat of extinction. Many indigenous knowledge resource centres have in the intervening 15 years (since Warren's warning in 1992) been established throughout the world as a way, "*to facilitate and control the sharing of indigenous knowledge*", and where indigenous knowledges can be, "*gathered, documented and disseminated in a coherent and systematic way*" (IKDM, 1993). The utility of indigenous knowledge resource centres may not be as ways to preserve or whakamana indigenous knowledges or mātauranga māori, but as a way to control how it is shared, gathered, documented and disseminated. Other commentators (Posey & Dutfield, 1996) have also warned that the documentation of indigenous knowledge itself causes harm.

If the gathering, documenting and disseminating of indigenous knowledges in indigenous knowledge resource centres can be said to aid the preservation of indigenous knowledge then this strategy is similar to protectionism. In indigenous knowledge resource centres indigenous knowledge becomes subject to a whole new set of criteria and rules often determined by non-indigenous peoples and sometimes involving little discussion with the traditional holders of that knowledge (Posey & Dutfield, 1996). In these places mātauranga māori and

other indigenous knowledges become nationalised and globalised, the heritage of all mankind, which they are not (Mead, A., 1997).

Mātauranga māori that is recorded and stored in universities and wānanga, and controlled in these contexts may also compromise access by Māori individuals and communities in some instances, to their own system of knowledge. By doing so it also compromises the ability of Māori individuals and communities to make an impression on the lives of tangata whenua and eventually of all New Zealanders. This can alienate large sectors of society and the Māori population. Growing numbers of skilled and knowledgeable urban Māori who may not have strong traditional access to mātauranga māori including access to poua or taua (and more importantly to poua and taua who are willing to share), access to traditional marae or even to other whānau members hampers their efforts to recover and capitalise on their indigenous heritage and knowledge. The frustration felt by non-Māori researchers in the early days of colonisation to the oral tradition approach by Māori to mātauranga māori and knowledge is evidenced by Best's proclamation that, "*we have never been allowed inside the palisades of Māori thought*" (Smith, C.W. 2000). This frustration is now also felt by Māori researchers who are "*battling to retain and recover their own traditional knowledge*" (Harris & Mercier, 2006). This contemporary expression of protectionism may restrict access to mātauranga māori to a class or classes of Māori.

The assumption that indigenous knowledges are threatened with extinction is borne out of observations that suggest it has stagnated and even become bogged down by tradition (Cetto et.al., 2000). These opinions on the uncertain state of indigenous knowledges (Warren, 1992) mostly from the outside are the predictions of a way of doing that is also struggling to make ground or even maintain ground in a world where the ground is constantly shifting. Predictions of the extinction of mātauranga māori and other indigenous ways of doing deserve to be treated with the same disdain that some claims of alien abduction are

treated in scientific circles, they are simply attempts to discredit mātauranga māori. Sadly they also undermine the potential of mātauranga māori to make a difference in modern Aotearoa NZ society by further marginalising it to the fringe.

A pseudo-scientific ideology often bases seemingly outrageous and often non-scientific researches on scientific principles and methodologies. The rise of Intelligent Design (Comfort, 2007; Gunn, 2006) or Creationism (National Academy of Sciences, 2008) are examples of pseudo-scientific ideologies that are now challenging the dominance of western science. They propose to fill the gaps in our knowledge or interpretation of the world around us where western science fails to fully satisfy our thirst for explanation. These ways of doing also threaten indigenous ways of doing. While they have in common an alternative to western science their foundations are very different and their motives diverse. Mātauranga māori and other indigenous ways of doing do not (or at least should not) seek to discredit western science – that would be throwing the baby out with the bathwater (Akabogu, 2002) – rather they seek to complement its endeavours to assist Māori individuals, communities and organisations to understand the world in which they live and operate.

Most Māori have grasped this distinction (Henare, 2003). Often ideologies such as Intelligent Design or Creationism appear to be motivated to discredit western science in the eyes of politicians and the greater public and may be attached to the promotion of biblical scripture as an explanation. Intelligent Design especially attempts to reverse the non-interference pact between religion and science spoken of by Abrams et.al. (2001). Instead of being described as threatened with extinction, indigenous ways of doing can be described as being in hibernation and Davis (2006) describes the recovery in Māori economic development – Te Wā Heke – as waking the sleeping giant which completes this allusion. A hibernation state for mātauranga māori may simply be an aspect of protectionism:

*While much has happened over the past 30 years, there are signs that Māori are beginning to recover through new forms of prosperity known as cultural wealth. Recovery has been largely premised upon the identification and active resurgence of traditional knowledge. (Davis, 2006:62)*

This thesis contends that it is opportune for mātauranga māori to play a lead role in shaping the future of Aotearoa NZ science. Contemporary struggles to maintain te reo Māori and now mātauranga māori are indications of the seriousness with which some Māori take this issue and also of the fact that some Māori consider the status of mātauranga māori to be indicative of their well-being. Hence the struggle to evolve mātauranga māori, to unleash it or breath new energy into it and enable it to play a more significant role in the lives of all Aotearoa NZers; *'Ti hei mauri ora.*<sup>21</sup> This struggle has now also been taken up by the Ministry of Research Science and Technology in Aotearoa NZ ([www.morst.govt.nz/current-work/vision-matauranga/](http://www.morst.govt.nz/current-work/vision-matauranga/)).

At the beginning of chapter 2 western science was defined as a branch of knowledge. Though some commentators have attempted to describe mātauranga māori there is no equivalent definition (Hutchings et.al., 1998; Winiata, 2001; Mead, 2003) and a range of descriptions exist (Salmond (1982); Verran & Turnbull (1995); Roberts (1997); Roberts & Wills (1998); Verran (2001); Nabobo-Baba (2006)). The World Intellectual Property Organisation (Ruiz, 2002) describes indigenous knowledge by saying that there is no agreed term and suggests that the terms indigenous knowledge and traditional knowledge be used interchangeably. At least one Māori scholar (Roberts, 1995) has protested against the use of the term traditional to describe mātauranga māori and other

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<sup>21</sup>These are the words uttered by Tāne-te-wānanga on his success at finding te ira tangata (the essence of mankind) and breathing life into the first Māori woman. They are almost revelatory and I have chosen to use them here to express the breathing of new life into Aotearoa NZ ways of doing at the interfaces with and between mātauranga māori and western science which in the authors view is also quite a revelation. In contemporary times they are often used in order to gain attention after the tauparapara and prior to the whaikorero in formal Māori gatherings such as pōwhiri.

indigenous advocates have done likewise (Nakashima et.al., 2002; Johnston in Duffield, 2002). Similarly the United Nations has grappled with how to define indigenous knowledge and has come up with the broad definition of the heritage of indigenous peoples including indigenous knowledges given in Chapter 1 (Daes, 1995). The terms indigenous knowledges or indigenous ways of doing are preferred throughout this thesis.

## **Conclusion**

Harm is the concept that unites most if not every indigenous person's experience of the interfaces and has been used in this chapter to emphasise the significance of those experiences for the interfaces with and between mātauranga māori and western science. While these harms have been well documented domestically and internationally, periodic reinterpretation of them is important especially to enable us to predict their impact on indigenous and māori participation in RS&T. This thesis says that Māori participation at the interfaces is below optimum and needs to be drastically addressed to improve the performance of Māori at the interfaces and develop opportunities for Māori development.

Māori experiences at the interfaces are influenced by harms (presented in Figure 2) that have accumulated over the last 170 years and that began with the trinity of harm (protectionism, colonisation and assimilation) described in this chapter. Protectionism can be described both as a traditional practice and as a forced practice heightened during colonisation to protect mātauranga māori from misappropriation in the face of western science, the dominant system of knowledge. Protectionism may be a flawed response to colonisation that puts the survival of mātauranga māori at risk if it unnecessarily restricts access to it and its dissemination among Māori. All harms (shown in Figure 2) continue to influence how Māori engage and participate in western science and this continues to affect Māori involvement at the interfaces.

The accumulation of harms at the interfaces with and between Māori society and western society, and mātauranga māori and western science has also affected the preparation of Māori for a future economy thought to be knowledge-centered. Effective Māori participation in the knowledge economy requires support and patience to allow Māori to engage at the interfaces as they determine, and to allow mātauranga māori to gain increased prominence in the Aotearoa NZ RS&T or innovation sector. It is critical that Māori raise the standard and participate to a greater extent in higher quality education and employment, including in western science and mātauranga māori. Māori are now also being encouraged to strive for excellence in these and other fields and to not settle for simple participation as the standard.

The proactive integration of mātauranga māori and western science at the interfaces will open up and create space where Māori can feel confident and where mātauranga māori can make a significant impact on the development of Māori and non-Māori communities, organisations and businesses. Western science, and consequently mātauranga Aotearoa (the system of knowledge that would develop at the interfaces if true integration of knowledge systems was achieved) are lagging traditionally favoured areas such as education, social services, health and others in responding to Māori wishes and aspirations to play a greater role in how knowledge (western science and mātauranga māori) is generated, used, disseminated and applied. While Māori are committed to supporting the revival of mātauranga māori and its return to a place of prominence in the innovation system, the Aotearoa NZ (western science based) RS&T system more often than not disregards it, its relevance to contemporary Aotearoa NZ lifestyles, and what it can offer to western science. Except where commercial outcomes are obvious from exploiting māori resources, and are coveted by non-Māori (or Māori) with misguided or ill-informed intentions. Lack of Māori involvement in these ventures represents further harm done to mātauranga māori and to the interfaces with and between mātauranga māori and western

science by reinforcing the stereotypes Māori often have of non-Māori researchers.

## 3.0 Methodology

### Profile of Harms

Three concepts were introduced in Chapters 1 and 2 as elements of a conceptual framework used to think about the interfaces between mātauranga māori and western science. The author arrived at these concepts after careful consideration of the national and international literature on the interfaces between indigenous knowledge and western science. The concepts are;

- multiple interfaces as spaces for free interaction between ways of doing;
- the idea of ways of doing, and
- harm as a recurring theme through the history of knowledge at the interfaces (Figure 2, p.40).

These concepts describe reference points for a discussion of the interfaces. The concept of multiple interfaces recognises the myriad of ways that Māori individuals, communities and organisations interact with western science (individuals, communities and organisations) as philosophies, knowledge systems, and practical activities or as tools for development. The three concepts were used to develop the interview schedule to explore their relevancy to a discussion of interfaces between mātauranga māori and western science. The interview schedule (appendix 3) did not restrict the interviews to an esoteric, philosophical discussion about the relative merits of mātauranga māori over western science or vice versa. Instead the questions allowed discussion to travel from philosophical discussions about mātauranga māori as a knowledge system, to the practical application of mātauranga māori at the interfaces in a western scientific institution, to the training adequacy of both Māori and non-Māori aspiring scientists at the interfaces. As well as differentiating between

mātauranga māori and western science,<sup>22</sup> the concept of ways of doing captured the practical application of indigenous knowledges and the idea of acceptable imperfection as knowledge is passed from one generation to the next.

This conceptual framework also allowed the author to conceive of mātauranga māori and western science (and other branches of knowledge) as comparable branches of knowledge and avoid elevating one over the other or others. The harms profile identified in Chapter 2 (Figure 2, p.40) identifies practices and events that have contributed to the loss and suppression of indigenous knowledges, these harms are alleged to be a common feature for all indigenous knowledge systems read about in the literature review, including mātauranga māori. The conceptual framework also enabled the interviewer to consider harms as experienced or identified by the Interviewees.

## **Method**

The main mode of data collection was face-to-face interviews with a small subset of Māori scientists working at the interfaces between mātauranga māori and western science. Qualitative interviews were considered to be a valuable method for collecting information related to personal experiences (Denzin & Lincoln, 2000) of working in the science sector and consideration of the relationships between mātauranga māori and western science.

## **Characteristics of the Sample Group**

The population of māori scientists in the sector, using the traditional definition of the word ("student or expert in science", Thompson, 1996:814), is small. A relatively small and connected population group is a recurring theme in any research involving Māori or Māori communities. This statement also holds true for Māori in the science sector. As a consequence anonymity of participants

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<sup>22</sup> This approach facilitated a clear understanding of the differences between indigenous knowledge systems and western science, and the similarities between supposedly unique indigenous knowledge systems

could not be guaranteed. Māori scientists selected for this project may therefore have had knowledge of each other.

In this research, the sample size itself is also very small, which places limits on generalisation of information. However generalisation is not the intent of this project rather documentation of a range of perspectives related to the interfaces is.

In the initial stages of the research it became clear that 4-6 Interviewees would be manageable and that it would be expeditious to select these solely from within the ranks of Aotearoa NZ's Crown Research Institutes. The author is an employee of this network and this provided relatively easy access to potential interview subjects. However only two of the four scientists interviewed for this research worked fulltime in a Crown Research Institute and only one of these is PhD qualified from an overseas institution (Interviewee 4). The other has had no formal university training in western science though has advanced up the ranks of the organisation to become a senior researcher with networks in the Māori community (Interviewee 2). These two Interviewees between them have 50 years experience in the Aotearoa NZ RS&T system and at one time or another have been colleagues of the author. A third interviewee is a recent PhD graduate and has had 2 years experience as a practising scientist – she no longer considers herself to be a scientist and continues to work in a university in another role (Interviewee 1) that is only indirectly related to science. This feature of the Interviewees background highlights what may be a tendency by Māori scientists to advocate for mātauranga māori from the margins of western science, or at the interfaces with and between mātauranga māori and western science. The fourth and least western science experienced interviewee represents a new generation of Māori scientists with only basic knowledge and experience of mātauranga māori and Te Ao Māori (the Māori world). This interviewee works at the interfaces between mātauranga māori and western science in an area of research that is highly topical both in Te Ao Māori and Aotearoa NZ society in

general. This has encouraged her to engage with her iwi and attempt to re-discover her Māoritanga (Interviewee 3).

The sample group was not selected based on experience in either mātauranga māori or western science, nor on how knowledgeable the participants were about mātauranga māori. It is likely that other Māori scientists in the general population inhabit similar realities, that is, they are also not particularly fluent (though may be interested) in either te reo or mātauranga māori. One criticism may be that no Māori scientist with a strong background in mātauranga māori was selected to be interviewed, this is a valid criticism though the sample groups characteristics also reflect the diversity of skills possessed by Māori scientists and possibly the difficulty in gaining access to more knowledgeable or experienced Māori scientists<sup>23</sup>. The research is designed to expel the myth that all Māori who participate in science, or Māori scientists for that matter, are necessarily fluent speakers and/or specialists with regard to mātauranga māori. This expectation by non-Māori scientists (that every Māori scientist must be a te reo māori and tikanga māori specialist simply by virtue of their heritage) is difficult enough however when it is also expected of Māori scientists by their Māori peers it is particularly challenging. A sample size of four cannot be regarded as characteristic of Māori scientists in Aotearoa NZ, however the sample used in this research was never meant to be representative.

The sample selection was biased (unintentionally) in several respects most notably in regard to gender and the Interviewees' knowledge of mātauranga māori. On the flip side of this the Interviewees also represented individuals at different stages of their career and with what could be reasonably described as varying levels of experience of western science. A feature of the research was that of the four Māori scientists interviewed two are relatively young and in the

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<sup>23</sup> On one occasion attempts were made 3 times to gain access to one senior Māori scientist and when finally an appointment was made, the prospective interviewee failed to attend the interview. This merely exposes the demands that are often made on Māori scientists both because of their expertise in western science but also because of the lack of other Māori scientists who can undertake some of their duties.

formative stages of their careers, while the other two are more experienced and could be assumed to be wiser to the nuances of the Aotearoa NZ research science and technology system. This itself is a comment on the level of interaction at the interfaces between mātauranga māori and western science – as the numbers of Māori scientists increase it is possible that their breadth of experience and knowledge of mātauranga māori and western science may also increase.

The interview group did not extend to non western-science trained experts in for example mātauranga māori, nor did it extend to non-Māori scientists or non-scientists. This feature reflects one of the research goals to promote the viewpoint of the Māori scientist in wider discussions about the interfaces between mātauranga māori and western science. It is the authors opinion that this view is sometimes marginalised in discussions about the interfaces between mātauranga māori and western science. The failure to include these groups will have influenced the results of the research and will have unintentionally marginalised the viewpoint of those outside the interview group. It is the authors contention that this does not necessarily invalidate the research, rather the methodology has allowed the viewpoint of a group of Māori scientists seldom heard from regarding their experiences of the interfaces between mātauranga māori and western science. While the interview group is small a good balance of viewpoints and opinions was achieved. The ultimate composition of the interviewee group is a reflection of the interviewers' background and bias as a Māori western science trained scientist with several years experience in a Crown Research Institute and a limited Te Ao Māori background. The research topic reflects the interviewers interest in mātauranga māori as a tool for the transformation of Māori and Aotearoa NZ individuals, communities and organisations for the 21<sup>st</sup> century.

## **Interview Questions**

The literature review provided ample amounts of material to develop interview questions and also allowed good insightful responses to be obtained from each interviewee. This pool of questions (Appendix 3) related to:

- Māori concerns about western science;
- the nature of past and current interaction between Māori and non-Māori at the interfaces with and between mātauranga māori and western science;
- the benefits and risks of interaction for Māori and for western science in Aotearoa NZ;
- Māori participation in western science, and
- the potential to include Māori values in western science.

The last subject generally elicited some agreement about the difficulty of practically integrating some Māori values into scientific practice and the risk of such an integration appearing to be token to outsiders.

## **Interviews**

Interviews (which involved the interviewee and the interviewer only) were generally run freely. Conversation was often begun by the interviewee and with little initial prompting from the interviewer. However on occasions when the stream of consciousness (of the interviewee) faltered or ceased, questions from the pool were used to generate further discussion or elicit comments. Interviews generally lasted no longer than 2 hours and all Interviewees were given the opportunity to follow up or clarify any opinion or subject raised during the interviews by phone. This was taken up on at least one occasion by Interviewee 4 and once by Interviewee 1. The information sheet, consent form and question schedule are included as Appendices 1, 2 and 3 respectively. Prior to the interviews being confirmed and then taking place the information sheet and consent form were posted to each interviewee who were then asked to confirm their interest. On some occasions they may have been verbally asked prior to

this. Once agreeing to participate at the interview, the information sheet was again presented to the interviewee and they were asked to sign the consent form. Interviews were recorded and transcribed verbatim by the author over a period of about 6 months. Clarification of points raised during the interviews was sought when necessary from the respective interviewee.

It is also notable that all four Interviewees displayed some eagerness to contribute to this research. The fourth interview consisted of some discussion around what mātauranga māori is, how the interviewee understood the concept and whether or not this conception aligned with that of the interviewer. This discussion was not about defining mātauranga māori or about besting each others descriptions or understanding, rather it enabled the interviewer to understand better the point of view of the interviewee and vice-versa. Each interview produced upwards of 25 pages of transcribed notes which were sent to Interviewees for their comments and if necessary alterations. Permission was also sought at this time (and in the consent form) to use quotations from each interview. One interview (Interview 4) had to be cut short owing to prior engagement of the interviewee however it was later picked up again via telephone link and subsequently completed.

## **Analysis**

The analysis process involved identifying reoccurring themes in the interview transcripts. These themes were then considered in relation the the harms framework that was introduced in chapter 2 and the potential for greater collaboration between mātauranga māori and western science. The results are presented in Chapter 4.

## 4.0 Results and Analysis

This research was an opportunity for Māori scientists actually participating at the interfaces to speak for themselves on their observations and experiences in the field and at the interfaces with and between mātauranga māori and western science.

A thematic analysis was carried out to identify common themes from each interview related to the interviewees personal experiences of working in the science sector and considering the relationships between mātauranga māori and western science.

The interview schedule was divided into five sections:

- Māori concerns about western science;
- the nature of past and current interaction between Māori and non-Māori at the interfaces with and between mātauranga māori and western science;
- the benefits and risks of interaction for Māori and for western science in Aotearoa NZ;
- Māori participation in western science, and
- the potential to include Māori values in western science.

The results are reported in relation to each of the five sections named above.

## **Māori Concerns about Western Science**

### **Western Science**

Interviewees made several comments about the number of shortfalls in Aotearoa NZ's RS&T system. Interviewee 4 referred to multiple dysfunctionalities that he saw at the interfaces with and between mātauranga māori and western science. Some of these were related to the science process itself: seeking and applying for funding; onerous reporting requirements, and inadequate funding. These are common generic complaints about research science and technology in Aotearoa NZ that based on the authors' experience are also made by non-Māori scientists. The last complaint specifically referred to the lack of funding provided for Māori or Māori related RS&T. Interviewees 2 and 4 indicated that non-Māori scientists also experienced difficulties when applying for funds for Māori-related or supported RS&T. The suggestion is that the current Aotearoa NZ RS&T system constrains the delivery of RS&T outcomes to Māori communities. Interviewees 1 and 3 (the two younger Interviewees) were particularly enthusiastic about delivering RS&T outcomes to their communities. Interviewees 2 and 4 (the two more experienced Interviewees) indicated that they were also enthusiastic about delivering RS&T outcomes to Māori communities though their energy for this had depleted long before due to the demands of their science careers.

Interviewee 1 was concerned about the general lack of support for scientists in Aotearoa NZ and at least once during the interviews commented on the challenging conditions that scientists in Aotearoa NZ must work in. This concern was held in common with the other Interviewees. The 'employment conditions' of scientists seems to be an established (almost customary!) hazard associated with doing RS&T in Aotearoa NZ, that is the shortfalls referred to in the previous paragraph. It seems to be accepted by Aotearoa NZ scientists and as a subset, Māori scientists, that there are systemic issues in Aotearoa NZ science that make their careers difficult as a matter of course. These comments may reflect a general feeling among the Aotearoa NZ RS&T community that science is not

valued in Aotearoa NZ. It also reveals a context that all scientists must overcome in order to participate at the interfaces between mātauranga māori and western science. The four Interviewees were aware that they operate within a larger reality – as participants in a larger western science system – that has potential to support or hinder their own aspirations which were in general to benefit Māori, “... *the reason we became scientists was to benefit our people in some way.*” (Interviewee 3).

Interviewees are prepared to tolerate what might be called systemic procedural challenges at the interfaces with and between mātauranga māori and western science in order to fulfil their passion for RS&T and their aspirations to help their people.

### **Antipathy towards Western Science**

While all Interviewees understood the utility of western science in terms of how it could contribute to Māori development there was also an underlying distrust of western science among the Interviewees. Interviewee 2 was the most concerned of the four Interviewees about the implications of this distrust for the ability to encourage and recruit young Māori into western science (not necessarily to undertake interfaces research), “... *take that knowledge back, and hopefully it can lead to economic development, jobs, based around that industry.*” (Interviewee 3).

It is difficult to blame this antipathy on a particular cause though some of the Interviewees suggested that it stemmed from the colonisation of Aotearoa NZ; accumulated harms since that time, and inherent racism<sup>24</sup> within the current

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<sup>24</sup> Racism is such a polarising word and issue that the author feels that it is important to make the note here that the racism referred to by the Interviewees, in particular Interviewee 4 and Interviewee 1 is institutional racism, seen by the Interviewees as a legacy of colonisation and assimilation. This may not be a western science specific concern though according to these Interviewees it is clearly having an impact on their careers. For example the reluctance to engage with Māori communities or organisations to undertake research science and technology, due to a perceived lack of funds by these organisations – despite obligations under the Treaty of Waitangi - may be classed as institutional racism. The perception that Māori students do not study western

Aotearoa NZ RS&T system, *“The interface(s) creates a lot of dilemmas and challenges for Māori because of the colonial connotations associated with it.”* (Interviewee 1).

Interviewee 1 as well as being cynical about the possibility of sincerely integrating mātauranga māori (with western science) into the interfaces, was also enthusiastic and referred to them as a land of opportunity. She acknowledged the colonial connotations associated with this description and the risks of exposing mātauranga māori (to non-Māori) at the interfaces.

There are a couple of concerns held by Interviewees that are indicated in these comments. One is regarding an observation by Interviewee 3 that some Māori families and/or communities reject western science out of hand and demonstrate strong disrespect for both higher learning and in particular western science:

*I actually think it's something that Māori in the past, many Māori families have not supported or valued higher education. I put a certain degree of it back on families themselves because I think sometimes we get, ... it's too easy to blame this system that's out there not being supportive. I think some of that's crap actually and I think some of it's just a lack of respect for that level of education.* (Interviewee 2)

The other concern is for how antipathy about western science may discourage young Māori from pursuing careers in western science and the downstream impact of that on Māori ability to achieve critical mass in terms of the scientific workforce. The Interviewees considered that antipathy towards western science within the Māori community has potential to derail Māori development aspirations and opportunities in the future.

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science may also be classed as institutional racism if it prevents an organisation from employing more Māori science students and thus contributing to the creation of a pool of Māori western trained scientists. The author has experienced on several occasions negative responses from non-Māori scientists who simply do not believe or understand that Māori are either capable of participating in western science as scientists or that Māori scientists are representing across the entire western scientific spectrum of disciplines and fields from physics and chemistry, to what Interviewee might term a controversial technology, nanotechnology.

### **Epistemological Tyranny**

The Interviewees complained about general employment conditions; persisting negative attitudes to Māori and mātauranga māori by some non-Māori scientists (Interviewee 1, Interviewee 2) and more importantly by non-Māori science bureaucrats (through ignorance or in some cases and to varying degrees, ambivalence (Walker, 1996)), and the assumed superiority of western science.

These concerns resonate well with Semali and Kincheloe's (1996) description of epistemological tyranny (Figure 2, p.39) and Apfell-Marglins comments regarding the domination of indigenous knowledges by western science (1996). Other concerns were less about the process of science and more about the attitudes and respect of scientists and science organisations for the value of mātauranga māori:

*The concern that comes to mind, having been inside (western science) and then crossed over so to speak, is that there is a looking down on mātauranga māori that's not just coming from, but is ingrained in scientists. ... But it's not just mātauranga māori... I think it's a lack of appreciation of different viewpoints, on different philosophical standpoints that New Zealand scientists in particular seem to have. (Interviewee 1)*

The Interviewees felt that not enough weight was given to mātauranga māori within the Aotearoa NZ RS&T system. Indigenous methodologies or data collected by Māori over several generations using them (intergenerational knowledge) and this type of information was often excluded from consideration especially when non-Māori scientists were researching solutions to issues relevant to Māori society.

There was a general feeling that to a certain extent Māori had been stereotyped concerning the kind of RS&T they are capable of or even interested in undertaking. The Interviewees considered that in some cases this inhibited any

progress Māori have made in regards to increasing the numbers of Māori in the RS&T workforce. For example Interviewee 4 frequently said that as a Māori you had to go 'against the grain' to be a scientist, and that circumstances (for example, peer pressure) converged on young Māori at age 13 -14 when they just 'fell out of the system'. These comments were also supported by Interviewee 2.

The interviews indicated that several characteristics of the interfaces with and between mātauranga māori and western science converge to create an environment where Māori scientists feel uncomfortable with how mātauranga māori is accepted (as a valid interpretation of knowledge) at the interfaces. These convergences are comparable to epistemological tyranny if they prevent the progress and expansion of mātauranga māori ways of doing at the interfaces.

### **Epistemological Contingency**

Abrams et.al. (2003) wrote about the division of western science and religion, this seemingly uncomfortable arrangement (especially considering that several leading advocates of western science (for example Sir Isaac Newton) were also significant advocates of religious ideals) seems to have been reached by agreement between both camps (religion and western science).<sup>25</sup> What is significant is that this agreement has persisted to contemporary times.

The comments from the Interviewees suggest that this division may no longer be relevant or valid in the 21<sup>st</sup> century, and it may even prevent Māori and other indigenous peoples from participating at the interfaces. There is now a push for greater recognition of other ways of doing in the western scientific worldview, or at least an acknowledgement that western ideals no longer hold pre-eminence at the interfaces or in knowledge determination in Aotearoa NZ. There was also a general feeling among the Interviewees that western science needed to be

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<sup>25</sup> Abrams et.al. referred to it as a non-interference pact. I would point out here that since colonisation, Māori and non-Māori who are taught western science whether at school, tertiary level or who are employed in this field have most likely never known science and religion to be anything other than separate. Conversely prior to and since colonisation, mātauranga māori continues to be endowed with spirituality.

integrated with indigenous knowledge systems (mātauranga māori) to be able to make itself relevant to indigenous peoples (Māori).

At least one author cited in the literature review (Semali & Kincheloe, 1996) suggested that the integration of indigenous knowledges into western science should be considered within local RS&T systems. The Interviewees also promoted the integration of mātauranga māori and Māori principles, values and ways of doing with western science as a form of epistemological contingency for mātauranga māori. They saw the attraction of combining the best methods and practices of western science with those from mātauranga māori to achieve a better way of doing for Aotearoa NZ, “... *participation will actually help preserve tikanga, preserve the traditions around the knowledge ... getting knowledge and providing new ways of passing that knowledge down.*” (Interviewee 4).

Akabogu (2003) clearly indicated indigenous desires not to exclude western scientific ideas from indigenous knowledge systems - that would be ‘throwing the baby out with the bath water’. A number of indigenous knowledge advocates have promoted the use of indigenous knowledge to complement western science and for development (Warren, 1992; Ulluwishewa; 2003). The four Interviewees concurred with this view and advocated a more effective integration of mātauranga māori with western science at the interfaces as a key strategy for Māori development and for significantly improving the ability of western science to benefit Aotearoa NZs’ citizens.

### **Domination by Western Science**

The Interviewees expressed concern about western science dominating ways of doing in Aotearoa NZ to the detriment of mātauranga māori and other systems of knowledge. There were concerns about the relevance of mātauranga māori to Māori and non-Māori in a world (increasingly) dominated by western science. Interviewee 4 considered the integration of mātauranga māori with western

science as a logical pathway to achieving its sustainability, use and relevance in the 21<sup>st</sup> century.

Interviewee 4 spoke about how mātauranga māori and western science may potentially evolve into a blended or hybrid knowledge system:

*There may well be a lot of blending (of knowledge systems) instead of becoming an alternative worldview in its entirety (mātauranga māori) it may actually be something that's not quite as diametrically opposed to western science as we might think. (Interviewee 4)*

Interviewee 4 mentioned concern that the learning of mātauranga māori was taking place more and more within a western scientific paradigm (in order to both sustain it and to promote its (widespread) use by Māori and non-Māori). He suggested that this well-intended practice may ultimately compromise the mauri of mātauranga māori and the retention of Māori values and tikanga, *"I would use the term insidious, all these Māori being educated in a pākehā pūtaiao, and it actually becomes the framework"* (Interviewee 4).

Interviewee 1 was concerned about the potential for mātauranga māori to be mined or subsumed within the more dominant western science system which would do little to support Māori science development. She implied that mātauranga māori might be marginalised more in this scenario than it already is:

*I just think we need to tread carefully lest we chase the mātauranga māori out of the interface(s). I think there's a danger that if we're trying to see what's at the interface(s) but looking from the western side of that, ... then we're actually using western science to mine matauranga māori, we're not looking at a middle ground anymore. I'd just be weary of people that are wanting to do research projects at the interface(s) but they're coming from, they're not using the tools from both ends... and I guess I'm really thinking about non-Māori. (Interviewee 1)*

The concern seems to be that by nurturing mātauranga māori within a mainstream paradigm, the resulting mātauranga is not actually mātauranga māori but some bastardised conception of it. The Interviewees all said that many of the principles of western science have also been long-standing principles of mātauranga māori. They indicated that they were willing, even keen to pursue the evolution of mātauranga māori (or mātauranga Aotearoa) by the incorporation of other western scientific principles on this foundation of shared values.

### **Loss of Values**

Several authors (Akabogu, 2003; Githaiga, 2003) referred to in the literature review indicated concern about the loss of indigenous values by indigenous youth. The message from the Interviewees seemed to be that the integration of mātauranga māori may be a valid strategy to prevent Māori science students from becoming disconnected from Māori principles and values (and tikanga), and from disregarding western science (Interviewee 4) as a valid and important pathway for Māori development. This strategy is not just important regarding Māori participation in western science, it is also vital for Aotearoa NZ in terms of finding ways to develop skilled employment opportunities for Māori and Pacific Islanders.

Chapter 2 referred to a new Aotearoa-focussed way of doing called mātauranga Aotearoa, Interviewee 1 also referred to an Aotearoa-focussed kind of knowledge that would result from sincere integration of western science with mātauranga māori:

*there are many projects out there that haven't really been tapped into because Māori are still kaitiaki of that knowledge ... if you were to release the floodgates you'd have a really dynamic and Aotearoa-focussed kind of science. (Interviewee 1)*

There was an associated concern held by Interviewee 1 and reinforced by the other Interviewees regarding the potential exploitation of mātauranga māori at the interfaces by non-Māori who do not 'use the tools from both ends' – mātauranga māori and western science. Interviewee 3 was concerned about how non-Māori and Māori were accessing mātauranga māori and how tikanga and other ethical requirements were being met. This interviewee was particularly concerned about consultation:

*I know that universities are making an effort to have consultation and have iwi involved, but I don't know if it works. Whether the Māori people involved, whether they feel like they are involved or whether they feel like it was just token, I'm a little bit worried about that. (Interviewee 3)*

The Interviewees suggested that the integration of mātauranga māori with western science is a valid approach to promote the retention of Māori values and ways of doing at the interfaces. This strategy also has the upside of making the interfaces more attractive places to be not only for Māori but also for other ethnic groups in Aotearoa NZ. It could be an effective strategy to increase the diversity of Aotearoa NZs RS&T workforce, differentiating it from other RS&T workforces around the world and capturing as yet unrealised talent and innovation from within Aotearoa NZs diverse ethnic communities.

### **Education and Training**

The Interviewees were concerned that a proportion of non-Māori scientists (and a growing proportion of Māori scientists) may not have good access to sources of mātauranga māori skills or knowledge to support their career development. Interviewees 1 and 2 were critical of the ability of western-trained non-Māori scientists to effectively undertake RS&T at the interfaces between mātauranga māori and western science and deliver results to Māori. They felt that non-Māori scientists received inadequate training about mātauranga māori, māori values and tikanga to effectively participate at the interfaces.

Interviewee 1 seemed to automatically assume that Māori scientists are naturally endowed with skills in and knowledge of mātauranga māori. Interviewee 3 suggested that there may also be a need for complementary mātauranga māori skills and knowledge training to be given to Māori science students, *“I don’t know, would you be able to explain mātauranga māori to me? Or is there like, cos I don’t really know”* (Interviewee 3).

Interviewee 4 repeated the idea that Māori (scientists) may be naturally endowed with ethics specifically regarding the development of what he termed irresponsible technologies. The Interviewees seemed to be inadvertently suggesting not that non-Māori scientists were unethical but that Māori scientists have superior ethics, *“... tikanga Māori is ingrained in many Māori and it kind of gives them a kind of internal check on the development of irresponsible technologies”* (Interviewee 4).

Interviewee 3 (acutely aware of her own lack of mātauranga māori skills and knowledge) claimed that based on her experience there was also a general lack of mātauranga māori skills and knowledge among her Māori science student colleagues:

*I would probably say that my knowledge of mātauranga māori is fairly sparse. I had the experience of going to a wānanga last week where we discussed some of these issues with other Māori scientists ... and we all had sort of varying knowledge.* (Interviewee 3)

Interviewee 3 also revealed a passion for learning about and understanding Māori values, tikanga and mātauranga māori as a part of her career development. She suggested that this was not an uncommon feature among her colleagues.

### **Scientific Literacy**

Interviewee 2 highlighted low levels of scientific literacy among Māori individuals and within Māori communities at the interfaces between mātauranga māori and western science, *“It’s important for Māori to participate in science because, ... it concerns me that if you are going to enter into that debate you also have to know what you are talking about”* (Interviewee 2).

While all Interviewees noted the importance of Māori studying and doing science and the significance of a Māori scientific workforce in the 21<sup>st</sup> century, they also noted that the Māori community itself needed to become western science literate in order to successfully participate at the interfaces and in Aotearoa NZ society. Interviewee 2 suggested that in her view Māori sometimes resorted to the use of polemic – unsubstantiated, often irrational and controversial opposition – as an excuse to not participate in RS&T. This served only to frustrate non-Māori scientists who according to Interviewee 2 would then be empowered to ignore further attempts by Māori to engage with western scientists.

There was agreement among the Interviewees that an understanding and working knowledge of western science and how it is integrated with mātauranga māori, is a critical skill required for Māori development in the 21<sup>st</sup> century. The Interviewees were concerned that while there are excellent examples of some successful Māori scientists in Aotearoa NZ and around the world, Māori (or non-Māori) scientists that possess both skills sets are rare.

### **Expressing Mātauranga Māori**

At least two Interviewees were concerned about their ability to freely express mātauranga māori, tikanga māori and Māori values within their workplaces. One interviewee questioned whether it was appropriate to express her mātauranga māori in the laboratory in the first instance and if so, how and when it was appropriate to do so:

*I have had to kill mussel samples, ... you know sacrifice samples and I have personally felt uncomfortable with that and wasn't really sure why and I think it might have to do with (whakapapa). So I ... I don't know any prayers or anything but before I cut them I kind of say 'sorry you guys this is for the greater good', and then I'll start cutting. (Interviewee 3)*

There was a lack of confidence shown by this interviewee both in terms of what was the appropriate tikanga for her to follow and if it was acceptable behaviour in a laboratory situation. This lack of confidence may stem directly from her apparent low level of understanding of mātauranga māori despite her enthusiasm to learn more about it, and highlights a training need for Māori and non-Māori science students. The concern she demonstrated to get these things correct complements the concern she also raised about the lack of mātauranga māori skills and knowledge of her colleagues.

Interviewee 4 raised concerns regarding how his organisation acted in two different circumstances where he felt an approach more consistent with tikanga Māori might have achieved a better outcome (for example his expression of manaaki was looked down upon by his colleagues). He was admonished in one case when he chose to support a Māori colleague in his organisation. He also questioned when the organisation he worked for stopped employing the children of staff members over school holidays on the basis that it was favouritism/nepotism; Interviewee 4 felt strongly that this practice was consistent with whanaungatanga.

Māori scientists at the interfaces may lack confidence to express mātauranga māori values and tikanga, this is also significant because the four Interviewees all expressed a desire to incorporate more mātauranga māori, tikanga māori and māori values into their work. This lack of confidence may be a result of poor understanding of mātauranga māori (as for Interviewee 3), a situation that is exacerbated by a lack of mātauranga māori training and education at the

interfaces between mātauranga māori and western science. The Interviewees agreed that this must be addressed if the potential of the interfaces are to be fully realised for the benefit of Māori and all Aotearoa NZ.

### **Attitudes and Respect**

Interviewee 2 raised concerns about how much attitudes and respect for mātauranga māori by western science and western-trained scientists had changed over the span of her career. She noted that while attitudes and respect for mātauranga māori may have changed superficially, she was concerned that beyond that outdated and negative attitudes towards mātauranga māori and about Māori participation in western science remained. While change was coming Interviewee 2 had concerns about its sincerity and alleged that a common practice in the past at least was to, "*rent a Māori*" when one was required in order to gain funding. This suggests that there is still a level of reluctance among non-Māori scientists to engage productively and genuinely both with Māori scientists and Māori communities to do RS&T. While government policy may be to support Māori science development, the best plans are sometimes thwarted by those meant to carry them out:

*I suppose it goes into the whole thing of trying to make a lot of systems more relevant for Māori, I guess whether its health or education or whatever, and maybe in the end science ends up being dragged perhaps kicking and screaming into that. (Interviewee 2)*

At least two Interviewees also referred to their concerns about a lack of respect shown by Māori towards higher education in general and western science in particular. Interviewee 4 made the comment that during his training to be a scientist he felt he constantly had to go against the expectations of his whānau. He also suggested that this may have contributed to his determination and passion to be a Māori scientist, "*To actually get involved in science ... you have to go against the grain, ... that's not a bad thing necessarily, but I don't think its optimal*" (Interviewee 4).

Interviewee 4 seemed to be suggesting that conditions are not optimal for Māori who choose western science or for that matter the interfaces. While some Māori achieve their goals, often beyond expectations and despite numerous difficulties (Interviewee 4 referred to these as dysfunctionalities at the interfaces with and between mātauranga māori and western science), according to the Interviewees this is not the best way to maximise opportunities and Māori potential for Māori development or Aotearoa NZ development.

### **Māori Innovation**

Interviewee 2 had a concern about the ability of Māori to innovate into the 21<sup>st</sup> century. Some discussion was had during this interview about the innovation record of Māori at least since colonising Aotearoa NZ and Interviewee 2's remark was that this characteristic of the interfaces was being lost, possibly as a result of the dominance of western science since colonisation and assimilation. She suggested that some Māori appeared to have little motivation to change (regarding how they think and apply knowledge) and are stuck in a paradigm (mātauranga māori dominant) that is their preferred way of doing, *"I do think that a lot of (Māori) people now are actually quite stuck. And I think that some of the suspicion of science can come from people who are stuck"* (Interviewee 2).

This characteristic of the interfaces is a particularly worrying one in a time when innovation and creativity are seen as pivotal features of a successful and developed economy. Except for the comment from Interviewee 2 about some Māori being stuck at the interfaces, the other Interviewees were especially proud of their observations about the innovation capacity of Māori at the interfaces. They agreed that this innovation capacity will be beneficial at the interfaces, to Māori development and to Aotearoa NZ society as a whole.

## **The Nature of Past and Current Interaction Between Māori and Non-Māori at the Interfaces**

### **Understanding the Interfaces**

Most of the Interviewees were uncertain about the interfaces, where it was, what it was and what happens or should happen there? This seemed to partly be a result of the interview style (Chapter 3) however all Interviewees recognised that there were at least two ways of doing at the interfaces – namely western science and mātauranga māori. Some Interviewees said they did not know if there even was an interface. They had never experienced an interface, nor had little involvement there other than as a western trained scientist or science student:

*I haven't really seen them as interfacing at all. (Interviewee 1)*

*Currently there's not much of an interface. (Interviewee 4)*

*I don't know if there is much of an interface. (Interviewee 3)*

The author interpreted some of these comments more as criticisms about the lack of interaction at the interfaces rather than as observations about the lack of an interface as such. Often an interviewee would deny the existence of the interfaces then immediately go on to complain about how there was little interaction between Māori and non-Māori and poor integration of mātauranga māori with western science at them. All Interviewees noted that the extent that they considered mātauranga māori and western science to be interacting was at best poor:

*that's a tricky one because I haven't really seen them as interfacing at all. I've kind of seen it as you know you do the one or you do the other one, I just feel that there's not really a lot of scope from where I sit to marry them in. (Interviewee 1)*

While most Interviewees seemed to recognise (even if only subconsciously) only a single interface they noted that there were various ways that Māori and non-Māori, mātauranga māori and western science and Māori and western science

organisations interacted across it. This helped inform the author's conception of multiple interfaces (Chapter 2).

The Interviewees' understanding of the interfaces seems to require augmenting or supporting if they and their colleagues (Māori and non-Māori) are to improve interaction between themselves and their organisations to maximise the potential of the interfaces for the benefit of Māori and Aotearoa NZ. The Interviewees all supported the idea of further training at the interfaces to support their western science and mātauranga māori skills and knowledge. Their comments seem to also indicate a need to increase their understanding of ways of doing at the interfaces as knowledge from at least two points of reference (western science and mātauranga māori), and for how those systems of knowledge can be integrated to develop innovative and unique solutions, rather than from a single framework (for example western science).

The kind of understanding proposed here is similar to that philosophical-type education said by Interviewee 1 to be lacking at the interfaces with and between mātauranga māori and western science. The Interviewees clearly articulated a need for further training in mātauranga māori skills and knowledge for participants at the interfaces, and ongoing western science training is a given as well. The interfaces have more exciting challenges and opportunities than either mātauranga māori or western science alone and the Interviewees suggested that they cannot be captured or translated into benefit for anyone if either western science or mātauranga māori continue to maintain a singular understanding of ways of doing.

### **Lack of Appreciation of Other Ways of Doing**

The Interviewees all commented on a lack of appreciation and general failure on both sides of the interfaces to acknowledge the value and worth of either knowledge system. Interviewee 2's comments regarding the use of polemic and the sometimes outright rejection of western science as a tool (see previous

section) for Māori development and benefit revealed the reluctance of some Māori – stuck on the traditionality of mātauranga māori (Interviewee 2) – to change. Interviewee 2 in fact suggested that this reluctance may contribute to what she sees as a lack of innovative capacity among some Māori at the interfaces. She was the only interviewee to put the inability of Māori to innovate – at least at a comparable level to how they used to innovate in the 19<sup>th</sup> century - this bluntly. Others indicated that the reluctance by some Māori to interact with non-Māori or scientists in general at the interfaces was stifling opportunities for development that could benefit all parties. Interviewee 1 has already been cited as suggesting that the interfaces were a land of opportunity and used metaphors like ‘open the floodgates’ to allude to the size of the potential advantages that could be gained if mātauranga māori and western science ways of doing interacted more at the interfaces.

The lack of acknowledgement and sometimes rejection of either mātauranga māori or western science was an easily identified feature of the interfaces. It was seen by the Interviewees as a stand-out tension at the interfaces between mātauranga māori and western science that prevented Māori (and non-Māori) from realising their potential for Aotearoa NZ development. This tension was clear despite support among the four Interviewees for greater integration of mātauranga māori and western science. It could be seen as an outcome associated with a poor level of scientific literacy at the interfaces – this characteristic of the interfaces between mātauranga māori and western science has also been mentioned in the previous section about concerns at the interfaces. It is almost as if the Interviewees are seeking to push Māori towards this end game (a more integrated way of doing at the interfaces) to create space where Māori scientists and researchers can comfortably interact using the tools from both ends (Interviewee 1) and the ways of doing of both mātauranga māori and western science. In this space support would be forthcoming for Māori scientists at the interfaces from all participants.

This feature of the interfaces may create tension between those Māori who do participate at the interfaces (for example some Māori scientists) and those who do not. Interviewee 4 who suggested current or aspiring Māori scientists were often required to go against the grain, was aware of this tension as were the other Interviewees. The Interviewees also suggested that this tension plays a role in encouraging better performance by Māori both in western science and at the interfaces, however it does little to support greater participation by other Māori who may be less well equipped to deal with this kind of peer pressure.

Interviewee 3 related how when she returns to her whānau and talks about her research with them she sometimes feels as though they do not really understand what it is she does, though nod appreciatively to convey their approval and unconditional support (āwhina). There is a tension between her and her whānau which arises because of a lack of scientific literacy generally within the Māori community. It is clear that Māori scientists need to be better supported in their choices at the interfaces by the leaders in their communities. More than this they also need to be seen being supported by Māori community and business leaders, by their peers to shore up Māori performance and endurance at the interfaces between mātauranga māori and western science. The Interviewees suggested that more overt support may also encourage greater participation by those (Māori) who perhaps do not appreciate the significance of Māori participation at the interfaces or the import of their own contribution to ways of doing at them.

### **Tokenism**

Existing mechanisms in the Aotearoa NZ science curriculum were not investigated as a part of this thesis. Their effectiveness to encourage Māori participation at the interface between mātauranga māori and western science, or increase the overall level of Māori responsiveness was greeted with scepticism by the Māori scientists interviewed. Interviewee's 2 and 4 made pointed reference to tokenism when discussing efforts made to integrate mātauranga māori ways of doing, increase Māori participation or raise the level of Māori

responsiveness within Aotearoa NZs' RS&T institutions, *"It's just like saying we've got this brown face, we're just a coconut organisation ... inside its all peachy white"* (Interviewee 4).

Interviewee 2 suggested that in the past non-Māori scientists and science administrators had to be dragged kicking and screaming into it (taking account of mātauranga māori, tikanga, māori values and being responsive to Māori):

*I suppose it goes into the whole thing of trying to make a lot of systems more relevant for Māori, I guess whether its health or education whatever, and maybe in the end science ends up being dragged perhaps kicking and screaming into that. (Interviewee 2)*

Her observation that this scenario in her workplace and among her colleagues was becoming scarcer was tempered with the comment that tokenism was still a feature of the interfaces in the 21<sup>st</sup> century. The interviewee expressed surprise at the amount of tokenism that still occurs within the Aotearoa NZ RS&T system though most Interviewees seemed to regard it as a persistent characteristic of interaction between māori and non-Māori at the interfaces and expected to experience instances of it within their normal working lives.

It is significant that all Interviewees had experienced tokenism to some degree. The two more experienced Interviewees had more institutional knowledge of the practice though the younger Interviewees also had strong opinions about it at the interfaces with and between mātauranga māori and western science. The Interviewees were realistic about its persistence though also agreed that for the interfaces to reach their potential for either Māori or Aotearoa NZ development, tokenism had to be reduced as much as possible and the interfaces had to be made more inclusive.

### **Learning Mātauranga Māori at the Interfaces**

Interviewee 3 said that Māori science students tended to separate their western science training from learning about and understanding māori language, values, principles and mātauranga māori:

*I think there are issues there and rather than dealing with them I think I have separated the two which is probably not a good thing, but it is a common tactic ... we do sort of separate them (mātauranga māori and western science) out but I am now making a conscious effort to reconcile the two. (Interviewee 3)*

This comment highlights the need by Māori scientists, current and prospective, for greater levels of support with their communities both to up-lift their knowledge and engagement with mātauranga māori and the Māori communities they work in or were born into, and to understand its implications for the interfaces and how they execute western science there.

Interviewee 1 also made a similar comment regarding her conscious decision to return to university to learn about māori culture and society and to learn te reo māori, after her science studies. This is a similar pathway taken by the author during his science studies and further conversation with this interviewee about her choices discussed whether there was a tendency for Māori science students to be attracted back to learn about māori culture and society. While Interviewee 3 suggested that Māori science students 'separated them' even she indicated a desire to recover some knowledge of mātauranga māori after her formal science studies had ended.

Interviewee 3 seemed to have prioritised her training in such a way to maximise her education in western science, she also indicated that this was how the interfaces between mātauranga māori and western science at this level were treated by other Māori science students. Perhaps this is not an ideal scenario though it raises the issue of young Māori science students advancing into

western science at the interfaces with little knowledge of mātauranga māori, māori values or tikanga. Interviewee 1 indicated that until learning about mātauranga māori and interacting with the Māori community she felt she was missing out on something and her training was incomplete. The idea of missing out on something, or missing out on experiencing mātauranga māori seemed to be a common theme throughout the interviews. This perhaps indicates an incompleteness about western science (and maybe also mātauranga māori ) training that jeopardises the effectiveness of participants at the interfaces between mātauranga māori and western science.

Interviewee 2 was different from the other Interviewees in that she has never had formal western science training and has trained on the job for the last two decades. Interviewee 2 has risen through the ranks to become a senior member of her organisation, though acknowledges that this strategy is now almost extinguished as a pathway for Māori or non-Māori to get into western science. She said that she has learnt about mātauranga māori, tikanga and māori values because of the contacts she has developed throughout her career, and even for her when she began, her literacy in these areas was minimal. She admits that even now she is by no means an expert and defers to members of the Māori community's that she works with to guide her on these aspects of her work at the interfaces. Interviewee 4 also indicated his reliance on members of his whānau or community to augment his understanding of aspects of mātauranga māori, including his Māori science colleagues and other Māori researchers.

Interviewee 4 suggested that Māori must achieve their own solutions for increasing participation and integration with western science at the interfaces and suggested that second chance learning was a valid approach to increasing the numbers of Māori participating in western science. The pool of resourceful Māori in the community with skills that could be captured and applied in a western science context is great. Interviewee 4's comment was that these individuals also have skills and knowledge of Māori values, tikanga and mātauranga māori that

could benefit everybody at the interfaces between mātauranga māori and western science. The younger Interviewees suggested that this knowledge could even rub off on non-Māori scientists, somehow allowing them to become better participants at the interfaces with and between mātauranga māori and western science, *“Well yeah, just some of their... the way they conduct themselves and the way they interact, ... will rub off I think... and I think that’s really cool”* (Interviewee 3).

The combination of these ways of doing would be a (land of opportunity, Interviewee 1) source of innovation that the Aotearoa NZ RS&T system needs to discover to compete in the future with other like-minded countries. All of the Interviewees felt that while the Aotearoa NZ RS&T system has attempted to recently, it has not effectively realised this potential. Second chance RS&T training may be an effective way of up-skilling the Māori population to achieve a greater level of security against economic disruptions caused by global or national economic cycles beyond their control. Interviewees 2 and 4 especially recalled the economic recession of the 1980s and the impact it had on Māori in low-paid, relatively unskilled employment. There is a large community of potential scientists or science support workers (that is, technicians and other researchers) in the country that should be encouraged to participate both in western science and for the development of Aotearoa NZ, at the interfaces between mātauranga māori and western science.

### **Deception by Maori**

Interviewee 2 noted how the ability of Māori scientists to actually participate in science, to do science was improving strongly. This comment referred specifically to the ability of Māori to do western science which is slightly different to saying that the ability of Māori to participate at the interfaces is also improving. Comments from Interviewee 3 suggest that while Māori scientists may be studying and achieving in this area their mātauranga māori skills are not always comparable. Interviewee 4 made a comment regarding the potential for western

science to become the framework within which mātauranga māori is taught and practised, this phenomenon may be linked to the above comments from Interviewees 2 and 3.

There is some enthusiasm at the interfaces for the integration of mātauranga māori and western science practices, methodologies and ways of doing and there is a lot of pride from the Interviewees in what mātauranga māori can bring to the interfaces. The Interviewees all noted at least in passing that some non-Māori scientists and science bureaucrats support the integration of mātauranga māori and western science and see mātauranga māori as an integral part of Aotearoa NZ's future competitiveness on the global stage. However there was some feeling among the Interviewees, Interviewee 2 especially that some Māori non-scientists often deceived non-Māori scientists and sometimes even Māori scientists about the traditionality of their resources. Interviewee 2 implied that this tactic was sometimes used by Māori as an excuse for not participating in research or allowing access to their resources by scientists or other researchers. While she agreed it was probably an understandable tactic, she abhorred the practice as being anti-scientific and unconstructive. She also suggested it may have resulted in some Māori vehemently protesting the authenticity of a particular tradition associated with a resource when in fact this is incorrect, shown in some instances by peer reviewed research.

The practice of some Māori, of using mātauranga māori as an excuse to prevent research being undertaken on their resources is as unpalatable as the practice by some Māori (also commented on by Interviewee 2) of resorting to the use of polemic as a means of discouraging new or further engagement between Māori and non-Māori at the interfaces between mātauranga māori and western science. These characteristics are as much harms done to mātauranga māori at the interfaces as are colonisation and assimilation. In fact they may be described as an insidious form of protectionism (see Chapter 2). For Māori society as a whole to realise the potential of the interfaces for Māori and Aotearoa NZ development

the interviewees agreed that Māori individuals and communities must begin to put aside these kinds of negative and deceptive tactics.

## **The Benefits and Risks of Interaction for Māori and for Western Science in Aotearoa NZ**

### **The Changing Nature of Mātauranga Māori**

Interviewee 4 commented on the change of mātauranga māori as it comes into increasing contact with other ways of doing and as though change is a typical event in the development of ways of doing. He suggested that the most dynamic thing about the interfaces was mātauranga māori:

*I've been thinking about what mātauranga māori is, is it dynamic? I think it has to be dynamic to have it exist. However we define it, it has to have at some point an element of dynamism about it. Mātauranga māori for me is a dynamic thing. Certainly there is a lot of information that isn't dynamic that has already been learnt. I would characterise the interface(s) as being dynamic as well. (Interviewee 4)*

The term other ways of doing refers to the influence of western science on mātauranga māori. When the interviewees referred to the influence of western science on mātauranga māori, they seemed to set western science up as the evil other way of doing as though to blame it for all the bad things that have occurred at the interfaces. Some of the interviewees acknowledged that since colonisation mātauranga māori is increasingly being influenced by non-Māori ways of doing, *"Mātauranga māori is knowledge gained from Māori experience and interpretation – as Māori have become more experienced with pākehā pūtaiao then mātauranga māori will increase and change."* (Interviewee 4).

This comment can be interpreted as an indication of fear or apprehension about the impact of more and more western science on the survival and stamina of mātauranga māori. It can also be taken positively, showing that mātauranga

māori is constantly in a state of change and incorporating more and more western science principles and values into its way of doing. The exchange of information and knowledge shared across the interfaces with and between mātauranga māori and western science occurs almost by default. All Interviewees noted the changing nature of mātauranga māori at the interfaces and as it (as a way of doing) interacts with other ways of doing. They acknowledged the traditional aspects of mātauranga māori though also acknowledged and were excited by the transformative potential of mātauranga māori for the future development of Māori and Aotearoa NZ society. This has already been referred to in previous sections and was a recurring theme throughout the interviews. The thread of discussion in interview 4 focused on the current domination of knowledge generation, dissemination and application by western science to the detriment of mātauranga māori.

Interviewee 4 commented on the risk associated with this growth if mātauranga māori is allowed to expand unchecked and without Māori being able to control its course. Comments made by both Durie (1996) and Mutu (1994) referred to the real risk of mātauranga māori being interpreted wrongly by unskilled individuals, there is also a risk associated with it being interpreted in a way to support the goals and ambitions of those interpreting it. What these comments highlight is the preference of some Māori participants at the interfaces for control or rangatiratanga over the destiny of mātauranga māori. This was a constant theme of the interviews – the four Interviewees indicated that a lot of the troubles that occur at the interfaces are the result of Māori attempting to exert control over mātauranga māori in the face of the long established, rigid, society-sanctioned and supported paradigm that is western science. The Interviewees suggested that by fairly redistributing control over knowledge generation, dissemination and application at the interfaces some of these issues may simply dissipate.

### **The Growth of New Knowledge**

Interviewee 1 alluded to the potential that exists at the interfaces between mātauranga māori and western science for the growth and development of new and uniquely Aotearoa NZ ways of doing. She was a little more explicit about branding this new way of doing an Aotearoa-focussed kind of science. The author has described the outcome of the integration of mātauranga māori and western science at the interfaces as mātauranga Aotearoa. This concept is a little different to the outcome described by Interviewee 1 as it allows for a greater impression to be made by mātauranga māori at the interfaces, an Aotearoa-focussed kind of science implies that western science may continue to dominate at the interfaces and it has already been suggested that if this were the case the outcome would simply be western science MARK II, *“There are so many projects out there that haven’t really been tapped into because Māori are still the kaitiaki of that knowledge. If you were to release the floodgates you’d have a really dynamic and Aotearoa-focussed kind of science”* (Interviewee 1).

There are several connotations here regarding the risks of exposing mātauranga māori to the interfaces: the idea of tapping into mātauranga māori implies some kind of exploitative motivation (wanting to capitalise on a ‘bonanza’ of new opportunities at the interfaces); releasing the floodgates conjures up images of numerous speculators waiting anxiously to be allowed access to something of value, and Aotearoa kind of science is more reflective of the Aotearoa NZ community, including Māori. Most Māori scientists would consider the interfaces to be full of opportunities for western scientists and for Māori though it may not be so easy to tease out their motivations either way at the interfaces between mātauranga māori and western science.

### **Meeting Obligations to Māori**

The two younger and apparently more enthusiastic Interviewees suggested that māori principles and values, especially the alleged ethical superiority of Māori scientists could rub off to affect their non-Māori colleagues. This miraculous

event supposedly has the potential to automatically make the interfaces a better place. The resulting way of doing at the interfaces would inevitably be more inclusive. Interviewee 2 was especially supportive of the idea that if more Māori scientists participated this could only benefit the interfaces between mātauranga māori and western science. There is a clear emphasis here on the need to increase the numbers of Māori scientists which while a valid approach fails to acknowledge the emphasis placed by Durie (2005:9) and others at Hui Taumata 2005 (2005a: 16) on the quality of the Māori workforce. Interviewee 2 indicated that the interaction that would occur at the interfaces would have positive spin offs by assisting non-Māori to meet their obligations to Māori at the interfaces.

Interviewee 2 suggested that some non-Māori struggled to engage with Māori communities when undertaking RS&T, despite this being acknowledged best practice in the Aotearoa NZ RS&T system. This indicates a deficit on their part in terms of their skill level or knowledge of Māori values, tikanga or mātauranga māori. It also assumes that Māori scientists or other participants at the interfaces will ordinarily step up to fill the cultural gaps in the knowledge of their non-Māori colleagues'. Some of the other Interviewees felt strongly that this was not their job and if faced with a situation such as this they would recoil from doing so. Interviewee 4 was especially annoyed at the lack of mātauranga māori knowledge or skills, including tikanga and māori values, held by senior staff within the Aotearoa NZ RS&T system. His comment about the inside being all peachy white demonstrated clearly his disdain for this skills deficit and he would not be likely to step into the breach to protect a staff member or colleague that exhibited it. The discussion the author had with Interviewee 4 also suggested that this deficit displayed a measure of unprofessionalism within Aotearoa NZs' RS&T system.

Interviewee 4's comments also referred to the growth within Māori organisations and communities and the greater access they are now having to their own resources through Treaty of Waitangi Settlements. He indicated that while this is

true and is undoubtedly relevant to how western science is conducted at the interfaces his organisation in particular has been slow to respond to Māori in regard to how RS&T is conducted especially using Māori resources. He suggested that the failure of western scientific individuals and organisations to respond to Māori in these cases will highlight the lack of interaction that has and continues to occur at the interfaces between mātauranga māori and western science.

### **Wealth and Knowledge Preservation**

Some of the Interviewees' suggested that Māori perspectives and values are not always incompatible with western scientific ambitions, especially when it concerns potential wealth generation through RS&T. All of the Māori scientists interviewed indicated that greater participation by Māori at the interfaces between mātauranga māori and western science would lead to an increase in wealth for Māori individuals, communities and organisations. Interviewee 1 alluded several times to the Māori right to develop using research science and technology (Interviewee 1), which is also enshrined within articles 3, 20, 23 and 30 of the United Nations Declaration on the Rights of Indigenous Peoples (Burayzat, 2006:58-73) and other international instruments like the Mataatua Declaration on Cultural and Intellectual Property Rights of Indigenous Peoples (1993). There was some feeling that Māori attachment to their perspectives and values contributes to low levels of Māori participation at the interfaces (Interviewee 2).

The idea that wealth generation is possible and is not incompatible with Māori values through western science is a key motivator for Māori who wish to participate at the interfaces between mātauranga māori and western science. It may be how Māori scientists justify their involvement in western science and the two younger Māori scientists were open about how western science could provide the means for Māori communities to develop and improve their

situation.<sup>26</sup> The Interviewees were generally pragmatic about this and the interfaces clearly offer benefits (in terms of development for the 21<sup>st</sup> century) to Māori communities, “... *it would be nice and scholarly of me to say that knowledge is important but wealth generation is as important, I mean we’re trying to kind of lift our people ...*” (Interviewee 1).

A Māori reality, where Māori need to generate income and revenue to stimulate development in their own communities was well recognised. All Interviewees noted the obligation to use knowledge (all knowledges) at the interfaces for Māori development. Semali and Kincheloe referred to the transformative potential of indigenous knowledges and the four Māori scientists interviewed were well aware of the transformative potential of the interfaces. The approach by the Māori scientists interviewed was to suggest that the potential of mātauranga māori, especially the potential for creating wealth, economic development and employment, and to improve the situation of Māori people, is much more appropriately exploited or capitalised on at the interfaces and in partnership with western scientific ways of doing and if Māori are able to exert a fair measure of rangatiratanga or control over their resources and interests. The four Māori scientists interviewed saw participation by Māori in western science and at the interfaces between mātauranga māori and western science as crucial to achieving these ends.

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<sup>26</sup> There is a clear assumption that Māori should participate at the interfaces by doing western science and that this is how the interfaces can contribute to Māori development. While all the Māori scientists interviewed explicitly stated their support for the integration of mātauranga māori and western science at the interfaces they were less clear about how this should be done to enable Māori communities to unlock parts of their mātauranga māori to support their own development. There seems to be a gulf of logic where Māori scientists can accept the logic of integrating mātauranga māori and western science, though not necessarily the logic of using the result (an Aotearoa-focussed way of doing as opposed to either western science alone or mātauranga māori alone) to improve the ability of the interfaces to contribute to Māori development. It is significant to note that the Ministry of Research Science and Technology’s Vision Mātauranga policy papers refers persistently to unlocking the potential of mātauranga māori.

## Ethics

Just a short comment here on the belief that if mātauranga māori and western science were integrated more at the interfaces the ethicality of western scientists would increase. Some comments have already been made regarding the assumption that because some Māori scientists are sufficiently ethical and skilled in the necessary areas of mātauranga māori all Māori scientists are inherently so and able to execute the requirements of for example consultation with Māori communities. Interviewee 3 had this to say about the benefits of increased Māori participation at the interfaces between mātauranga māori and western science:

*I think there is a benefit, but I think the perceived benefit is the links to the iwi and ... scientists, universities see that as a good thing ... and it is a good thing ... it facilitates ... yeah consultation, access to Māori communities, hopefully dissemination of information ... all those sorts of things that are important and I think ... the university recognises the importance of the Māori community ... and wants to do this so having Māori in there will facilitate that. But they're also important for just who they are ... and what they bring as a Māori in the role ... to being a scientist. And I don't know if its tangible and I don't know if I could say what it is but there's a difference, or I think there's a difference.*  
(Interviewee 3)

This comment may be interpreted cynically to suggest that the only reason western science organisations and scientists themselves may encourage Māori to participate at the interfaces is to enhance opportunities at it for themselves. However it is a reality, and the Interviewees generally agreed that Māori must work with the organisations that have been built to enhance western science ways of doing in order to promote mātauranga māori at the interfaces. Most scientists also concurred with the notion of the inherent ethicality of Māori and hence Māori scientists at the interfaces between mātauranga māori and western science. Interviewee 2 also alluded to the pressure exerted by her family to

ensure that what she did at the interfaces benefited her people and this kind of positive peer pressure may enhance the behaviour of some Māori.

### **Māori Participation in Western Science**

Several comments have already been recorded concerning the importance of increasing Māori participation at the interfaces between mātauranga māori and western science. Participation at the interfaces between mātauranga māori and western science gave Māori scientists an opportunity to 'do science' (Interviewee 1) or do and be innovative with mātauranga māori (Interviewee 4). The Interviewees agreed that if Māori are going to develop to a point where Māori society and communities are fit for the 21<sup>st</sup> century and robust enough to withstand some of the harsh economic times of the past, participation at the interfaces must be increased. Interviewee 4 offered some suggestions to increase Māori participation, observing that a number of distractions and other priorities exist at the interfaces that play a role in distancing Māori prospects from studying western science. Because there is a lack of clarity about what the interfaces are and because they are not taught about in schools, Māori children may be growing up believing there is only one option for participation, western science.

Interviewee 4 offered some further suggestions to increase Māori participation at the interfaces. He observed that there are a number of distractions or priorities at the interfaces that play a role in distancing Māori prospects from studying or engaging with western science. He also felt that a multi-pronged approach to increasing Māori participation was needed:

*I think it needs a multi-pronged approach... first of all I see a number of dys-functionalities that hinder Māori participation in science...*

*How can Māori participation in science be enhanced? Get all the kids through the high schools in numbers, that's the first thing, the second thing is there needs to be (alternative) educational pathways, multiple education*

*pathways, tertiary education pathways for involvement in science, you know ... like second chance learners. (Interviewee 4)*

One of the first barriers to western scientific study is at high school, and historically in Aotearoa NZ science has just not been a favoured option for young high school students (Māori and non-Māori) with other priorities on their mind. Interviewee 4 said that this barrier was nothing new and he had experienced it himself.

### **The Potential to Include Māori Values in Western Science**

The four Interviewees came from a range of disciplines within western science. Interviewee 1 indicated that in her field (physics) it would probably be extremely difficult to incorporate Māori values and she indicated that she hadn't ever really thought about it. Comments from Interviewee 3 regarding her wish to understand mātauranga māori better and acknowledge it within her laboratory indicates a willingness to explore how Māori values can be incorporated in her field of study. Interviewee 2 said that she often called on Māori community members that frequently support her activities to advise her on how to satisfy tikanga māori or express values in her area of science and interviewee 4 clearly tries to express mātauranga māori, māori values and tikanga māori within his employment. Interviewees 2, 3 and 4 all work in life sciences related areas of science and the comment from interviewee 2 suggested that this made it easier for them to express tikanga Māori. Conversely Interviewee 1 suggested that it might be easier to express Māori values or tikanga Māori in a life science related field rather than in the physical sciences.

This may indicate that some Māori scientists have poor understanding of how Māori values might be expressed at the interfaces. The two more experienced Interviewees also indicated the potential for tokenism to creep in and Māori values to be treated with less dignity perhaps than they are currently. Interviewee 2 suggested that the expression of Māori values and tikanga Māori by a

particular Māori scientist should be left up to that individual and not forced on them.

Interviewee 4 has already said that in the two instances he attempted to express tikanga māori in his workplace, they were not received well. He suggested that any attempt to force māori values into a RS&T organisation or onto individuals within that organisation may be met with dismay or even hostility. However it should remain up to the individual to choose whether and how he or she does so.

## **Conclusion**

This Chapter outlined five areas that were discussed during interviews with four Māori scientists who are currently participating at the interfaces between mātauranga māori and western science. These included Māori concerns about western science, the nature of past and current interactions between mātauranga māori and western science, the benefits and risks of these and future interactions, Māori participation at the interfaces and the potential to include Māori values at the interfaces.

While the Māori scientists interviewed were generally critical of the impact of western science on mātauranga māori they were also enthusiastic about how the interfaces can be improved for the integration of mātauranga māori and western science, and for greater Māori participation and performance. The Māori scientists that were interviewed were keen to play a role in achieving this. They felt that the survival and integration of mātauranga māori with western science was not only important for mātauranga māori and Māori development, it was critical for western science and its ability to be perceived as relevant to Māori Aotearoa NZers and other ethnic minorities in this country.

While the Interviewees indicated several concerns about western science at the interfaces they also indicated that in some instances the way Māori responded to western science, scientists and science organisations gave cause for concern at

the interfaces. They suggested that the interfaces were characterised by uncertainty, lack of appreciation for each others worldview, misunderstandings of those worldviews, distrust and apathy. These characteristics have potential to create more harm at the interfaces between mātauranga māori and western science in the future if they are not addressed. The interviewees suggested that both Māori and non-Māori needed training to complement their skill sets in either western science or mātauranga māori and that this could mitigate some of these characteristics.

The interviewees also indicated that literacy is a key factor in improving the interfaces and extracting as much benefit as possible from them for Māori and Aotearoa NZ development. Science students are expected to grasp the fundamentals of science and their chosen field of study before they enter the workforce, though there are no similar standards of knowledge of mātauranga māori required of science students or scientists. This is a serious gap at the interfaces. Of more concern is the apparent lack of understanding by some Māori scientists of mātauranga māori. Both scientific literacy and mātauranga māori literacy are critical for the interfaces between mātauranga māori and western science, not only for scientists or researchers but for communities, organisations and businesses. A lack of scientific literacy in the Māori community is one of the most important issues determining Māori participation at the interfaces between mātauranga māori and western science. It will have a profound effect on how Māori are able to capitalise on new technologies and influence the direction of knowledge at the interfaces in coming years.

The Interviewees acknowledged the changing and evolving nature of mātauranga māori, looking on its integration with western science as an opportunity for growth. They also acknowledged the importance of rangatiratanga over mātauranga māori to Māori and the concomitant significance of control over knowledge (and mātauranga māori) to non-Māori. This could prove to be the

sticking point in any movement to integrate mātauranga māori with western science in the future.

## 5.0 Discussion

This section reviews the themes of the interfaces with and between mātauranga māori and their relevance to the harms profile presented in Chapter 2 (p.40). It then suggests ways that Māori and non-Māori can improve the interfaces between mātauranga māori and western science to:

- promote the sincere integration of mātauranga māori principles, values and Aotearoa NZ ways of doing into the practice of knowledge in Aotearoa NZ;
- encourage Māori participants to respond positively to challenges and harms at the interfaces; and
- expose opportunities for the transformation of Aotearoa NZ communities through research, science and technology (RS&T).

### Interfaces Themes

Chapter 4 identified five interconnected themes that are present at the interfaces with and between mātauranga māori and western science. The themes were passion, activity, uncertainty, difficulty or challenge and deficit. This chapter will explore these themes in more detail within the context of the harms profile introduced in Chapter 2 (Figure 2, p.40).

Passion at the interfaces between mātauranga māori is expressed both by Māori and non-Māori who want to exploit or capitalise on mātauranga māori, create opportunities for development, protect and preserve mātauranga māori for future generations, or control the direction and development of knowledge in Aotearoa NZ. The Interviewees say that these passions can overflow and cause tensions that inhibit the smooth integration of mātauranga māori with western science.

The Interviewees say that control of the generation, production, dissemination use and application of knowledge is a central objective of western science.

Rangatiratanga or self determination is also a key objective of Māori and this explains the attempts by some to sequester mātauranga māori from the interfaces. The Interviewees suggest that this approach risks isolating mātauranga māori and restricting its influence on knowledge and the development of Māori communities, organisations and businesses.

The interviewees indicated that rangatiratanga at the interfaces between mātauranga māori and western science is about determining the destiny of mātauranga māori, rather than about control of knowledge. The Interviewees said there is passion in the Māori community to determine how mātauranga māori can enhance the interfaces through influencing the generation, production, dissemination, use and application of knowledge. They also suggest that these aspirations have the unfortunate side effect of antagonising some non-Māori scientists who wish to use mātauranga māori at the interfaces only so far as it can be exploited for commercial or even personal academic advantage.

The Interviewees were passionate and enthusiastic about the potential of western science to transform Māori communities, organisations and businesses in the 21<sup>st</sup> century, The passion of mainly the younger Interviewees tended to almost minimise the significance of mātauranga māori at the interfaces. This passion must be captured and channelled to promote and market mātauranga māori to non-Māori at the interfaces between mātauranga māori and western science.

Extremes of activity at the interfaces make it difficult for Māori and non-Māori to predict the consequences of change, which is a relatively constant characteristic of the interfaces, on mātauranga māori, māori perspectives and māori values. Activity is a universal theme of the interfaces between mātauranga māori and western science. The uncertainty that is created at the interfaces for Māori and non-Māori because of change and/or activity is a factor in determining the level of participation of Māori communities, organisations and businesses in RS&T and is

often seen as a risk for these entities.

Relatively rapid developments in western science are seen by the Interviewees as opportunities for Māori to participate in world leading RS&T and to extract benefits from the interfaces in terms of education and training for Māori youth. Participation at the interfaces by Māori will also lead to employment opportunities, short or long term development opportunities, and commercial opportunities for Māori communities, organisations and businesses. Failure or reluctance to participate in these developments restricts the ability of Māori to partake in the outcomes of these RS&T projects. The integration of mātauranga māori and western science should be cognisant of this risk averse approach by Māori to activity and change at the interfaces. This kind of change should be lead and directed by Māori to ensure that rangatiratanga is recognised and mana is enhanced, and the implications for Māori of participation are clearly understood and mitigated where necessary.

Another key theme of the interfaces is uncertainty. There is uncertainty at the interfaces between mātauranga māori and western science about how Māori should participate at the interfaces, how mātauranga māori can or should be integrated with western science, and questions about the validity and authenticity of mātauranga māori. Uncertainty tends to discourage māori and non-Māori from engaging with each other to undertake RS&T, often because Māori or non-Māori feel they possess inadequate knowledge or skills of each others' way of doing or approach to knowledge. Education and training activities to overcome this uncertainty and build confidence, especially about mātauranga māori, māori perspectives and values should become a feature of the interfaces between mātauranga māori and western science.

Active interfaces are ideal places for uncertainty to flourish. Low participation (and performance) by Māori in western science may be a precursor to low participation at the interfaces. Greater certainty about how mātauranga māori,

māori perspectives and values can be integrated with western science and the value of mātauranga māori to the interfaces will avoid the kind of knowledge and skills deficits currently seen at the interfaces in non-Māori and Māori participants. Such training will also overcome some of the negative attitudes associated with mātauranga māori and western science.

Deficit(s) at the interfaces are stark reminders of the challenges faced by Māori at the interfaces between mātauranga māori and western science. Numerous instances where respect for mātauranga māori is lacking or where support for mātauranga māori and/or Māori scientists were reported by the Interviewees. These deficits are matched only by those that are apparent when training needs and levels of knowledge of mātauranga māori especially are considered. This research has indicated a lack of training and skills development for both Māori and non-Māori at the interfaces between mātauranga māori. This is matched by a similar lack of understanding, awareness and comprehension of western science within Māori communities, organisations and businesses. It is an enormous challenge to overcome in order to rectify some of the deficits cited by the Interviewees. This research has shown Māori scientists to be ready and enthusiastic about meeting this challenge in order to enhance mātauranga māori but to also improve the interfaces as spaces for Māori to participate freely and comfortably.

The five themes resulted in a lack of Māori representation, a lack of Māori participation, and under-performance by Māori at the interfaces. Two harms that are frequent at the interfaces between mātauranga māori in the 21<sup>st</sup> century include a lack of scientific literacy and a lack of understanding or comprehension of mātauranga māori, māori perspectives and māori values. These harms compromise the ability of Māori individuals, communities, organisations and businesses to engage and benefit from RS&T at the interfaces between mātauranga māori and western science.

## **The Integration of Western Science with Mātauranga Māori**

The way harms at the interfaces between mātauranga māori and western science are presented in Figure 2 (p.39) may cause some to suppose that they are static, frozen in time and perhaps no longer relevant to modern Aotearoa NZ society. This is an inaccurate interpretation of the figure and Interviewee 4 (Pp67) showed that harms such as epistemological tyranny are still very real and infiltrate the interfaces to inhibit the integration of mātauranga māori and western science in modern times.

The interfaces between mātauranga māori and western science have been a feature of the relationship between Māori and non-Māori since colonisation. Māori scientists acknowledge this and it is vital that Māori and non-Māori who attempt to interact at the interfaces are aware of the history of these spaces. The experiences of mātua, kaumātua and tupuna Māori at the interfaces between mātauranga māori and western science influence contemporary Māori perceptions of them. This influences Māori recruitment and participation and reduces the transformative potential of the interfaces for Māori development and Aotearoa NZ development.

Some Māori scientists harbour misgivings about exposing mātauranga māori especially, and māori perspectives and values at the interfaces. This action can put mātauranga māori at risk of being improperly exploited by non-Māori, reduce the ability of Māori to capitalise on knowledge and/or technology that is based on mātauranga māori, compromise the relevance of mātauranga māori in the modern world and continue to marginalise mātauranga māori as a way of doing.

The integration of mātauranga māori and western science should be tightly managed by Māori potentially in a co-management scenario where rangatiratanga is able to be practically expressed (not just acknowledged) by the customary holders of mātauranga māori.

Sincere integration of mātauranga māori with western science can improve the recruitment and participation of Māori in western science and at the interfaces and non-Māori attitudes and non-Māori awareness of mātauranga māori. It will lead to greater acceptance of mātauranga māori as a valid and important way of doing at the interfaces, create opportunities for education and training in mātauranga māori, māori principles and values. Integration of mātauranga māori with western science will lead to distinctive, innovative and Aotearoa-focussed solutions for development that benefits Māori and Aotearoa NZ communities, organisations and businesses.

### **Missed Opportunities**

There have been many missed opportunities to integrate mātauranga māori with western science at the interfaces in Aotearoa NZ since colonisation. Because of the characteristics and themes of the interfaces that are revealed in this thesis Aotearoa NZ knowledge is yet to attain a state where the interfaces can be appraised as comfortable places where Māori and non-Māori can combine their talents to produce distinctive Aotearoa NZ solutions that are both practical and relevant.

The Interviewees are sceptical about the possibility of the sincere integration of mātauranga māori and western science despite their own resolute enthusiasm. Scepticism, suspicion and distrust of non-Māori scientists and science bureaucrats when it concerns mātauranga māori are significant and enduring characteristics of the interfaces. Māori scientists see little evidence of the integration of mātauranga māori with western science.

The integration of mātauranga māori with western science at the interfaces cannot be expected to occur on its own or hapahazardly according to the timetables of individual non-Māori scientists or science organisations. History shows that this strategy is unlikely to result in significant gains for either Māori or non-Māori at the interfaces. The results show that for the sake of mātauranga

māori, western science and mātauranga Aotearoa integration must be planned, managed and resourced appropriately by Aotearoa NZ policy makers.

If this occurs evidence of integration and its success will be easier to observe and record. The success of this strategy to promote mātauranga māori, encourage Māori participation and expose opportunities for the transformation of Aotearoa NZ communities will be measureable and practitioners at the interfaces made accountable for it. Accountability for integration does not appear to be a significant feature of either the RS&T sector or the interfaces between mātauranga māori at present.

Feelings of uncertainty about the possible integration of mātauranga māori and western science by Māori scientists and non-scientists are not because of a lack of enthusiasm about the integration of mātauranga māori and western science. This uncertainty results from what Māori scientists allege is reluctance by non-Māori scientists and/or science bureaucrats to capitalise on opportunities for integration. Uncertainty and reluctance are lasting themes of the interfaces between mātauranga māori and western science.

Reluctance to integrate mātauranga māori with western science is an outcome of ill-informed disdain and disrespect for mātauranga māori, māori principles and māori values. The Interviewees suggest it is also a result of deficiencies in the cultural (mātauranga māori) knowledge of non-Māori scientists and science bureaucrats. Greater promotion of mātauranga māori and the training of non-Māori scientists about māori perspectives and values will support the long term sustainable (non-token) integration of mātauranga māori with western science at the interfaces.

Māori dissent at the interfaces that results from discomfort, disillusionment, distrust and suspicion of western science leads to their reluctance to support the integration of mātauranga māori and western science. Māori scientists may feel

frustrated by a lack of understanding of the interfaces. They do not subsequently observe or comprehend how mātauranga māori and western science can interact to produce creative, innovative solutions for Māori and/or Aotearoa NZ development. When the integration of mātauranga māori and western science is seen to be happening at the interfaces this will lead to greater understanding and comprehension of the opportunities of the interfaces for both non-Māori and Māori.

### **Attitudes at the Interfaces**

Māori scientists feel frustrated and angry that some non-Māori scientists and science bureaucrats in Aotearoa NZ fail to understand or acknowledge the significance and value of mātauranga māori, māori perspectives and māori values to how RS&T is conducted in an Aotearoa NZ context. Non-Māori indifference about the survival of mātauranga māori has led to apathy about the integration of mātauranga māori and western science at the interfaces. It also explains the reluctance of some non-Māori scientists to even attempt interaction with Māori communities, organisations and businesses. This seriously compromises Māori participation in RS&T, and the ability of Māori to ensure that RS&T returns benefits to their communities, organisations or businesses.

There is general reluctance in some Māori communities to engage at the interfaces with non-Māori or even Māori scientists to undertake RS&T. In some instances this extends to a general reluctance to integrate western science perspectives and values with mātauranga māori ways of doing. There is an urgent need to address the cultural skills deficiency of non-Māori by providing mātauranga māori, māori perspectives and values training. There is a complementary need to raise the level of understanding and scientific literacy of Māori communities so they are better equipped to participate and engage in knowledge at the interfaces between mātauranga māori and western science.

The Interviewees consider that Aotearoa NZ society burdened by baggage associated with Treaty of Waitangi claims and settlements and various race relations controversies negatively influences on how mātauranga māori is expressed and integrated with western science at the interfaces. They do not feel that the viewpoint of western science or scientists (regarding Treaty of Waitangi issues and/or Māori self-determination) is necessarily any different to that of the rest of non-Māori society. They generally disagree with accepted wisdom that suggests western scientists are somehow above these kinds of subjective and polarised debates (the objective view from nowhere, Chapter 2, p.40) despite western science claims to the contrary.

Interviewee 1 cited Dickinson as evidence of non-Māori scientists' sometimes negative and even derogatory attitudes to mātauranga māori (though Dickinson's comments have been condemned by both Māori and non-Māori). The negative perceptions that non-Māori scientists and science bureaucrats have of mātauranga māori are a legacy of colonisation and the context at the interfaces in which Māori scientists are expected to perform on a par with their non-Māori colleagues. Such criticism can deter Māori from participating at the interfaces and lead to poor recruitment and participation by Māori in RS&T projects. This represents a serious threat to the ability of Māori to determine how mātauranga māori and knowledge at the interfaces between mātauranga māori and western science can contribute to Māori development.

There is a pressing need for more positive messages about mātauranga māori and how this way of doing can contribute to knowledge production, generation, dissemination at the interfaces, and to Māori and Aotearoa NZ development. A programme to improve non-Māori understanding of mātauranga māori, māori perspectives and values may enhance the potential of the interfaces to produce robust solutions for Māori and Aotearoa NZ development. This will contribute to changing attitudes to mātauranga māori and improve the way that non-Māori

scientists, science bureaucrats and policy makers respond to mātauranga māori, māori perspectives and māori values at the interfaces.

The impact of colonisation on how RS&T is conducted in Aotearoa NZ should be further investigated to ensure all Māori and non-Māori scientists and science bureaucrats understand the context in which Māori scientists work. This will create understanding of the struggle by Māori to enhance the position of mātauranga māori in the Aotearoa NZ RS&T system and at the interfaces.

Some non-Māori scientists<sup>27</sup> have discovered that the ability of mātauranga māori to contribute new ways of doing and understanding to the practice of knowledge in Aotearoa NZ will be beneficial to western science and therefore to the interfaces. Visiting non-Māori scientists, or immigrant scientists are often more inclusive and accepting of other ways of doing including mātauranga māori. Reluctance to acknowledge or integrate mātauranga māori, māori perspectives and values with western science is an issue specific to Aotearoa NZ trained non-Māori scientists.

There is a need for science education and training in Aotearoa NZ to include some understanding of mātauranga māori perspectives and Māori values as a strong component throughout the Aotearoa NZ science curriculum.

### **Development Potential at the Interfaces**

Māori scientists do not consider the interfaces to be a favourable environment for promoting the strong growth and development of mātauranga māori. This does not preclude their desire to continue striving at the interfaces to make those

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<sup>27</sup> Unfortunately more often than not largely those non-Māori scientists who have immigrated to Aotearoa NZ from apparently more pluralistic societies and knowledge traditions. The uptake of aspects of mātauranga māori by non-Māori scientists and within RS&T organisations and institutions in Aotearoa NZ is often motivated by commercial potential and restricted to exploitation of māori resources. This is not integration and signals a need for Māori and non-Māori to guard against exploitation of mātauranga māori for exploitations sake and with little benefit for Māori.

spaces more acceptable to Māori scientists, communities and businesses. When the interfaces are not conducive to mātauranga māori or fail to accommodate māori perspectives and values the knowledge that is produced, generated and disseminated there may fail to meet its transformative potential and the (development) needs of the community. The Interviewees identified a strong link between science and development in the 21<sup>st</sup> century. This is recognised by Māori scientists and non-Māori scientists as a critical nexus for Māori development in the 21<sup>st</sup> century.

There are numerous opportunities at the interfaces between mātauranga māori and western science for not only Māori development, but for Aotearoa NZ development in general. Māori scientists are concerned that the integration of mātauranga māori and western science at the interfaces should result in real outcomes for Māori and non-Māori communities, organisations or businesses. This may include Māori specific outcomes or non-specific outcomes that Māori are able to benefit from. Greater participation by Māori communities, organisations and businesses in RS&T will help to ensure beneficial outcomes from knowledge at the interfaces for Māori. Greater involvement by Māori scientists, to the point of leadership in RS&T projects will enable this criterion to be met in the future.

### **The Benefits of Integration**

The Interviewees suggest that there is some resentment towards western scientific organisations and institutions that appear to create obstacles or excuses to not pursue projects that result in real outcomes for Māori. A tactic used by some Māori scientists to increase the likelihood of their RS&T organisations engaging with Māori to pursue these opportunities, is to highlight what the nature of the benefits will be for non-Māori (or all NZers). By emphasising the link between benefit to Aotearoa NZ and benefit to Māori (what benefits Māori benefits Aotearoa NZ), the advantages of engaging with Māori

communities, organisations or businesses to undertake RS&T at the interfaces will become more readily apparent.

Māori scientists report that Māori communities and organisations are becoming more focused on economic outcomes for themselves through research and development (with equally strong emphasis on social, cultural and environmental outcomes). They say that just because of the alignment of Māori perspectives and values more closely with social, cultural and environmental concerns this does not discount the value Māori place on economic development. The Interviewees said that wealth generation is just as important as the generation of knowledge and the preservation of mātauranga māori at the interfaces. The Interviewees suggest that the importance of Māori economic development also recognises the intricate balance of those elements that are more easily recognised as aligning with Māori values.

RS&T currently requires Māori scientists to emphasise economic outcomes. The Interviewees suggested that this is often at the expense of social, cultural or environmental considerations. The focus and likelihood of any transformational benefit (social, cultural and environmental as well as economic benefit) arising from RS&T for Māori becomes secondary to the commercial imperative. This risks Māori development remaining an afterthought in the Aotearoa NZ RS&T system and the interfaces between mātauranga māor and wesern science.

The Māori scientists interviewed for this research suggested that current and new cohort's of Māori scientists and science students are unlikely or only begrudgingly likely to accept this situation. The Foundation for RS&T generally weights research proposals to give regard to economic, social, cultural and environmental outcomes that might arise from a research project. This is commendable however Māori scientists are sceptical and suggest that economic outcomes will always trump social, cultural or environmental outcomes. This conclusion for Māori scientists, communities, organisations and businesses is

based on the track record of RS&T that may promise much though delivers little in the way of Māori outcomes.

Māori scientists, researchers and/or communities have needed to promote their own research projects, so that the significance of Māori perspectives and values as they apply to Māori communities, organisations or businesses are supported and made known to the RS&T sector. More regard should be given to these factors by RS&T policy makers, funders and providers if Māori can be expected to participate regularly in RS&T at the interfaces. Inaccurate stereotypes of māori research capability and māori RS&T interests tend to exclude Māori from participating in large research projects with strong economic development drivers. This threatens to restrict Māori participation at the interfaces between mātauranga māori and western science. Lack of participation in RS&T is one of the harms in Figure 2 and this can be linked to the negative attitudes of non-Māori about mātauranga māori, māori perspectives and māori values.

How the Aotearoa NZ RS&T system responds to mātauranga māori, māori perspectives and values is lagging the Māori responsiveness of other sectors of Aotearoa NZ society. Changing demographics, the ongoing renaissance in mātauranga māori, māori perspectives and māori values and the growth of well trained and qualified Māori researchers and scientists will continue to challenge the Aotearoa NZ RS&T system. The Aotearoa NZ RS&T system is going to have to change quickly to keep up with emerging trends in the generation, production and dissemination of knowledge in Aotearoa NZ and Māori ways of doing at the interfaces. The Interviewees suggest that in some respects Māori scientists are waiting for their non-Māori counterparts and the predominantly non-Māori overlords of the RS&T sector in Aotearoa NZ to catch up.

## **The Incorporation of Māori Perspectives, Values and Methodologies at the Interfaces**

The apparent negative appraisal (by Māori scientists) of the potential integration of mātauranga māori and western science at the interfaces is challenged by Māori scientists' own acknowledgement that non-Māori scientists can also be staunch advocates for the inclusion of mātauranga māori values, perspectives and methodologies. Māori scientists are cautiously appreciative of non-Māori efforts to take up the challenge on their behalf. They sometimes remain uncertain about the motives of non-Māori scientists who aim to undertake RS&T with Māori and their competency to be able to do so correctly. Uncertainty is another lasting theme of the interfaces between mātauranga māori and western science.

The Interviewees suggested that non-Māori scientists and/or science bureaucrats (and/or politicians) will co-opt Māori values and perspectives in order to achieve their own agenda/s rather than truly integrate these into RS&T projects that also achieve outcomes for Māori. This approach leaves mātauranga māori open to abuse and misinterpretation by unskilled non-Māori scientists and bureaucrats. Durie (1996) and Mutu (1994) warned about the potential for Māori concepts, perspectives and values to be incorrectly interpreted by non-Māori. Non-Māori scientists and science bureaucrats must be encouraged to explore how their skills and knowledge can be brought to bear at the interfaces on development solutions for Māori communities, organisations and/or businesses.

Ad-hoc incorporation of māori values into western science can diminish their purpose and create more tension than solutions for Māori scientists and/or communities. Māori scientists suggest that the application of Māori perspectives and values in an apparently closed western science context is already viewed with consternation by their non-Māori colleagues and is sometimes actively discouraged within RS&T organisations. Strict guidelines that support the use of māori perspectives, māori values and māori methodologies at the interfaces

need to accompany any education or training given to non-Māori (and Māori) scientists and science bureaucrats.

### **Dilemmas at the Interfaces**

Māori scientists are acutely aware of the problematic position (the dilemmas and challenges for themselves at the interfaces, Interviewee 1) they place themselves in at the interfaces and their obligations to treat mātauranga māori respectfully while contributing to beneficial outcomes for Māori communities and organisations. This contradiction, apparent acceptance then apparent rejection and strong criticism of the interfaces, is a recurring theme at the interfaces between mātauranga māori and western science and challenges the diplomatic skills of Māori scientists.

It is in this challenging context where Māori scientists must determine the best approach (demanded of them by their career, science peers and their professionalism) even if it challenges the orthodox Māori approach to for example, controversial technologies such as genetic modification, xenotransplantation or nanotechnology. Despite the dilemma's faced by Māori scientists as a result of these apparently irreconcilable challenges, they do not shy away from the challenges of the interfaces.

The Interviewees consider that they are in a privileged position where they are able and trusted by their own people to make difficult calls about mātauranga māori and how it is exploited or capitalised on in RS&T at the interfaces. They apply informal conventions around taking guidance from kaumātua and other Māori non-science colleagues who work at the interfaces between mātauranga māori and western science to support their decisions.

The Interviewees suggest that Māori scientists at the interfaces are willing and enthusiastic for this kind of support. However the Interviewees say there is little allowance made within their organisations for Māori support networks that inform

and support the decision-making of Māori scientists or to support the education and training of non-Māori scientists and staff in aspects of mātauranga māori, māori perspectives and values. The sincere integration of mātauranga māori and western science requires modern and professional RS&T providers to support these important activities for the positive development of the interfaces as spaces where creativity, innovation and knowledge from both ways of doing can prosper.

### **Tokenism at the Interfaces**

The Interviewees feel that there is a change occurring in how RS&T are conducted in Aotearoa NZ. There are flows of funds coming into Māori iwi and non-iwi organisations that mean Māori are able and willing to play a stronger hand in determining the direction and outcomes of RS&T. Māori scientists do not believe that non-Māori RS&T leaders and organisations are prepared for Māori to play this kind of proactive role in knowledge determination, production, generation and dissemination in Aotearoa NZ. The Interviewees agree that if non-Māori want to benefit from new Māori wealth, then they must begin to consider with more urgency how themselves and their organisations can respond proactively to the integration of mātauranga māori and western science at the interfaces. The Interviewees suggest that Māori scientists are beginning to feel more comfortable with expressing their frustration and resentment with the Aotearoa NZs' western scientific organisations and institutions.

Despite the seemingly well intended support of their non-Māori colleagues, Māori scientists are of the opinion that negative sentiment towards mātauranga māori will almost always prevail over the efforts of Māori and/or non-Māori to forge a unified way of doing in Aotearoa NZ. The comments of the more experienced Interviewees indicated that some Māori scientists may be just as likely to interpret good intentions as tokenism. One Interviewee suggested that some Māori scientists have become sensitised to tokenism over years of confronting this challenge. Intrepid young Māori scientists, raised on stories about the trials

of western science are aware of the implications of tokenism in their own fields of research.

Both groups of Māori scientists tend to be highly critical of western science when they experience tokenism and/or institutional racism. The Māori scientists interviewed for this research suggested that this reaction is often interpreted negatively by their non-Māori colleagues. It is possible that some non-Māori scientists do not fully understand the implications of tokenism. The Māori response to tokenism may compound tension already at the interfaces in regard to the integration of mātauranga māori with western science. This is an additional barrier that Māori scientists need to overcome when encouraging their non-Māori colleagues to engage with Māori communities and/or organisations to do RS&T. Māori scientists seem to be resigned to the occurrence of tokenism in Aotearoa NZ RS&T.

Tokenism may never be extinguished at the interfaces and it is important to recognise that tokenism is not peculiar to the interfaces between mātauranga māori and western science. Other indigenous knowledges<sup>28</sup> are also treated in this way by the Aotearoa NZ RS&T system. The important thing is that Māori scientists and their supporters remain vigilant to mitigate its effects and use it to enlighten their non-Māori colleagues to the marginalisation of Māori people and māori ways of doing at the interfaces between mātauranga māori and western science. Workshops detailing the implications of tokenism and colonisation for the RS&T sector will be beneficial in achieving this and the approach will encourage greater acknowledgement of other ways of doing.

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<sup>28</sup> For example some Pacific Island ways of doing and even Traditional Chinese Medicine. How mātauranga māori, māori perspectives and māori values are integrated at the interfaces has ramification for how these and other knowledge traditions are also treated by the Aotearoa NZ RS&T system.

## **Scientific Literacy**

This research has shown that one of the main concerns of the Interviewees about the interfaces is literacy. The lack of scientific literacy by Māori at the interfaces is a deficit that contributes to lack of participation and under-performance at the interfaces between mātauranga māori and western science. The interviewees suggested that characteristics such as the ethical behaviour or sharper insight of Māori scientists could influence their non-Māori colleagues at the interfaces. The lack of scientific literacy among Māori communities, organisations and businesses can limit Māori participation at the interfaces and reduce this supposed benefit. This is a popular belief about the interfaces between mātauranga māori and western science though it will be difficult to measure.

Māori scientists readily identify the need for themselves to be proficient in western science methods and techniques. They also signal the need for Māori in communities, organisations and businesses to increase their scientific literacy to ensure that they are able to competently engage with non-Māori at the interfaces. This will also enable Māori to intelligently debate western scientific principles and knowledge at the interfaces, and raise the profile of the interfaces within the Māori community. Scientific literacy is a key factor in determining how Māori will be able to benefit from RS&T through Māori development in the future.

The Interviewees highlight the need (and by doing so imply the failure of the Aotearoa NZ RS&T system to plan for epistemological contingency) for non-Māori scientists to raise their knowledge of mātauranga māori, māori principles and values. It is clear that voluntary alignment with these objectives is not working. The Interviewees indicated that sometimes non-Māori need to be dragged kicking and screaming or coerced into increasing their literacy in this area. The government can play a role in requiring cultural knowledge, perspectives or worldviews training in the RS&T curriculum for both non-Māori and Māori scientists.

Māori scientific literacy is a keystone challenge for the interfaces between mātauranga māori and western science. It is a key determinant of Māori participation and performance. Scientific literacy will determine the development of Māori communities, organisations and businesses in the 21<sup>st</sup> century. This thesis has made much of the inability of some non-Māori to grasp or comprehend mātauranga māori perspectives, values or methodologies. The Interviewees have highlighted the apparent inability shown by some Māori to comprehend western science. The inability of Māori to engage competently with non-Māori scientists seriously compromises their ability to play a greater role at the interfaces between mātauranga māori and western science at least in the short term.

The Interviewees comments about the participation and performance of Māori at the interfaces do not take into account the value of mātauranga māori skills and knowledge or how this capability may play a significant role in transforming the interfaces. The Interviewees think that participation by Māori at the interfaces should be in the form of more Māori scientists or technicians who are skilled and knowledgeable about western science. They seem to place more significance on the ability of Māori to undertake western science at the interfaces than on their ability to express, incorporate or undertake research using mātauranga māori principles, values or methodologies. The interfaces between mātauranga māori and western science will be greatly enhanced by the involvement of Māori experts in mātauranga māori, māori perspectives and values. Greater efforts should be made to employ these people with the RS&T system to support the integration of mātauranga māori and western science.

## 6.0 Conclusion

### **Harm done to the Interfaces**

This thesis has shown that the characteristics of the interfaces between mātauranga māori and western science today are the culmination of harms that have occurred at the interfaces since colonisation. These harms have impacted on Māori participation and representation, Māori achievement and the level of scientific literacy within Māori communities, organisations and businesses. Harm done to mātauranga māori is harm also perpetrated on western science. Moving forward this harm is detrimental to the interfaces because it prevents constructive interaction at a number of levels between mātauranga māori and western science, Māori and non-Māori scientists, Māori and non-Māori communities undertaking science or other RS&T, and Māori and non-Māori science-based businesses. Significantly it also dissuades and prevents Māori communities from even engaging with western science at the interfaces. This leads to missed opportunities for transformational development and enrichment of both Māori and non-Māori in Aotearoa NZ communities.

The interfaces between mātauranga māori and western science cannot be healthy, vibrant or effective for Aotearoa NZ until mātauranga māori and western science are integrated. Some will argue that these two ways of doing are already integrated and it is true that to an extent mātauranga māori and western science interact to achieve outcomes from RS&T. Interviews with four Māori scientists say that the extent of this interaction in some cases may extend only to the provision of access to Māori owned or controlled resources by Māori to scientists. Little in the way of increasing Māori participation, performance or even raising the level of scientific literacy within Māori society is achieved.

Integration implies a two way partnership requiring give and take from both sides. The research showed that for the interfaces to be operational and healthy, the

uptake of western science by Māori must improve. Until Māori accept and interact better with western science, science organisations and science-based businesses, opportunities and the transformative potential of the interfaces for Māori development will not be realised. This argument recognises the obligations Māori have to engage with western scientists, organisations and businesses, participate in western science projects and other activities, and promote the interfaces within their whānau, hapū, iwi and other environments.

### **Pathways Forward**

The research revealed two pathways forward for knowledge in Aotearoa NZ. One is through a rejuvenated version of western science. This is often referred to as modern science and is idealised as something better than the current model. Mātauranga Aotearoa is the result of the sincere integration of mātauranga māori with western science at the interfaces. Importantly it does not propose the full-scale domination of the knowledge-scape by mātauranga māori, and recognises the significant contribution western science principles, methods and standards make to Māori and non-Māori development. Option 2 clearly allows for epistemological contingency in a blended system of knowledge or way of doing for Aotearoa NZ.

The thesis argued that modern science may be nothing more than western science MARK II and this pathway would lead to Māori and other indigenous peoples being further marginalised at the interfaces. Outcomes from modern science will not be advantageous for Māori, will not improve outcomes from RS&T for Māori communities, organisations and businesses, and will not promote reconciliation or integration of mātauranga māori with western science at the interfaces. This pathway will continue to lead to a loss of opportunities for the transformation and development of Māori and Aotearoa NZ communities.

While the modern science strategy enables those in control or with an interest in modern science (nominally non-Māori in Aotearoa NZ) to harness the

transformative potential of mātauranga māori, the other option enables the transformative potential of mātauranga māori to be harnessed by all participants at the interfaces between mātauranga māori and western science. It has the added advantage of providing options for the preservation, protection and revitalisation of mātauranga māori for future generations, a long-standing objective of Māori and non-Māori.

Mātauranga Aotearoa is a unified system of knowledge that can provide recognisable and relevant outcomes for Māori and other ethnic groups in Aotearoa NZ that modern science currently struggles to achieve. This is a critical point while the demographic makeup of Aotearoa NZ is shifting to a point where the future of the workforce will be increasingly Polynesian and composed of members from a range of ethnic groups.

The success of mātauranga Aotearoa depends on the coming together of a community of like minded individuals (possibly from each of these groups) to promote the integration of mātauranga māori with western science. This research has shown that Māori talent and human resources are available to facilitate a strong and sustainable Māori scientific workforce and develop a world-class level of scientific literacy among Māori at the interfaces. The key to capturing this talent pool and increasing the appeal of western science to these individuals and communities may be to develop alternative pathways into western science that allow Māori and other ethnicities to train as scientists and researchers<sup>29</sup>.

The survival and integration of mātauranga māori with western science is not only important for mātauranga māori and māori development. It is critical for

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<sup>29</sup> One of the Interviewees (Interviewee 4) said that solutions to increasing Māori participation at the interfaces and recruiting more Māori students to study western science had to come from Māori communities themselves. Discussion with this interviewee also produced an idea that could prove to be a worthwhile strategy to increase the level of Māori participation at the interfaces. Second chance learning for science would increase the talent pool, recognise the diverse skills that Māori have and ultimately raise participation.

western science and its ability to be perceived as relevant to Māori and other ethnic minorities in Aotearoa NZ.

### **Challenges at the Interfaces**

This thesis concludes that there are three areas where changes must be implemented to allow the integration of mātauranga māori with western science to flourish and produce results for all Aotearoa NZers. The most significant, at least from a scientific perspective is scientific literacy. The potential impact of increasing the level of scientific literacy within Māori communities is enormous and has widespread ramifications that address some of the concerns Māori scientists have about the interfaces (see Chapter 4). It is critical to realising the transformational potential of the interfaces for Māori development and has significant spill over benefits for community and regional development throughout Aotearoa NZ. Through increasing scientific literacy, Māori may be able to enforce rangatiratanga over how mātauranga māori is integrated with western science. Māori will also be encouraged to participate in RS&T and innovation at the interfaces, creating significant impact on Māori economic, social, cultural and environmental aspirations.

Scientific literacy refers to the capability of Māori to comprehend scientific principles and engage competently with western science and non-Māori scientists. Mātauranga māori literacy is also a critical factor at the interfaces between mātauranga māori and western science.

There is a risk that the modern science paradigm will continue to marginalise mātauranga māori so that mātauranga māori, māori perspectives and values become more inaccessible. By introducing a standard requiring all scientists to be mātauranga māori literate the Aotearoa NZ RS&T and innovation sector will significantly improve its track record in this area and develop highly skilled, well rounded scientists with a penchant for innovation and creativity drawn from two previously isolated ways of doing. Mātauranga Māori will also be preserved for

future generations of Aotearoa NZers. Ongoing training that deals with the legacy of harm at the interfaces and provides this kind of support for scientists will also facilitate improved attitudes and respect for mātauranga māori. This was one of the key concerns of Māori scientists at the interfaces between mātauranga māori and western science. This training should include education about the impact of the trinity of harm - protectionism, colonisation and assimilation - on mātauranga māori.

Control of knowledge, including mātauranga māori, may be one of the root causes of harm been done to mātauranga māori and the interfaces. It is not unique to western science or non-Māori. Rangatiratanga is often crudely interpreted as absolute Māori control and ownership, in context absolute control or ownership of knowledge. This interpretation is unnecessarily inflammatory in contemporary Aotearoa NZ society and does little to increase the likelihood of mātauranga māori playing an equal role alongside western science at the interfaces. This thesis refutes the idea that knowledge is owned by anyone. Rangatiratanga at the interfaces refers to the self determination of mātauranga māori, and Māori authority over knowledge. Rangatiratanga is also an expression of how Māori aim to bring mātauranga māori back to a position of prominence and activity in the Aotearoa NZ RS&T and innovation sector. Any programme to integrate mātauranga māori with western science at the interfaces should allow Māori to play a fair role in determining how mātauranga māori is accessed, manipulated and applied at the interfaces. A system of integration needs to be developed that (sincerely<sup>30</sup>) allows Māori a greater level of rangatiratanga over their way of doing, promotes the integration of mātauranga māori with western science and demonstrates the benefits of enhanced rangatiratanga (by Māori) over knowledge to non-Māori. Rangatiratanga and mana should be enhanced for all parties, including non-Maori.

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<sup>30</sup> The author considers that it is easy to say that this is either the case or the intention, and less easy to actually apply the principle to the interfaces. RS&T policy makers, and this research also suggests practitioners, must act honestly and with integrity when promoting Māori rangatiratanga over mātauranga māori at the interfaces and when determining the level of involvement by Māori individuals and communities in how knowledge is determined in Aotearoa NZ.

The third key challenge at the interfaces is to do with Māori participation. If mātauranga māori and western science are to be successfully integrated at the interfaces then Māori participation must be addressed. The increased presence of Māori scientists, researchers and mātauranga māori experts at the interfaces will create the necessary conditions to enable mātauranga māori, māori perspectives, māori values and ways of doing to be expressed with greater confidence. Māori participation also refers to the participation of Māori groups, communities, organisations and businesses in RS&T. The research suggests that some Māori actively discouraged engagement with western science, and proactively created barriers to increased involvement of their own communities in RS&T projects. The thesis suggested that this strategy was misguided protectionism and potentially does more harm to the interfaces than just by denying a non-Māori scientist or science organisation access to Māori resources. This strategy may actively inhibit Māori/scientists engagement at the interfaces and continue to do so for other future RS&T projects.

By raising the level of scientific literacy in the Māori community it is likely that Māori communities will come to better comprehend western science. This will enable Māori to be more proactive about how they participate in RS&T projects and how they engage with non-Māori scientists, and improve the effectiveness of engagement at the interfaces. A greater level of understanding of western science will lead to easier interpretation of intentions and a greater likelihood of Māori participation as end users, active researchers and scientists at the interfaces. This is critical to achieving the development objectives of Māori communities, organisations and businesses.

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# **Appendix 1**

## **Information Sheet**



**Massey University**  
COLLEGE OF HUMANITIES AND SOCIAL SCIENCES

TE PŪTAHI-Ā-TOI  
School of Māori Studies  
Private Bag 11 222  
Palmerston North  
New Zealand  
T 64 6 356 9099 extn 7235  
F 64 6 350 5634  
<http://maori.massey.ac.nz>

Ti hei mauri ora!

*'Dancing at the Interface – Ways of Seeing'*  
The Interface between Indigenous Knowledge and Western Science

INFORMATION SHEET

A research project conducted by Stephen Tauwhare to meet the requirements of a Master of Philosophy degree at Massey University, Palmerston North

Tena koe,

I have already contacted you to ask you about participating in the following research. This information sheet describes the research and the level of participation required of you for the research. I will be in contact with you by phone or email shortly to arrange a place and time for our interview.

THE PEOPLE

RESEARCHER: Stephen Tauwhare

As well as being a part time Masters student at Massey University I am also a scientist currently involved in research on the muka and pia harakeke properties of varieties of harakeke. This work is independent of research being undertaken for this thesis.

SUPERVISOR: Margaret Forster  
Te Pūtahi a Toi/School of Māori Studies  
Te Kūnenga ki Pūrehuroa/Massey University  
Private Bag 11-222  
Palmerston North  
(06) 356 9099 xtn 7091

THE RESEARCH

The research looks at the interface between indigenous knowledge and western science, what occurs here, how does it affect Māori and other indigenous people and how can it be manipulated to benefit Māori.

## PURPOSE OF THE RESEARCH

- to explore the interface between indigenous knowledge and western science by focussing on a subset of interactions that occur at the interface including:
  - the relationship between western science and colonialism
  - intellectual property rights regimes including the potential of sui generis intellectual property rights mechanisms for the protection and development of indigenous knowledge for indigenous peoples
  - the inclusion of indigenous values in western science, and
  - the use of oral tradition as a more comfortable pedagogy by which Māori can interact with western science and a vehicle for the inclusion of indigenous values in modern science
- to advocate for the genuine integration of mātauranga Māori and western science

## OUTCOMES OF THE RESEARCH

By exploring these interactions the research aims to contribute to Māori development and western science by, ...

- facilitating greater participation by Māori and other indigenous peoples in western science
- promoting the scientific capacity of Māori and encouraging full participation by Māori in science including as creators of new knowledge, active and passive participants in science and technology and as consumers
- encouraging the consideration and adoption of Māori values by western science as it is conducted in Aotearoa New Zealand
- encouraging Māori to successfully exploit western scientific technologies in a way that protects the mana and integrity of both mātauranga Māori and western science, and ...
- increasing the comprehension of Māori methodologies and practices by western trained scientists

## YOUR PARTICIPATION

Your participation will involve an interview of approximately 1 – 1½ hours that may be tape recorded or not according to your preference. The interview will be transcribed and the transcript copied to your self for corrections and comments and then analysed by myself. I also anticipate that at the end of the project solutions for the integration of western science and indigenous knowledge may be proposed. If you agree these may be disseminated to you for further input and comment prior to submitting the thesis.

On completion of the thesis copies will be made available to yourself and will also be stored in the Massey University Library, Turitea campus, Palmerston North.

**Mauri ora**

Stephen Tauwhare

# **Appendix 2**

## **Consent Form**



**Massey University**  
COLLEGE OF HUMANITIES AND SOCIAL SCIENCES

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F 04 5 350 5834  
<http://maori.massey.ac.nz>

Ti hei mauri ora!

*'Dancing at the Interface – Ways of Seeing'*  
The Interface between Indigenous Knowledge and Western Science

### PARTICIPANT CONSENT FORM

This consent form will be held for a period of five (5) years

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I agree/do not agree to the interview being audio taped.

I wish/do not wish to have my tapes returned to me.

I wish/do not wish to have data placed in an official archive.

I agree to participate in this study under the conditions set out in the Information Sheet.

Signature:

Date:

Full Name - printed

# **Appendix 3**

## **Question Schedule**



**Massey University**  
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Ti hei mauri ora!

*'Dancing at the Interface – Ways of Seeing'*  
The Interface between Indigenous Knowledge and Western Science

QUESTION SCHEDULE

- 1/ Why should mātauranga Māori and western science become integrated?
- 2/ Is it appropriate that mātauranga Māori and western science be integrated?
- 3/ Does this in anyway damage/compromise the mauri of one or the other?

MĀORI CONCERNS WITH SCIENCE (Q4-5)

- 4/ Are Māori concerns with science unique from the concerns of the rest of society?  
[Are Māori being too precious?]
- 5/ What are the commonalities between the views of Māori and the rest of society?

NATURE OF PAST AND CURRENT INTERACTION AT THE  
INTERFACE (Q6-Q16)

6/ How would you characterise the interface between mātauranga Māori and western science? [is this unique to NZ?] How do indigenous knowledge/mātauranga Māori and western science currently interact at the interface?

- 7/ How does this interaction impact on [what are the effects of this interaction?], ...
- a) Māori?
  - b) Western Science?
  - c) Society as a whole?

8/ Does western science need Māori and other indigenous peoples to be involved?

9/ What does this add to western science?

- 10/ Is the current western science 'regime/establishment' benefiting/working for Māori at all?
- a) why/how?
  - b) why not?

11/ How well do you think scientists understand and cope with Māori society and its values and traditions?

12/ How well do you think the New Zealand government and science in New Zealand acknowledge the validity and effectiveness of mātauranga Māori and its potential for New Zealand science development?

13/ How well do you think the New Zealand government and science in New Zealand respond to the concerns and issues of Māori in regard to science in New Zealand and to Māori aspirations in science?

14/ Is this [the lack of this?] a hindrance to Māori being more involved in western science?

15/ Is this difficulty recognised in New Zealand government science policy? Should it be?

16/ What are the implications of wai262 for the way science is done in New Zealand?  
a) commercial?  
b) intellectual?  
c) economic? Etc...

### BENEFITS/RISKS FOR MĀORI (Q17-Q23)

17/ What are the implications of Māori involvement in western science for Māori?

18/ What opportunities are presented by an increased Māori presence in science?  
a) for Māori?  
b) for Science?

19/ How can increased Māori participation in western science contribute to Māori development?

20/ How do you think Māori should respond to the development of the knowledge economy in New Zealand and how important do you think it is that we do?

21/ How can Māori take advantage of the knowledge economy and how well positioned are we to do this? Do Māori need Māori scientists to do this?

22/ What are the implications of Māori non-involvement in western science for Māori?

23/ What should Māori be wary of when becoming more intimate with western science? [What are the issues for Māori? How can they be addressed?]

### BENEFITS/RISKS FOR SCIENCE (Q24-Q27)

24/ What are the implications of Māori involvement in western science for science?

25/ How can Māori involvement in science contribute to the development of modern science?

26/ How do you see the inclusion of Māori values in science contributing to its effectiveness (its universality) and relevance to indigenous peoples and communities?

27/ What are the implications of Māori/indigenous peoples non-involvement in western Science for science?

### **MĀORI PARTICIPATION IN WESTERN SCIENCE (Q32-Q37)**

28/ How important do you think it is for Māori to participate in the development of modern science?

29/ How would you describe Māori participation in western science?

30/ Why do you think Māori professionals/semi-professionals do not figure prominently in western Science?

31/ Why is science an uncomfortable place for indigenous peoples and Māori to be? [is science hard? Or is it just hard for Māori? What makes it hard for Māori?]

32/ What are the implications of this 'apathy' for Māori/New Zealand and how can we address it?

33/ How can Māori participation in science and non-Māori comprehension of the needs and aspirations of Māori and Māori in science be enhanced?

### **INCLUSION OF VALUES IN SCIENCE (Q38-Q45)**

34/ Should 'Māori' values be an integral part of how science is done in New Zealand?

35/ Would the inclusion of 'Māori' values facilitate greater understanding and participation by Māori in science?

36/ Are 'Māori' values and concepts compatible with, and necessary for, a more inclusive and 'universal' science?

- a) for Māori?
- b) but also for non-Māori non-Scientists?

37/ What 'Māori' values in particular do you think are applicable to western science?

38/ What do you wish for the future of science in New Zealand?