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**Whānau identification of mātauranga and tikanga
Māori through the engagement and interaction with
emerging technologies that are generated by AI**

A dissertation
submitted in partial fulfilment
of the requirements for the degree

of

Doctorial in Māori Cultural Studies/Tikanga Māori

Te Pūtahi a Toi

at

Massey University, Manawatū



**MASSEY
UNIVERSITY**

by

PETERA WHAIAO HUDSON

Te Whakatōhea

2024

Whakaari: (*Abstract*)

Whakaari

Whakaari our island they foretell the weather pending such is the abstract

Created by

Dr Te Kahautu Maxwell

This research is strategically positioned to demonstrate whānau connections to one another as an extended whānau, to our lands, to our socioeconomic situation, and to our emotional identity as Māori people raised in the Whakatōhea (see *Prologue and Chapter 1*). The purpose of this research was to identify mātauranga Māori and tikanga Māori that have the potential to, when woven into algorithms, inform next-generation AI systems, that have the propensity to promote cultural well-being for our whānau and their futures. A critical review of selected literature was undertaken to understand the dialectic between te ao Māori and AI (see *Chapter 2*). The eclectic methodologies according to Kaupapa Māori theorising were outlined to aid in the identification of potential issues confronted when undertaking this research. These methodologies justify the selection of specific methods and their suitability for understanding Māori in AI-related development and their beliefs and practices (see *Chapter 3*). Following this, the findings are presented by addressing each question with supporting data. Subsequently, the aggregation of this data revealed critical elements and factors of transformation that would enable the promotion of cultural well-being for our whānau and their futures (see *Chapter 4*). Finally, this research supported the conclusion that Māori can develop transformative practices of change that has the potential to decolonise imperial-dominated AI systems. The research provided an opportunity for further exploration around developing knowledge-sharing interventions to help understand the prominence of the Western perspectives and to confront contemporary AI-related issues for our whānau (see *Chapter 5*).

Keywords: AI; Artificial Intelligence; mātauranga Māori; tikanga Māori; Whānau; cultural well-being; Kaupapa Māori theorising; Indigenous methodologies.

Tāpae: (*To dedicate*)

This research is dedicated to:

Dr Mark Laws (Ngāti Awa, Ngāti Tūwharetoa, Te Arawa)

1958-2010

Mark was born and raised in Kawerau, in the Bay of Plenty, Aotearoa. Mark held a PhD in information science from the University of Otago and lectured at Otago for many years. Before returning to Whakatāne Mark also spent time lecturing in Hawaii. In 2004, prior to Mark's passing he was the founding head of the Te Whare Wānanga o Awanuiārangi computer information science and technology faculty. His vision was to develop programmes and support systems for staff and students around information communication technology. Mark is survived by his wife, Karina, three children, and nine grandchildren. A spokesperson for the wānanga said all of Mr Laws' plans had come to fruition in 2009 with the establishment of the Tokorau Indigenous Innovation Institute. Mark also sat on many of the management, academic, research, ethics, and policy committees, while lecturing and supervising graduate research students. Mark was appointed the Ngāti Awa representative on Whakatāne District Council's iwi liaison committee. He had also helped develop a community-based diabetes online programme in conjunction with Bay of Plenty District Health Board. In addition, Mark had a long association with Touch New Zealand as a referee, gaining a black badge qualification and refereeing at the 1995 World Cup in Hawaii.

Mark was an exceptionally successful and well-respected scholar who significantly advanced the fields of information science and technology both in Aotearoa and overseas. Despite his passing, his aim for creating ICT-related programmes and support systems for faculty and students has been realised, and his legacy is carried on by the Tokorau Indigenous Innovation Institute and other projects he helped build.

He ki taurangi (*Acknowledgements*)

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Tuhituhi Wānanga Mariko – Virtual writing space

Mate Ururoa – Facebook Messenger support rōpū (*group*).

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¹ The Māori and Indigenous (MAI) programme is for the enhancement of Māori and Indigenous post-graduate students throughout Aotearoa

² To meet and discuss, deliberate, consider - traditional place of learning - tertiary institution

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Finally, yet importantly – ***Our research whānau***

I wish to express my profound gratitude to Te Uri o Patumoana and Raikete Amoamo, and to the Māori experts, data scientists and thought leaders, some descendants of Te Whakatōhea and others from around Aotearoa, who have generously given their time, knowledge, and expertise to support my PhD research. Their contributions as whānau have been instrumental in shaping the direction of our research and providing me with a deep understanding of the cultural and historical context of our work. Their invaluable insights and critical feedback have challenged me to think more deeply and critically about our research and its implications for Aotearoa. I am particularly grateful for their unwavering commitment to the principles of tikanga Māori and the values of kaitiakitanga, manaakitanga, and whanaungatanga, which have been central to our collaborative research process. Their contributions have been foundational to ensuring that our research remains culturally responsive and relevant, and that it contributes meaningfully to the advancement of Māori and Indigenous knowledges. I would like to thank each and every one of our whānau for their contributions, and for sharing their knowledge, experiences, and perspectives with me. I am extremely appreciative for the opportunity to work alongside them, and for the enriching experiences and insights they have provided me with. Without their support, this research would not have been possible.

Mākeo: (Table of contents)

Mākeo

Mākeo is our maunga³.

The translation is 'Mā' means clear and 'keo' is the Whakatōhea word for summit.

From the summit of Mākeo the whole of the Bay of Plenty coastline can be seen as well as the hinterlands.

Such is the purpose of the Table of Contents.

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³ Mountain

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Pāpakanui: (List of tables)

Pāpakanui

Pāpakanui is an old pā site of Ngāti Rua situated on the eastern side of the Ōtara river. Today the Pākehā name for Pāpakanui is Tablelands, List of Tables.

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Te Haka a Tamauru: (*List of figures*)

Te Haka a Tamauru

Te Haka a Tamauru is a ridge line with a grove of Kahikatea which resembles a war party performing the haka.

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Te Waiwhakaata a Tūtāmure: (Glossary)

Te Waiwhakaata a Tūtāmure

Te Waiwhakaata a Tūtāmure is a pool of water at Mahia that Tūtāmure used as a mirror.

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Terms	Definitions
Ahikā	Burning flames Authority over the land
Ako	The ways that we like to do things
Aotearoa	Māori name for New Zealand
Āhurutanga	Feeling comfortable and safe
Hapū	Sub-tribes
Hoa tāne	Husband or male partner
Hoa wahine	Wife or female partner
Iwi	Tribe
Kānga pirau Kānga wai Kānga kōpiro	Types of fermented hummus-like maize porridge
Kāhui	Company
Kai awa	Food from the river
Kai moana	Seafood
Kaitiaki	Trustee, minder, guard, custodian, guardian, caregiver, keeper, steward
Kanohi ki te kanohi	Present yourself to people face to face
Kanohi kitea	Face to face
Kapahaka	Māori action songs and the groups who perform them
Karakia	Incantations/prayer
Karakia tīmatanga	Opening prayer
Karakia Whakamutunga	Closing prayer
Kaumātua	Adult, elder, elderly man, elderly woman, old man - a person of status within the whānau
Kaupapa Māori	A way to value each and every person in Aotearoa while ensuring the basic question of their welfare is central to any decision-making process
Kaupapa Māori	Māori theorising
Kawa	Māori protocol and etiquette
Kawānatanga	Government
Kei Oha te Taniwha	The game of Hangman

Terms	Definitions
Ko ahau anō	Me, myself and I, autoethnography or self-reflection
Koha	Transformative change
Kōhanga Reo	Māori language preschool
Kōrero	Speech, narrative, story, news, account, discussion, conversation, discourse, statement, information
Koro	An elderly Māori man, especially a male relative or ancestor.
Kotahitanga	Unity, togetherness, solidarity, collective action.
Kuia	An elderly Māori woman, especially a female relative or ancestor
Kupu	Word, vocabulary, saying, talk, message, statement, utterance, lyric
Kura Kaupapa Māori	Māori-language immersion school
Mahi	Work
Mana	An impersonal supernatural power
Mana whenua	Authority over the land
Mana motuhake	The authority through self-determination and control over one's destiny
Mariko	Virtual
Mātauranga Māori	Māori epistemologies, Māori knowledge
Mauri	Life force
Moana	Ocean
Moemoeā	Vision
Moko	Blue mackerel
Mokopuna	Grandchild
Moko tuarua	Great-grandchildren
Moni ika	Whitebait tax
Ngā mihinui	Thank you very much
Ngā mihi aroha	With much love
Ngā Poutama Whetū	Culturally progressive literacies evaluation procedure
Noa	To be free from the extensions of tapu, ordinary, unrestricted, void
Pākehā	New Zealanders of European descent
Paerangi	Māori Boarding Schools
Papatūānuku	Earth, Earth mother and wife of Ranginui
Parāoa parai	Fried bread
Pākehā	New Zealander of European descent
Pono	Correctness
Raupatu	Confiscation of land
Rēwena	A bread made from potato yeast
Rōpū	Group
Rua	Storage pit
Tapu	Be sacred, prohibited, restricted, set apart, forbidden
Tātai arorangi	Astronomical knowledge
Tamariki	Children
Tākiri	A process of a single snare on a perch
Tangata	Human, individual

Terms	Definitions
Tangata whenua	Māori people of a particular locality, or as a whole as the original inhabitants of New Zealand
Tangihanga	Funeral
Taonga	Property, goods, possession, effects, gifts
Taonga tuku iho	Our gifts from our ancestors
Te Ika-a-Māui	North Island of Aotearoa
Te ao Māori	Māori worldview
Te ao mariko	The virtual world
Te reo Māori	Māori language
Tika	Correctness
Tikanga Māori	Māori ontologies, Māori cultural practices and experiences
Teina	Younger brother/sister/cousins
Tino rangatiratanga	The pursuit of self-governance and self-determination
Tohunga	An expert practitioner of any skill or art, either religious or otherwise
Tuakana	Elder brother/sister/cousins
Tūpuna	Ancestors
Tūpuna awatea	Ancestor from the dawning of the new age
Tūpuna waka	Wayfaring ancestors
Tūrangawaewae	Domicile, standing, place where one has the right to stand
Tutu	Play
Uri	Offspring, descendant
Urupā	Cemetery
Wahine	Female, women, feminine
Wairua	Soul
Waka	Canoe
Wānanga	To meet and discuss, deliberate, consider - traditional place of learning - tertiary institution
Wānanga mariko	Virtual wānanga
Whakapapa	Genealogy
Whakapono	Integrity, trust
Whakaaro	Thought, opinion, plan, understanding, idea, intention, gift, conscience
Whakataukī	Proverb, significant saying
Whakawhanaungatanga	Relationship building
Whānau	Whānau and extended whānau
Whanaunga	Relative, relation, kin, blood relation
Whanaungatanga	Relationship, kinship, sense of whānau connection
Whāngai	Foster child, adopted child
Wharekura	School
Wharenui	Meeting house, large house
Whare Wānanga	Place of higher learning, Māori tertiary institutes
Whenua	Land rights Land or home or house Tribal homelands

Karakia⁴ Tīmatanga: (*Opening Prayer*)

He hōnore he korōria he maungārongo ki runga i te whenua he whakaaro pai ki ngā
tāngata katoa.

Whakamoemiti tonu ki a koe e Ihowa mō āu manaakitanga i a mātua katoa.

Hei āwhina, hei tohutohu i a mātou i roto i ngā mahi katoa.

Honour and glory to God. Peace on Earth. Goodwill to all people

Inoi (prayer)

Heavenly Father, thank you for guiding and helping our work with our thesis.

⁴ Incantations/prayer

Prologue - Nukutere

My story: Ngā Uri o Patumoana and Raikete

Amoamo⁵

Nukutere⁶

'Nuku' means to move. 'Tere' to float or move quickly.

A Prologue is an introduction or work or acts that introduces or leads into another piece, providing a glance at the kaupapa - Nukutere.

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Prologue

In this prologue, I attempt to show the vital relationship of myself to the intention of this thesis. This relationship is built on my experiences growing up as a member of a whānau (*whānau and extended whānau*), a hapū (*sub-tribe*) and an iwi (*tribe*) of people who are regionally identified and descend from common ancestors. My tribal background is Te Whakatōhea. Our traditional lands and territories are located on the eastern end of the North Island province of the Bay of Plenty. The principal town in our region is Ōpōtiki. We are bounded by a coastline that has been a significant food-basket for our people, and we have a strong relationship with the moana (*ocean*).

My individual Kaupapa Māori perspective is simultaneously located within these collective identities. In this sense, my positioning is culturally dialectal in that I am always a whānau and tribal person, not just an individual. This tension goes to the essence of my thesis. My questions explore how my extended whānau and I can maintain our tribal relationships, responsibilities, and connection to our traditional whenua and moana in a changing world with new demands regarding our survivance

⁵ The offsprings/desendants of Patumoana and Raikete Amoamo

⁶ Nukutere was one of the Māori migration canoes that brought Te Whakatōhea descendants to Aotearoa.

socially, economically, and culturally. For most of our whānau, pursuing economic security has required us to move away from our home territory to find work. Many have married and moved to other places to raise their families. The consequences of this dislocation from our home territory have caused interruptions to our ability to lead a Whakatōhea cultural existence and limit our responsibilities to being a good Whakatōhea citizen. Our whānau members have become separated by living in different places in Aotearoa (and overseas). Many have also become disconnected from our traditional values, lifestyle, lands, culture, and history that distinguish us as Whakatōhea tribal members. This problem is compounded when our whānau become distressed and anxious because they want to be connected and to return home to fulfil these expectations. However, this is heightened by several factors, including distance, cost, and the frequency of events such as tangihanga (*funeral*). Add to this the cultural capital erosion occurring through the inability to support/fulfil our cultural obligations and responsibilities. It has become increasingly challenging to meet as a whānau, to see our new mokopuna, to listen to our elders' stories, to keep up with our reo Māori (*the Māori language*), to catch up with the latest news and to be seen kanohi ki te kanohi (*present yourself to people face to face*) as descendants of Patumoana and Raikete Amoamo.

Prologue Figure 1: Nanny and NannyPa



*Note: Patumoana
and
Raikete Amoamo
1979
(Own photo)*

This story comes from ngā uri, the descendants of my Nanny and NannyPa (my affectionate name for my grandparents), our tūpuna (*Ancestors*). Ngā uri o Patumoana and Raikete John Amoamo, at the time of the writing of this narrative, numbered one hundred and six (112) members. Six (6) siblings or our Mātua and Mātua Whaia generation; twenty-one (21) cousins representing our Rangatahi generation; forty-seven (47) children of our Rangatahi from our Mokopuna generation; and the generation of our Mokopuna Tuarua numbering twenty-eight (28). I am the third (3rd) born cousin, my mother and father being Martha Mahuta and Terence Whaiao Hudson.

Prologue Figure 2: Original sibling portrait



Prologue Figure 3: My Mum, Aunties and Uncle



Note: Prologue Figures 2 and 3: Back row: Frank, Martha Mahuta, Hera. Front row: Patumoana, Ripeka, and Tamaku (Own photos)

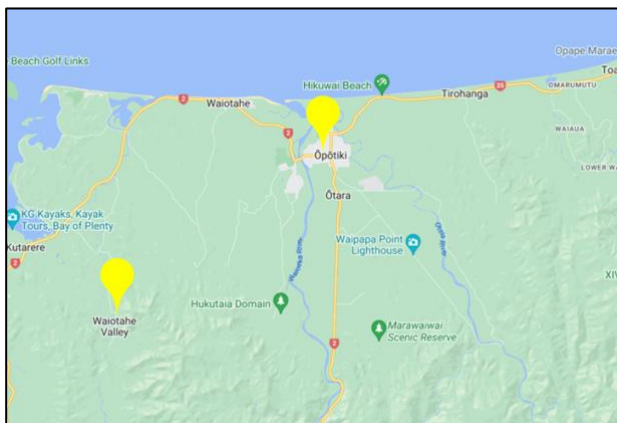
Tūrangawaewae, Whenua

Nanny and NannyPa brought their whānau up on a farm in the fertile Waioatahe Valley, west of Opotiki, on our tribal homelands of the Whakatōhea. This farm was called *Ahirau*. Ahirau was a four-five-acre farm block comprised of three large paddocks that carried a small herd of milking cows and rotational crops, including potatoes, kumara, pumpkins, watermelons, corn, peanuts and sugar cane. Ahirau was bordered on the west and north sides by the Waioatahe River, to the east by a hedgerow and to the south by a property fence line with the next-door neighbour's farm.

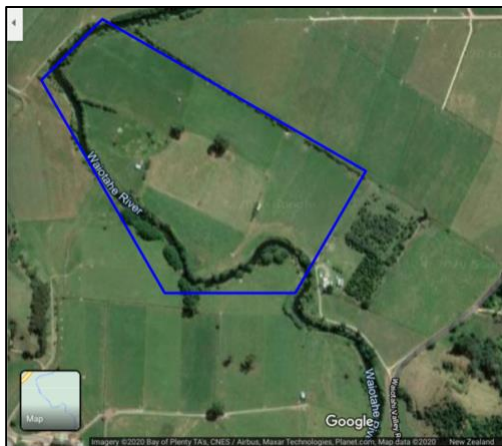
Prologue Figure 4: Te Whakatōhea (Starr, 2013)



Prologue Figure 5: Location of the Waioatahe Valley and Ōpōtiki (Google Maps, 2023a)



Prologue Figure 6: Ahirau Farm boundaries (Google Maps, 2023)



Nanny and NannyPa named their farm Ahirau after the point where the Waiotaha River meets the Pacific Ocean at the Waiotaha pipi bed. The pipi bed was renowned for the abundance of kai moana (*seafood*) and kai awa (*food from the river*), and it was told that the flames of the numerous cooking fires could be seen along the beach, cooking the abundance of food for the families that had gathered the kai. Hence, the translation of Ahirau was created to mean one hundred fires (T. Amoamo, personal communication, 26 February 2022). It is believed that Nanny and NannyPa named their farm Ahirau as the metaphor for abundance, which the Waiotaha pipi³ bed was for them. Nanny and NannyPa hoped their farm, Ahirau, would provide plenty from its fertile lands.

This tale of Ahirau and Nanny and NannyPa's efforts to start and maintain the farm has imbued fundamental Māori values such as stewardship of the land, kinship, hospitality, reciprocity, adherence to customary practises, and the importance of genealogy and ancestry within me and, therefore into my research.

My Aunties recall how Nanny and NannyPa would load their whānau car with kai from the rotational crops field, called the *Five-Acre Block* and drive to Ōpape, delivering and sharing the food with whānau along the way. Ahirau was a very appropriate name as, like the point where the Waiotaha River meets the Pacific Ocean at the Waiotaha pipi bed, Nanny and NannyPa's farm became the equal of the providing an abundance of cultivated kai.

Nanny and NannyPa showed the strong sense of community and interconnectedness essential to Māori culture by exemplifying manaakitanga and reciprocity. My positioning in this thesis has been impacted significantly by Nanny and NannyPa's transformation of knowledge and demonstrating these values of helping one another and sharing resources, fostering a sense of whanaungatanga (*kinship*), and improving the community's general well-being.

***Prologue Figure 7: Te Uri o Patumoana me Raikete Amoamo, Maromahue Marae
2014***



Note: Te Uri o Patumoana me Raikete Amoamo with a few Waiotaha Valley friends and neighbours (Own photo)

Being the third cousin in a line of twenty-one Māori cousins gives me a unique and culturally diverse experience. My culture is deeply rooted in the rituals, customs, and ancestral inheritance of the whānau. Strong familial ties and a strong emphasis on community and whānau are present. As I conducted this research, my Patumoana and Raikete Amoamo whānau roots gave me a distinct insight since they fostered a strong sense of connection and belonging among me and my whānau. This familial background has dramatically impacted the research path in several ways. First, the research has a solid base in the whakapapa, which traces my ancestors' lines of connection. Whakapapa is the foundation for our collective identity and cultural grounding incorporated throughout this thesis.

Prologue Figure 8: Alle Gray and Petera



Note: Alle Gray-Ure and I are eating ice cream in Ōpōtiki, well, I am, Alle must have dropped hers. (Own photo)

Second, the significance of cultural events, rites, and customs provides a better understanding of lived experience. These lively, happy Māori gatherings and celebrations within our whānau context offered numerous opportunities to witness the importance of cultural festivities, rites, and traditions first-hand. Gatherings, such as Māori celebration of birthdays, were a vibrant and joyful event that featured many customary ceremonies and practices. I gained a deeper appreciation for the significance of these practices in our whānau environment after seeing the moving haka performed by whānau members and participating in the celebration's sharing of traditional meals. Since I participated in such important events, I recognised our whānau's cultural diversity and ties, and this increased comprehension of Māori community life. Finally, being a part of my Patumoana and Raikete Amoamo whānau also provided opportunities to learn about and share intergenerational cultural customs, such as stories, myths, and legends passed down through the centuries, enhancing the research perspective.

This research ethos has been formed by the distinctive Māori cultural values of *manaakitanga* (*hospitality*), *whanaungatanga* (*kinship*), and *kaitiakitanga* (*stewardship of the land*) through my experiences with my cousins, highlighting the significance of these values in scholarly work. My desire to learn te reo Māori, which not only strengthens cultural ties but also makes it possible to communicate in culturally significant ways during the research process, has also been sparked by being a member of my Patumoana and Raikete Amoamo whānau.

The Māori cultural values of *manaakitanga* (*hospitality*), *whanaungatanga* (*kinship*), and *kaitiakitanga* (*stewardship of the land*), which I have personally encountered through interactions with my cousins, have had a significant impact on my academic career. These principles have influenced the research ethics, highlighting the benefits of hospitality, kinship, and land stewardship. My interactions with the close-knit Patumoana and Raikete Amoamo whānau have highlighted these principles' importance to academic work. My affiliation with my whānau has fuelled my desire to study te reo Māori. Using te reo Māori, I can engage in meaningful cultural interactions throughout the research, strengthening my cultural links. By incorporating te reo Māori into my academic endeavours, I am embracing te reo Māori and the

principles underpinning the research. Through my journey, I have learned to recognise how these principles enhance my academic pursuits to guide how I approach my work holistically and culturally.

My Patumoana and Raikete Amoamo whānau also provide a sizable support network for overcoming obstacles and celebrating academic success during the research. This thesis contributes significantly to preserving and continuing our customs and knowledge since cultural practices are more likely to be preserved and passed down to younger generations. The ability to research and follow tikanga Māori (*customary procedures*) as a Patumoana and Raikete Amoamo whānau member has also impacted the research methods and approach, respecting and engaging in appropriate research methods. Ultimately, my Patumoana and Raikete Amoamo whānau's strong sense of belonging and connection to one's ancestors, ancestry, and ancestral lands set the direction of this research journey. This academic journey has been significantly enhanced by incorporating these rich narratives of cultural perspectives, values, and a sense of community.

Mum and Dad

My Mum, Martha Mahuta Hudson (nee Amoamo), is the third sibling of our Nanny and NannyPā. She is primarily associated with Omarumutu Marae. The following pepeha describes her relationship with Omarumutu.

Ko Tūtāmure te whare tipuna,
Ko Hine-i-kauia te wharekai,
Ko Mākeo te maunga,
Ko Waiāua te awa,
Ko Ngāti Ruatakenga te hapū,
Ko Te Whakatōhea te iwi.

The educational context in which Mum grew up was highly influenced by the arrival of the colonial missionaries in the early 1800s. Following the signing of the Treaty of Waitangi in 1840, notions regarding the government's low expectations for Māori education emerged. Additionally, instructional rules regarding the establishment of

Native Schools and the prohibition of te reo Māori being spoken in playgrounds were codified into law.

Mum was born in Ōpōtiki in 1933, where Western domination expected Māori whānau to raise their children as predominantly English speakers. Mum was fortunate to speak Māori to her parents and grandmother at home. However, English was, by that time, the primary language of instruction in schools in the wider Ōpōtiki region.

During the 1950s and 1963, secondary school student numbers rose from 67,478 to 149,063 nationally (Swarbrick, n.d.). Mum was encouraged to train as a teacher and enrolled at Ardmore Teachers College in Papakura, Auckland. After her training, Mum returned to Ōpōtiki to commence her teaching career at Ōpōtiki Primary School. During her 40-year tenure at Ōpōtiki Primary School, Mum, alongside her very good friend Rangi Koopu and Rangi's son Eru Koopu, created Ōpōtiki Primary School's Kura Reo Māori.

Prologue Figure 9: Te Kura Kaupapa Māori - Ōpōtiki Primary School, 1990



Note: (Own photo)

The Ministry of Education seconded Mum as the Resource Teacher of Māori, where she worked with principals, teachers, students and school communities in Kura Māori throughout Te Whānau-ā-Apanui, Te Whakatōhea, Ngāti Awa and Tūhoe. Mum's final years of teaching were spent at Kutarere Primary teaching in the bilingual infant classroom. Mum now resides with us in Whanganui.

Despite all Mum's efforts to educate others in te reo, we, in essence, were encouraged in a different direction to follow a mainstream pathway. Ironically, I was part of a Māori speaking community, my Mum supporting the maintenance of the Māori language elsewhere, but our whānau drifted in a different direction where her own experiences did not translate into our home environment.

My father's name was Terence Whaiao Hudson, to be known as Dad from here forward. Through my Grandfather, Tua Hudson and Grandmother, Bella Pirihi, we are associated with Te Rere Marae. The following pepeha describes his relationship to Te Rere.

Ko Te Iringa te whare tipuna
Ko Whiripare te wharekai
Ko Maungarangi te maunga
Ko Ōtara te awa
Ko Ngāti Ngāhere te hapū
Ko Te Whakatōhea te iwi.

Ngāti Ngāhere derives its name from the circumstance surrounding the death of our ancestor Te Hau-o-te-rangi, whose slain body was suspended in the forest. His eldest son, Tahu and his whānau adopted the name Ngāti Ngāhere, the people of the bush. During the Government land confiscation at Paerātā, many of the Ngāti Ngāhere refused to be relocated to the Ōpape Reserve and chose to live at Te Rere, meaning to fly, a small reserve granted to them. The land derives from Te Rere moari, a swinging maypole where swimmers would swing out over the Ōtara River and drop into the water. Te Rere became the established centre of Ngāti Ngāhere. Ngāti Ngāhere, like many other Whakatōhea hapū, erected a modern wharenuī named Te Iringa in 1910.

My Dad was born in Ōpōtiki in 1929. He attended Ōpōtiki Primary and Ōpōtiki College. After leaving college, he became a Ford Motors mechanic specialist at the local Ōpōtiki Ford Motors. His specialisation as a mechanic was servicing and maintaining Ford motorcars. His final years in the motor trade before retirement were as the Parts Service Manager at Ōpōtiki Ford Motors. Much of Dad's training took place on the garage floor, spending nearly 50 years in the motor trade industry. Dad was part of the generation that witnessed many of the automobile technological innovations that paved the way for many of the significant advancements in the industry.

As emerging technologies in Ford vehicles became more sophisticated, Dad attended in-service training at the Ford Motors assembly plant in Seaview, Wellington, followed by continued training at the relocated assembly plant in Wiri, Auckland. From the arrival of engines that used fossil fuels to power transportation, the impact of technology in redefining automobiles throughout has been enormous. During the time Dad spent at Ford Motors in Ōpōtiki, he observed and was a part of the redefining of the ways vehicles used fuel; monitored braking, cooling, speed, steering and electrical systems; and advancements in making cars safer and more user-friendly. As in every other industry, the automobile industry was rapidly advancing in contemporary times.

My Dad's personal story is important because he was very technically minded. During the 1950s and 60s, the stereotype was that Māori were not very good at doing overly technical things. This stereotype has drifted down over the years and into contemporary schooling. So, the majority of Māori, including myself, have been taught and heard many reasons that we were inept in science, technology, engineering and mathematics. But, despite this, my Dad passed down his technical knowledge to me. I have always felt closely aligned with Dad's technical persuasions and not intimidated by technology or this discourse of inferiority. Hence, this has stood me in good stead as to why I have always been interested in technology and education – both traits I have inherited from my parents.

Mum and Dad's singular positions significantly impact the prospective breadth of my life journey and its relationship to this research. The historical impact of colonial missionaries on Māori was significant. Māori preexisting spiritual traditions were either supplanted or blended with Christian concepts. The missionaries were also largely responsible for exposing Māori to Western advancements in trade, agriculture, and literacy. Mum's experience as a teacher and resource teacher of Māori is an intentional response to the invigoration of Māori education rejuvenate te reo Māori and language revitalisation.

My Dad's whānau's connection to Te Rere Marae offers a rich cultural history related to Ngāti Ngahere, and his experience as a Ford Motors mechanic specialist provides specific insights into developments in the automotive industry. These varied experiences offer a chance to write this thesis that covers a wide range of topics, including indigenous education, language revitalisation, cultural preservation, and technical advancements. My overall aim in undertaking such a journey is to conceptualise pathways for protecting cultural heritage, especially for those living outside our tribal homelands, while accepting modern improvements by illuminating how technology affects indigenous populations and how cultural knowledge drives technological innovations. All these factors have been ingrained in me over my lifetime spent with Nanny, NannyPa, and my parents.

Margins of the margins - My parents' struggle

Mum and Dad found themselves not eligible for financial support to send me to a Māori boarding school, as Mum and Dad were deemed 'too rich'. Mum and Dad, therefore, worked hard to accumulate enough money to send me, not to a Māori boarding school, but, St Paul's Collegiate School, a non-Māori Anglican boy's secondary boarding school in Hamilton, Aotearoa. I was placed in the bottom streamed class, as classified by my primary school efforts and a Pākehā entrance examination. I was one of six Māori students in a school of 350 Pākehā boys, and my secondary schooling life was immersed in Western ideologies. Consequently, any similarities to the practices of the Key Principles of Kura Kaupapa Māori

developed by Smith (1997a) during my secondary school education were non-existent. Due to their experiences, my parents chose to enrol me into the Pākehā education system, with the intention of me learning the tools of the Pākehā to be able to live in that world. However, on reflection, when looking back at these past events, it is apparent that the underpinning aim of the New Zealand government was to further marginalise *the margins*. The term marginalise the margins is frequently used to describe people or groups already marginalised on a social, economic, or political level but also experience several levels of exclusion and discrimination inside their communities or cultures (Elers et al., 2021). Ultimately, the goal was to incorporate Māori into European culture as soon as feasible (Walker, 2016). On reflection, my journey was similar to that of my parents, however, it happened three decades later.

The significance of educational equity and cultural preservation in marginalised groups is vital to position me in this thesis. The ongoing effects of state-imposed laws on Māori education, the difficulties experienced by students similar to myself in environments with many different cultural influences, and the role of cultural identity and self-determination in determining educational experiences inform my positionality. The argument is that these lived experiences shed light on the tenacity and resolve of parents and grandparents who work hard to give their children and grandchildren better opportunities while navigating systems attempting to assimilate underrepresented groups into dominant cultures.

Hamilton Teachers College

In the late 1970s, I enrolled at Hamilton Teachers College and was embraced by peers and friends from regions of Aotearoa whose whānau were engaged in things Māori and who had attended Māori boarding schools. We were led by espousing academic leaders such as Atihana and Hera Johns, George Marsden, Timoti Kāretu, Te Wharehuia Milroy, Hirini Melbourne and John Moorfield, who encouraged us to participate in a cultural revitalisation of Māori. This environment provided an opportunity for disturbances in my mindset as a myriad of courses and events were

offered, including Māori Studies, Te reo and tikanga Māori, kapahaka practices and performances, and spontaneous discussions and debates.

More importantly, I was immersed, surrounded, and loved by other Māori students and staff, which became the norm. I started to wonder about my origins and who I was as Māori. I became a part of a “social movement born out of frustrations of urbanisation” (Walker, 2016, p. 210). In particular, Walker points out that this was “an underground expression of rising political consciousness” (Walker, 2016, p. 210). This environment started to provide Māori with tools to decolonise the methodologies of Western philosophical colonisation of our lives. Aspects of *whakawhanaungatanga* (*relationship building*) glued our whānau at Hamilton Teachers College, identifying, maintaining, and forming past, present, and future relationships, which enabled us to locate ourselves as Māori with other Māori. From this social movement of Māori at Teachers College, we became a part of the more significant social movement of Māori peoples in Aotearoa, which grew the expanded social movement of Indigenous people around the World. Overall, this international solidarity of Indigenous political consciousness created and continues to make changes for the betterment of Indigenous peoples.

During this period, we experienced the occupation of Bastion Point, which lasted 506 days. This protest was led by Ngāti Whātua, a local iwi, tribe, who were protesting the loss of land in the Ōrākei block that had previously been deemed unalienable. Ngāti Whātua ki Ōrākei owned less than a hectare of the reserve after it had been significantly decreased in size through forceful acquisition. Yet, the government proposed a housing construction on what had been Ngāti Whātua reserve territory, which is when protesters took action by occupying Bastion Point (Smith, 2021; Walker, 2004). Regarding protest demonstrations, Bastion Point was one of the longest, beginning on 5 January 1977, the same year I started at Teacher’s College, and ending on 25 May 1978, when 222 protesters were evicted and arrested by police. Similar demonstrations have occurred throughout the New Zealand timeline. Another significant event happened while I was at Teacher’s College in 1978. The location was

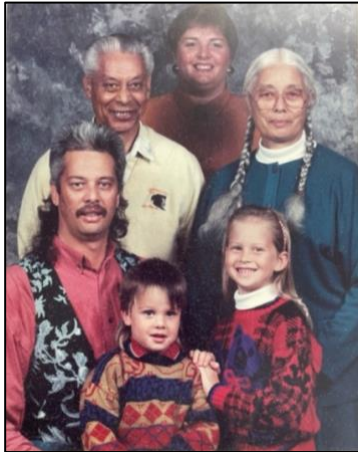
Whāingaroa, Raglan, where Māori land had been stolen during World War II for an unbuilt airfield. However, land confiscation had occurred approximately a decade earlier, when in 1969, some of this land had been turned into a golf course instead of being returned to its original owners (Smith, 2021; Walker, 2004). For many students at Teacher's College during the 70s and 80s, this was a time when critical thinking and independence were encouraged and celebrated. My time at Teacher's College ended with my graduation in 1979 and having a certified teaching qualification.

Marie-Louise, the children, and the grandchildren: My journey

I spent my first year of teaching at Mokoia Intermediate and Wanganui Intermediate. At that time, I met my future wife, Marie-Louise (nee Pelzers), of Dutch ancestry. We spent three years living and working in Europe. In 1987, we moved to Copenhagen, Denmark, where we spent 12 months where I taught at the Copenhagen International Junior School (CIJS) - this time opened a window into the lives of direct descendants of the Sámi people, who inhabit the vast expanse of northernmost Europe. While in Denmark, Marie-Louise fell pregnant with our daughter Ria. However, with my CIJS teaching contract only 12 months, we decided to travel back to Aotearoa for our daughter's birth. We then moved to Singapore to complete a 4-year teaching contract at the Singapore International School. During our time in Singapore, our son Ken was born.

Here, we observed that, similar to the Sámi people, interracial religious and ideological tensions were evident. These tensions between Singapore and its neighbouring countries led to Singapore becoming an independent country in 1965. Our visit to Singapore occurred in 1988, yet during this time, Marie-Louise and I experienced interracial religious tensions between Southeast Asians.

Prologue Figure 10: The Hudson whānau



Note: Back: Marie-Louise Hudson. Middle: Terence Whaiiao Hudson, Mahuta Hudson. Front: Petera Hudson, Ken Hudson and Ria Hudson. Singapore, 1990 (Own photo)

We then travelled to the Northern Diegueno, Kumeyaay, Luiseno, Cahuilla, and Cupeno, the Native American tribal lands of the area, including San Diego County, where we resided for three years. During this time, I completed a master's degree in educational administration. We immersed ourselves in the First Nations culture only to observe European norms and beliefs characterising the Spanish colonisation of the Americas and the Western colonisation of the First Nations peoples.

Prologue Figure 11: First Nations Cultural Festive, San Diego, CA



Note: 1993 (Own photo)

As told in the narration above, we travelled to and lived on several Indigenous ancestral lands. These travel experiences allowed us to learn first-hand how Indigenous whānau have learned to take new knowledge and create new opportunities for themselves and their families.

Transformative change - Working in ICTPD⁷

During the late 1990s, Marie-Louise and I created a teachers' services company called EDUCA (NZ) Limited. With the help of Mum and Dad, we built a tandem axle mobile computer classroom called EDUCA TransTech equipped with 14 Apple Mac stand-alone, internet-telecommunication networked, multimedia, audio/visual and computers, as seen in Prologue Figure 12. We aimed to offer the EDUCA TransTech to schools to provide interactive computer lessons to support students' learning outcomes. It was discovered very early in the delivery of our programme to the students that it was not the students who needed interactive computer lessons but the teachers who required professional development around the inclusion of interactive computers into their teaching pedagogies.

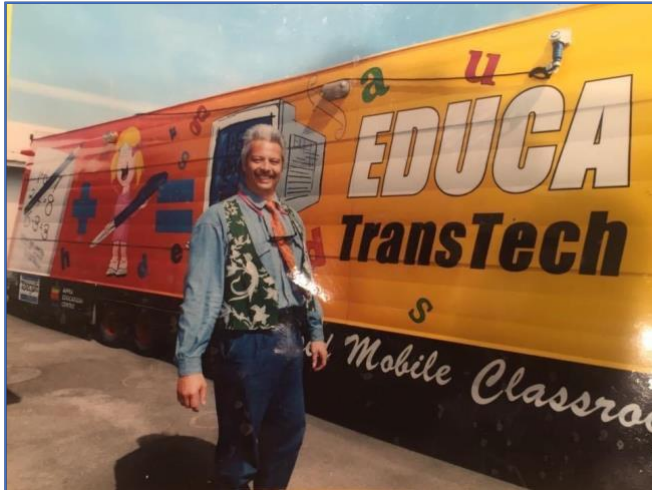
EDUCA (NZ) Limited became a significant provider of national ICTPD programmes. The digital divide between Māori schools and non-Māori schools in Aotearoa was pronounced, so EDUCA (NZ) Limited chose to work alongside Rural schools and Kura Māori, whose school rolls had a high percentage of Māori students (Wylie et al., 2003).

EDUCA (NZ) Limited was also privileged to work in Te Hiringa i te Mahara, a national project funded by the Ministry of Education to reduce the stresses associated with the excessive workload of Māori secondary school teachers. The initiative grew from the 1997 Ministerial Review into Workload Pressures of Secondary School Teachers, which identified the workload of Māori teachers, particularly te reo Māori teachers, as a priority (Wylie et al., 2003). Te Hiringa i te Mahara project's used research and evaluation was essential since it allowed for the ongoing assessment of the project's execution and effects on the participating

⁷ ICTPD – Information and Communication Professional Development

teachers. With this strategy, we were able to make sure that the project was fulfilling the requirements of specific Māori teacher needs and gain insightful information on their capacity for transformational change.

Prologue Figure 12: EDUCA TransTech Mobile Computer Classroom



Note: Just about to start Information and Communication Technology Professional Development in EDUCA TransTech Mobile Computer Classroom, Kokohuia School, Whanganui, Aotearoa 1994
(Own photo)

Connection with whenua and whānau - migration and diaspora

Like my wife's and children's migratory story, our Whānau Patumoana and Raikete Amoamo, migration and diaspora stories, are not unique to our whānau. Some people were drawn to the city by experiences and bright lights, and then they returned home due to those experiences. Some frequently returned, some infrequently, while others purchased new houses elsewhere and never did return to our tribal homelands (Williams, 2015). Māori have recently left their ancestral iwi homes to settle in urban areas that are essentially Pākēha (Haami, 2018). In addition, urban drift among Māori, or the movement of people from the countryside to the city, is a well-researched topic (Haami, 2018; Mead et al., 1982; Walker, 1990).

Our whānau history is linked to whakapapa and migration. Many of my whānau, children, grandchildren, aunties, uncles, cousins, nieces, and nephews live away from our tribal homeland of Te Whakatōhea. Approximately 83% of our whānau live outside our tribal boundaries of Te Whakatōhea, with 24% living outside Aotearoa. Many of our whānau were born outside of our tribal boundaries. Our

whānau who have migrated outside of Te Whakatōhea have not lost touch with their whakapapa or their connections to the whenua of their tribal homeland. Here, geographical distance, governmental decree, or theoretical concepts cannot break tribal ties. Regardless of where you live, how much knowledge you may have of your whanaunga, or how many contacts you may have with your tribal homelands, you continue to be a part of a tribal story.

Prologue Figure 13: Whānau reunions



Note: Left to right, top to bottom: Pic 1: Ali, who lives in Bluehaven, NSW, with her Wellington, Aotearoa-based niece and nephews in Whanganui – Tyra, Ali, Nate, and Lincoln. Pic 2: John lives in Ōtaki, Aotearoa, with Aunt Maku in Blaxland, NSW, Australia. Pic 3: France-based cousin Kayla meets German-based cousin Manuel in Germany. Pic 4: Ken, who is living in Coogee, Sydney, and myself, based in Whanganui, Aotearoa, catching up with Cousin Ali, who lives in Bluehaven, NSW, Australia. Pic 5: German-based nephew Elijah catches up with Blaxland, NSW, Australia, Uncle Kendal.

(Own photos)

Cultural Dislocation

The signing of the Whakatōhea Deed of Settlement was an important event for the Whakatōhea people on May 27, 2023. It marked the resolution of historical claims with the Crown and the beginning of a new chapter in the relationship between the Crown and Te Whakatōhea. Although I could not attend the signing of the Deed of Settlement due to the tyranny of distance and the effect of geographical detachment, I sat with my Mum and watched the events online. In this instance, we used technology

to bridge the physical distance as we witnessed this historic moment for our people, Whakatōhea and my whānau. The signing of the Whakatōhea Deed of Settlement was an incredibly moving event which brought to the forefront of my consciousness the importance of upholding and defending Māori customs, values and practises during the settlement and reconciliation process with the Crown.

Prologue Figure 14: Te Whakatōhea Deed of Settlement via online stream



Note: My Mum watched the signing of the Whakatōhea Deed of Settlement via online stream on May 27, 2023
(Own photo)

It is important to recognise the difficulty of disconnection, separation and dislocation from our home territories. Prologue Figure 14 provides an example of bridging the physical distance as we witness this historical moment, an incredibly moving event. The utilisation of contemporary technologies has the potential to help reconnect whanau with iwi aspirations. Cutting edge technological platforms and application appear as a feasible remedy to cultural dislocation.

Prologue summary

The purpose of this prologue is to share stories and anecdotes that connect me to the work I am undertaking here. I share these background stories because I want to share real-life experiences that have influenced my thinking. For example, my experience growing up as a Whakatōhea person, why and how I became interested in technology, stories of my youth, my mother and father's influence, my schooling experience, specific cultural encounters and events, significant learnings and so on. I also share this prologue so that the reader can assess my biases and the extent of my objectivity.

I make no apology for these biases as they inform who I am as a researcher who is a proud descendant of Whakatōhea.

I have shared these insights to demonstrate the various relationships we have with each other, our community lifestyle, and our values. These memories are part of my cultural makeup – part of my Whakatōhea identity. However, my current living circumstances often inhibit me from fulfilling my cultural obligations because of economics, travel distance, work commitments, local responsibilities, and other factors. Therefore, my interest in doing this thesis is a belief in the need of our whānau to maintain their connectedness to tribal identity, our mountains, rivers, lands, seas, our traditions, our urupā where our ancestors are buried, and most of all, to our relatives. We must keep our extended whānau intact, connected, and functional as a whānau. We must utilise contemporary technological tools to help our whānau re-connect with and respond to our iwi's ambitions. Whakatōhea's powerful force is both necessary and essential. Recognising the difficulty of disconnection, investigating cutting-edge technological platforms and apps appears as a feasible remedy.

Chapter 1 - Te kai hoki i Waiaua.

Introduction: Thesis

Whakataukī⁸: Te kai hoki i Waiaua

The food is abundant at Waiaua

This Whakatōhea whakataukī refers to the abundance of food at Waiaua. In reference to the stories and the memories, this chapter talks about originating with Patumoana and Raikete Amoamo, who belong to Waiaua and Ngāti Rua.

by

Tāpuikākahu a Whakatōhea tūpuna from Ngāti Rua

1.0 Introduction

This research is undertaken as a Whānau Research. While I am the lead researcher, undertaking this work for a PhD, I am focused on producing an outcome that is beneficial for my wider whānau. As a consequence of this whānau focus, I have deliberately involved them in this work – testing and reflecting with them the progress of the research. This research aims to identify factors that promote Māori well-being for our whānau which reflects their desire to retain their connectedness to each other as a whānau, and to also maintain their Whakatōhea identity. An important expectation of this research is to identify the key elements which will support our whānau to develop virtual interactions.

Many of our Research Whānau are Te Uri o Patumoana and Raikete Amoamo.⁹ A smaller number were drawn from Māori experts, data scientists, and thought leaders, from within Te Whakatōhea and from around Aotearoa. Our whānau posited that the Kaupapa Māori Key Principles developed by Smith (1997a) have the potential to

⁸ Proverb, significant saying

⁹ To be known as the Research Whānau or whānau researchers from here on.

impact the cultural well-being of our whānau and their futures. Thus, Smith’s research has become an important baseline from which this research project springs from.

1.1 Whānau questions

1.1.1 Research question 1:

Understanding te ao Māori is vital because it affects how cultural traditions and heritage are shared and conserved in our ever-changing world. Hence, the following question was developed to address this concern:

How can mātauranga and tikanga Māori and emerging technologies provide for cultural well-being for whānau and their futures?

Māori cultural sustainability, resilience and identity are guided by mātauranga and tikanga Māori. This research posits that mātauranga and tikanga Māori have the potential to inform next generation AI systems therefore promoting well-being for our whānau and their futures.

1.1.2 Research question 2:

An essential part of Māori culture and identity, resilience and well-being are addressed under *whakawhanungatanga*. Whakawhanaungatanga refers to forming and upholding bonds, connections, and reciprocal commitments between individuals and groups, creating and maintaining strong communities. When fostering whānau connectedness, whakawhanaungatanga can be a key factor in reducing the physical distance many Māori whānau who live away from their whenua, away from their ancestral land or tribal territory. AI systems have the potential to promotion whānau connections, belonging and well-being. The following question was designed to pay attention to these notions:

How can emerging technologies enhance whānau connectivity, beyond kanohi ki te kanohi, considering that many of our whānau are living away from our whenua, away from their ancestral land or tribal territory?

1.1.3 Research question 3:

The answer to the following query is crucial because it discusses the broader social and ethical ramifications to the many facets of our lives. It is vital to consider how domestic and global social and ethical frameworks impact the context of mātauranga and tikanga Māori. Cultural well-being is informed by mātauranga, te reo, and tikanga Māori which in turn advances Indigenous knowledge locally and globally to shape well-being for our whānau and their futures. To focus on these ideas, the following question was created:

How do mātauranga Māori, te reo Māori and tikanga Māori contribute to the domestic and the global conversation regarding emerging technologies cultural well-being for Indigenous people and their futures?

All of these questions are connected to the overarching issue of maintaining and advancing Māori culture and identity in the face of both historical and present-day difficulties. The following section outlines the disruption and disintegration of whānau and cultural identity through the colonisation of Te Whakatōhea. This next section also serves as the driving forces in the identification of how Māori cultural practices and knowledge might be shared and perpetuated, especially in light of past trauma and present systematic inequity.

1.2 Thesis organisation

This thesis sets out to develop a counter strategy to these divisive forces generalised here as *colonisation*. The essence of the strategy is to identify the key elements and factors that would potentially inform an emerging technology platform that can assist the continuation of Māori cultural well-being.

The Prologue shows the highlights my relationship to the intention of this thesis (see Prologue). Next, we focused on producing an outcome that is beneficial for wider whānau which reflects their desire to retain their connectedness to each other as a whānau, and to also maintain their Whakatōhea identity (see Chapter 1).

Then, addressing Questions 2 and 3, a critically review selected international and national literature on Artificial Intelligence (AI) through the lens of Western ideologies, cultural and AI reforms and AI through te ao Māori. The review examined the impact of te ao Māori on selected authors, and it identified Indigenous, Māori and significant literature influencing AI-related development to understand the dialectic between te ao Māori and AI (see Chapter 2).

All three questions are attentioned in the next task where we explain the ontological and epistemological positioning of our research and how this position led us to a narrative inquiry research model (see Chapter 3). This chapter identified some potential issues confronted when undertaking our research. It justifies the selection of specific methods and their suitability for understanding Māori in AI-related development and their beliefs and practices. The Research Process was explained, highlighting the processes in generating data to know how the connections between Māori and AI-related development promote cultural well-being for our whānau and their futures. Finally, we introduced the Research Whānau to the discussion and described how I, the lead researcher maintained ethical practices during data generation and the drafting of the findings.

This chapter attentions tikanga Māori practices that influence and are the catalyst for the promotion of cultural well-being for our whānau and their futures. Our whānau presented the findings by addressing each research and subsidiary questions with supporting data. Finally, we report on the factors that facilitate optimal conditions that support Māori in AI-related development (see Chapter 4).

These two chapters also pay attention to all three questions. Subsequently, these research findings allowed discussion highlighting the AI-related conditions promoting cultural well-being for our whānau and their futures (see Chapter 5). Finally, Whānau summarised the study effort in our Research, focusing on its conclusions, perceived advantages and disadvantages, and prospective applications (see Postscript).

1.3 Context of colonialisation and its new formations

In the eastern Bay of Plenty region of Aotearoa, there is a Māori tribe known as Te Whakatōhea. European settlers in the 19th century had a big impact on the tribe and its whānau. Before European contact, Te Whakatōhea had a highly developed kinship-based social structure with distinct responsibilities for each member of the whānau. The arrival of European invaders disrupted this social structure, like with many other indigenous tribes around the world. Due to the adoption of a foreign economic system, administrative structures, and cultural norms, traditional Māori way of life and society underwent substantial changes.

One of colonisation's most significant repercussions on Te Whakatōhea was the loss of land. Large portions of Māori land were brutally taken by European settlers for farming and settlement (Walker, 2004). Many Māori families were consequently compelled to abandon their ancestral lands and way of life, which included farming, fishing, and gathering (Wynyard, 2019). Losing land has wider effects for Te Whakatōhea, including loss of its cultural identity, spiritual links, and economic independence (Naera, 2020, May 25). Due to the introduction of new diseases brought about by colonisation, Te Whakatōhea population was severely affected by measles, influenza, and tuberculosis. Due to widespread illness and mortality brought on by the lack of antibodies to various diseases, the iwi population and social structure deteriorated. Moreover, Te Whakatōhea invasion by the Pākehā during the late 18th century had a significant impact on the whānau and continues to do so. Even though the tribe has worked to preserve its cultural history and traditional ways of life, the social, political, and economic landscape of the region is nevertheless influenced by colonialism.

In addition to losing a large portion of their land to colonial oppressors, Te Whakatōhea also suffered greatly from the loss of connection with kuia and kaumātua due to several contributing factors including disruption of traditional structures, disease and population decline and land confiscation and displacement (Hirini et al., 1999). Our kuia and kaumātua are the Māori knowledge bearers, who were crucial to maintaining Māori cultural identity. Kuia and kaumātua are respected elders with a wealth of cultural knowledge and experience. They are crucial for maintaining Māori

cultural identity and transferring cultural knowledge and practises from one generation to the next. The loss of connection with kuia and kaumātua has led to a loss of cultural knowledge and practises as well as a sense of being cut off from one's cultural past and identity. Losing connection with Māori knowledge keepers has had a big influence on Māori communities, especially when it comes to passing down traditional knowledge and practises. Inequitable socioeconomic conditions, colonisation, and relocation have had a disproportionately negative impact on connections with kuia and kaumātua (Hirini et al., 1999).

Migration and diaspora have had a profound impact on the transfer of cultural knowledge and practises to future generations (Cameron et al., 2017). The tyranny of distance is illustrated with the relocation of Māori both inside and outside of Aotearoa. Diasporic Māori groups have subsequently arisen, which may provide unique challenges for maintaining and transmitting cultural identity (Higgins, 2018). Migration and diaspora are highlighting the separation of Māori from their traditional cultural networks and surroundings, which is resulting in the loss of cultural practises and knowledge. This is resulting in the alienation from one's cultural history and identity, in addition to making it more difficult to learn traditional cultural facts and practises (Higgins, 2018).

The disappearance of the Māori language has had a profound effect on Māori cultural identity (L. T. Smith, 1989). A key component of Māori culture is the Māori language since it allows Māori people to communicate their cultural concepts, ideals, and values. Additionally, it is a way that Māori show their identity, connect to their ancestry, and pass on their traditional knowledge from one generation to the next. Throughout the colonial era, the Māori language was deliberately suppressed, and Māori children were disciplined for speaking their own language in class. The loss of one's language, culture, and sense of self has a profound effect on Māori cultural identity (Stewart & Stewart-Harawira, 2020). The loss of the Māori language also contributed to the loss of traditional knowledge and practises because a significant percentage of this knowledge is transmitted orally through the language. Since language has become more important for maintaining cultural identity and well-being, efforts have been made to rejuvenate the Māori language.

The New Zealand government has put regulations in place to make it easier for the language to be revived. To promote the use of the Māori language, the Māori Language Commission (Te Taura Whiri i te Reo Māori) was established in 1987. Despite these initiatives, the loss of the Māori language still profoundly affects Māori cultural identity. Many Māori nowadays struggle to understand or speak their own language, which can make them feel disconnected from their cultural roots and sense of self. This sense of connection can be a factor in a number of social and health difficulties, such as diminished cultural pride, feelings of marginalisation and disempowerment, and mental health conditions including despair and anxiety. In short, the disappearance of the Māori language has had a significant negative influence on Māori cultural identity and has led to a loss of language, culture, and sense of self. Promoting cultural revival and empowering Māori communities depend on revitalising the Māori language (Hond et al., 2019).

When members of a whānau, hapū, or iwi are encouraged to prioritise individualism over collective duty, it can cause a whānau to dissolve. Neoliberalism, a school of economic thought, places a high focus on privatisation, free markets, and individual responsibility (Smith, 1997b). This worldview places a greater premium on individual success and achievement than on communal or societal structures. The traditional cultural practises and ideals of Māori society, which emphasise the communal well-being of the whānau and the greater community, may be at odds with this emphasis on individualism (Smith, 2012). Neoliberal policies, such as austerity measures, privatisation of public services, and deregulation of industries, can be detrimental to Māori communities, particularly those that are already marginalised (Smith, 2020). For instance, when public services like education and health care are privatised, those who lack the resources to pay for private alternatives may be denied access to these essential services. Lack of resources may make health and social problems in the whānau and greater community worse.

Furthermore, the neoliberal emphasis on individual responsibility might result in a loss of support for social institutions like whānau, hapū, and iwi. The lack of assistance could cause Māori communities to lose their sense of cultural identity and fall apart socially (Smith, 2012). Working towards policies and practises that support the

wellbeing of the whānau and the greater community requires an understanding of the significance of communal social structures in Māori society. When this is taken into account, it may be necessary to challenge the dominance of neoliberal economic principles and support alternative models that place a greater emphasis on social welfare than individual success.

The dissolution of whānau is a particularly corrosive kind of colonisation as it jeopardises the base of Māori cultural identity. The whānau and whakapapa, which form the foundation of Māori society, are highly respected in traditional Māori culture (Mead, 2016). In contrast to the nuclear whānau, the term whānau refers to a larger network of relatives, each of whom plays a certain role and benefits the group as a whole. A whānau can disintegrate in a number of ways, such as when members are uprooted from their ancestral territories, when European social norms intrude, or when traditional practises and rituals are disturbed (Smith, 2021). The whānau's social cohesiveness would suffer as a result, and its members might lose their cultural identity and sense of agency. Colonisation typically results in the imposition of a new economic structure, which might speed the dissolution of whānau. As Māori were frequently forced to leave their traditional areas and way of life in order to work for European immigrants, the typical responsibilities and obligations within the whānau were altered (Haami, 2018). The failure of social institutions and the loss of cultural identity typically followed the whānau's incapacity to continue caring for its members in the same way.

Chapter 2 - Toheraoa, toheraoa, Te Whakatōhea maurua.

Review of literature: Māori resilience, sustainability, and resistance in a space of Western AI ascendancy

Whakataukī: Toheraoa, toheraoa, Te Whakatōhea maurua

Whakatōhea united in solidarity in the face of adversity

This Whakatōhea whakataukī refers to the toheraoa shrub that grows in all conditions in the ranges where it is cold in winter and on the coast where it scorches in summer. The toheraoa is a resilient plant that resembles Whakatōhea and has endured and overcome the illegal confiscation or theft of its tribal estate and the many, many government laws and policies that were passed intentionally to colonize and marginalise Māori, even further. This thesis is a testament to how far we as Whakatōhea have come.

Maurua is a weave that joins two papa of whāriki mats together to make the whāriki bigger. Maurua symbolizes unity and coming together to overcome all challenges that we face as the Whakatōhea nation. There is power in numbers.

Created by

Dr Te Kahautu Maxwell

2.0 Introduction

In order to support our whānau's wish to remain connected to one another as a whānau and to uphold their Whakatōhea identity, this research looks for elements that contribute to Māori well-being. The identification of the fundamental components that will assist our whānau in creating a digital platform as a key expectation of this research.

Since the beginning of British settlement, life experiences have tended to be a “painful and humiliating experience of social and cultural domination by Pākehā” (Smith, 1997a, p. 167). Māori are over-represented in underachievement in education, poor health, dependency on welfare and incarceration. These poor statistics exacerbate the inequalities in our country, inflamed by individual and institutional racism (Blackmore, 2019). It is public knowledge that algorithms are now being used in Aotearoa by the ACC, Ministries of Corrections, Healthcare, and the Police to predict behaviour. These algorithmic predictions are now amplifying the poor statistics of Māori.

The pursuit of AI that mimics human is far from over. The lessons learnt from historical and contemporary philosophers, mathematicians, logicians, and data scientists from the public and private sectors and governments worldwide will help provide a pathway to creating Māori organisational theories for AI systems. These lessons will also develop ways to make these systems work, and governance protocols that will point Māori toward AI R&D solutions for Māori, with Māori and by Māori. Innovative Māori technology and its adaptation in both historical and contemporary times provide sureness in response to Professor Rangi Mātāmua’s thoughts on the impact of new technologies:

“Is Artificial Intelligence the new (r)evolution or the new coloniser of Māori?”
(Whaanga, 2020)

It will be affirmative that Māori will not allow artificial intelligence to be the new coloniser, but instead a new revolution for Māori.

The first section of this literature review considers the exponential growth of AI-related development in the last three years and compares conversations with the relationships Māori have with te ao Māori (*Māori worldview*), and conversations being had by AI world leaders. This section focuses on understanding the interplay between the two (see Section B. Part 1: Abundance intelligence: A Kaupapa Māori intervention).

The second section of this review will investigate and account for international and national Government AI policy progress and the advancements of AI R&D in the business sector and universities. This chapter intends to understand the global political and economic context, which will reshape Māori receptivity, resilience and sustainability in Māori AI R&D (see Section C. Part 2: Artificial intelligence reforms).

The third section of this literature review will provide context by journeying on the fables and legends of the ancient storytellers and studying the Greek philosophers' theories to investigate how these ancestors saw their relationships with the concepts of machines and robots. Our journey will continue through the millennia providing a picture of the AI R&D terrain. This section seeks to lay out the Western landscape that a Māori transformative initiative needs to address (see Section D. Part 3: Artificial intelligence in a space of Western ascendancy).

This chapter is closed with a discussion and summary (see Section E: Chapter Summary).

2.1 Part 1: Abundance intelligence: A Kaupapa Māori intervention

Ka mua, ka muri

Walking backwards into the future

This Māori proverb expresses a great truth around a simple metaphor. The analogy is of a person walking backwards into the future. It suggests that the past is visible, but the end is not. We have imperfect information for the road ahead, a natural state of affairs. It suggests that we look back for clues to the way forward and understand that the future is unwritten, where the future comes out of the past but will not be identical. In this sense, the only constant is change. In this spirit, we wish to take a walk back through AI historical context to paint a picture of the evolution of AI. This will help us to understand the complexities of western AI theories and operation practices, therefore allowing us to specifically identify fundamental Kaupapa Māori components

that will assist our whānau in creating a digital platform which is a key expectation of this research.

2.1.1 Introduction

This thesis' primary concern is the ability of Māori to pay attention to the hegemonic propensities displayed in current AI systems and create AI systems that promote the well-being of Māori whānau. The rapid progress of AI development has led to many conversations among AI world leaders about AI's ethical and societal implications. These conversations focus on issues such as privacy, bias, and discrimination, as well as the potential impact of AI on job displacement and inequality. While these discussions are crucial, they tend to centre on Western perspectives and values, often neglecting other cultural worldviews and knowledge systems. In contrast, Māori's relationship with te ao Māori is rooted in a holistic understanding of the interconnectedness of all things, including humans, nature, and the spiritual world (Marsden & Royal, 2003). Māori view knowledge and technology as a means to enhance their connection with the natural world rather than as a tool to dominate it. Therefore, Māori may approach the development and deployment of AI differently, emphasizing the importance of ethical and cultural considerations that are unique to their worldview. The interplay between the two lies in need for a more inclusive and diverse conversation about AI improved and implemented that acknowledges and respects different cultural worldviews and knowledge systems. Such an approach would ensure that AI is advanced and applied responsibly and ethically, considering the potential impact on all stakeholders, including those with different cultural and societal backgrounds. Ultimately, this would lead to a more equitable and sustainable future for all.

2.1.2 The open letter

In an open letter, more than 1,000 innovators and researchers in the field of technology, among them Elon Musk, have encouraged artificial intelligence labs to put a hold on the creation of the most cutting-edge systems and warn that such tools pose "profound risks to society and humanity" (Metz & Schmidt, 2023, March 29). The exponential growth of cutting-edge systems spoken about in the open letter

include GPT-3 (known as ChatGPT), a machine learning model that can produce text in natural¹⁰ language in response to various cues, including questions, statements, and instructions (Nath et al., 2022). DALL-E, is another language model which produces excellent visuals from written descriptions (Frosio, 2023). These two systems have been developed by a collective of tech industry leaders, including again Elon Musk, with including Sam Altman, Greg Brockman, Ilya Sutskever, John Schulman, and Wojciech Zaremba. Similarly, Demis Hassabis, Mustafa Suleyman, and Shane Legg established DeepMind, an AI research facility owned by Alphabet, which is also Google's parent company created AlphaFold, an AI system for predicting protein structures, which has the potential to revolutionise medication and illness treatment. DeepMind is also responsible for developing MuZero, developing learn and plan in complex and dynamic environments, without prior knowledge of the game's rules or the task it tries to solve (Wang et al., 2022).

The stories of OpenAI and the innovations of GPT-3 and DALL-E, as well as DeepMind's AlphaFold and MuZero, serve as examples of the expansion of AI-related development, particularly the exponential advancement and deployment of AI in the past 12 months. AI-powered technologies are essential to the healthcare sector for providing individualised care and accurate medical diagnosis. For example: AI enabled sensor and wearable technology, additive manufacturing and medical imaging, Chatbots powered by AI are being used to triage patients, provide basic medical advice, and answer questions, robotic process automation and virtual reality, and tissue engineering and nanomedicine (Haleem et al., 2022). AI algorithms are used in finance to identify fraud, forecast market trends, and enhance investment portfolios. In addition to facilitating the development of autonomous vehicles and improving logistics systems, AI is revolutionising the transportation industry (Yusriadi et al., 2023). The rapid growth of AI is exciting because it has the potential to change many industries and improve many facets of our life. However, it raises moral and societal challenges like job loss, privacy concerns, and potential bias and discrimination.

¹⁰ Natural language is the spoken or written language used by people to interact with one another in daily life.

Ongoing debates and collaborations between academics, legislators, and stakeholders are crucial to guarantee that AI is created and applied responsibly and ethically.

Elon Musk, Stuart Russell, Geoffrey Hinton, Nick Bostrom, Max Tegmark, and Yoshua Bengio are all prominent figures who have raised concerns about the potential dangers of AI. Supporting Musk's warning about AI's profound risks to society and humanity, Stuart Russell, a computer science professor at UC Berkeley, is also a leading voice in advocating for the development of AI aligned with human values, arguing that the risks of not doing so could be catastrophic. Russell argues that AI systems must be designed to align with human values and act according to those values (Gabriel, 2020). Geoffrey Hinton, a world-renowned computer scientist and AI researcher widely recognised as one of the pioneers in the deep learning revolution. Hinton's work forwarded the advancement the field of deep learning, the training artificial neural networks to learn and make predictions from large amounts of data (Mastery, 2023, May 11). Aligned with fellow AI world leaders' thoughts and actions, Hinton has left Google and has been apologetic of over parts of his life's work as he fears that the growth of AI could lead to killer robots that are smarter than humans (Allen, 2023, May 2). Nick Bostrom is a professor at the University of Oxford and a leading voice in AI safety and empirical risks, has raised concerns about the possibility of creating a much more intelligent AI than humans, commonly known as a *superintelligence*. He has warned that if such an AI were to be made, it could pose an existential risk to humanity, potentially even leading to the extinction of our species. Bostrom's argument is based on the idea that a superintelligence could rapidly surpass human intelligence and capabilities, leading to a situation where humans are no longer in control of the technology they have created (Bostrom, 2013). The notion that humans are no longer in control of the technology could lead to unintended and potentially catastrophic outcomes, such as the development of AI systems that pursue goals incompatible with human welfare or that are too complex for humans to understand or control. Bostrom has called for greater attention and resources to be devoted to researching and addressing the potential risks of advanced AI.

Max Tegmark is a physicist and professor at the Massachusetts Institute of Technology (MIT) and a leading voice in AI safety and ethics. He is the author of the book "Life 3.0: Being Human in the Age of Artificial Intelligence," which explores advanced AI's

potential risks and opportunities (Tegmark, 2018). Like Russell, Tegmark has also emphasised the importance of AI aligned with human values and goals. He argues that if AI is developed in a way not aligned with human values, it could lead to unintended and potentially catastrophic outcomes, such as developing AI systems that pursue goals incompatible with human welfare.

Yoshua Bengio is a computer science professor at the University of Montreal and is a prominent figure in artificial intelligence, vocally advocating for ethical considerations in the development of AI. Bengio has called for a less human-centric approach to the development of AI, in which AI systems are designed to solve problems caused by humans, for example, air quality, endangered species, overfishing and population growth. With these credentials and visions, Bengio is leading a Canadian government AI-funded contract known as SCALE AI. SCALE AI is a supercluster initiative funded by the Canadian government that focuses on developing AI-driven supply chains and manufacturing processes. The initiative aims to help Canadian businesses adopt AI technologies, increase competitiveness and create jobs in the AI sector as a leading figure in AI and deep learning.

Running parallel with SCALE AI is the New Frontiers of Research Fund Transformation grant, awarded by the Canadian government to Abundant Intelligencies, an award of almost \$23million Canadian dollars over six years to encourage, uphold, and prioritise the voices of Indigenous peoples through AI conversation and research. Thirty-seven co-investigators and collaborators from Canada, the United States, and New Zealand are involved in Abundant Intelligences spanning 8 universities and 12 Indigenous community-based organisations. (Lewis, 2020). Professor Hēmi Whaanga, Co-principal investigator and Professor at Te Pūtahi a Toi School of Māori Knowledge at Massey University in Aotearoa stresses the importance of prioritising Indigenous ways of being and thinking to inform and advance the conversations around ethics, data sovereignty, and intellectual property, our taonga, as we enter new frontiers of technological advancement. Abundant Intelligences engages with our kindred, society, and community groups in order to develop a more inclusive framework for artificial intelligence that takes into account collective identities, community, and trust. Professor Whaanga emphasises that “we

use Abundant Intelligences because ‘abundant’ implies both diversity and knowledge practices that contribute to thriving networks of being in a particular place” (Witehira, 2023, May 8, para 6).

Dr Johnson Witehira, co-founder of Indigenous Design and Innovation Aotearoa (IDIA) and ĀPŌPŌ Indigenous CreativeTech Hub, Wellington, Aotearoa, will take a leading role, alongside their friends and at Te Hiku Media, Kaitaia, Aotearoa and will be hosting locally-rooted pods to lead the kōrero and explore the opportunities and implications of artificial intelligence from a distinctly kaupapa Māori, te ao Māori perspective (Witehira, 2023, May 8). The New Frontiers of Research Fund Transformation project aims to bring indigenous, particularly Māori voices, to AI development. The project aims to ensure that AI is used in ways that safely help us on our digital journey into the future. The New Frontiers of Research Fund Transformation project puts Māori in the driver’s seat, an intervention growing organically by active Māori users of technology, with other Māori, for Māori.

As suggested in the paragraphs above, the rapid progress of AI development has led to numerous conversations among AI world leaders about AI's ethical and societal implications. These concerns include:

- AI posing an existential threat to humanity
- AI systems developing goals that are not aligned with human values
- AI being used in harmful ways
- The development of superintelligent AI that could pose an existential threat to humanity AI exacerbating social inequalities
- The need of greater transparency and accountability in the development of AI.

The majority of these discussions, however, tend to ignore other cultural worldviews and knowledge systems in favour of Western ideals and ideas (Rae, 2020). The Māori perspective through the lens of te ao Māori, on the other hand, is based on a thorough comprehension of the interconnection of all things, including people, nature, and the spiritual realm. Instead, than utilising knowledge and technology to conquer the natural environment, Māori see them as a tool to deepen their connection to it. As a

result, Māori take a distinctive approach to the development and application of AI that emphasises the significance of moral and cultural factors that are in line with their viewpoint.

The interplay between the conversations between AI world leaders and the unique way Māori view their relationships with the development and deployment of AI signals the need of a more inclusive and diverse discussion about AI development and deployment that acknowledges and respects different cultural worldviews and knowledge systems. Such an approach would ensure that AI is developed and deployed responsibly and ethically, considering the potential impact on all stakeholders, including those with different cultural and societal backgrounds. Ultimately, this would lead to a more equitable and sustainable future for all.

2.1.3 Māori and technology

Māori technological experiences have been well documented and recounted in our stories and whānau history, for example *Pūrākau, Māori Myths Retold by Māori Writer*, edited by Witi Ihimaera and Whiti Hereaka (Hereaka & Ihimaera, 2019). In Māori traditions, Māui is a cultural hero and a trickster, famous for his exploits and cleverness. He possessed superhuman strength and could shapeshift into animals such as birds and worms. Māui is credited with catching a giant fish using a fishhook fashioned from his grandmother's jawbone, the giant fish would be known as Te Ika-a-Māui (*the North Island of Aotearoa*). Maui's curiosity about where the fire came from placed him in the domain of Mahuika, the Māori fire avatar. In some versions of the Mahuika story, it was from her that Māui, the clever, gifted superhero of supernatural parents, obtained the secret of making fire. Mahuika's five children were named to represent the fingers on the human hand, collectively called ngā Mānawa. The symbolism of this connection between fingers and fire is revealed in the stories, where Māui obtains fire from Mahuika by tricking her into giving him her fingernails. Maui's ability to fabricate the most robust and heat-resistant ropes to capture the sun adds to his many renowned feats. Consequently, Māui's legendary accomplishments were only the forerunner to further extraordinary endeavours by our Māori tūpuna.

Our Māori ancestors were legendary seafarers, astrologers, historians, protectors of our genealogy, acclaimed orators, exceptional hunters and gathers and the guardians of the many treasures that surrounded them. Innovation and adaptation of Māori technologies, developed through scientific knowledge, have solved problems and overcome everyday challenges in historical and modern Māori times (Broughton et al., 2015; Hikuroa, 2017; Keegan & Sciascia, 2018; Paul-Burke et al., 2021). Quentin Roake (2014) highlights the same engineering principles in constructing Māori ocean-faring waka, where differently shaped hulls were built to enhance waka capabilities. A V-shaped hull ensured maximum speed, and the U-shaped hull created efficient manoeuvrability of a craft. Single or double-hulled waka were constructed to maximise haulage loads. Hulls were not levelled smoothly, but small wave-like patterns chiselled into the surface to ensure less drag in the water. Sail and kite technologies were assembled to increase aerodynamics and enhance the waka's speed using current and wind propulsion. Additionally, paddles were designed to act as additional keel stability for a craft, and steering paddles were crafted to steer the waka and prevent yawing caused by the wind and sea swells. Navigation of these remarkable crafts was also performed with extraordinary skill.

Māori ancestors referred to *astronomical knowledge* as tātai arorangi. Tātai arorangi was utilised to help sail the vast distances travelled across the Pacific to first settle in Aotearoa. This feat was partly made possible by an in-depth understanding of the position and movement of the stars (Harris et al., 2013). When decoded from a maritime context, this knowledge provided a compass showing the stars aligned with their constellational houses. Navigators who knew the direction and position where the stars rose and set could use the horizon as a compass. Hence, knowledge of the night sky is an essential mental construct of knowledge needed for wayfinding. The star compass was devised to help navigators memorise this knowledge (Harris et al., 2013). However, Māori astronomical knowledge was not limited to navigation, as tātai arorangi was vital in everyday life.

Tātai arorangi not only helped our ancestors navigate the oceans, but this knowledge was also crucial for many aspects of daily life, from growing crops, fishing, telling time, and changing seasons. Māori technologies used to gather seasonal birds and fish

were unique to the various fowl and marine species. Snaring with looped ropes was a standard method of catching birds. *Tākiri*, *a process of a single snare on a perch*, was designed to capture the bird by the feet. A cord attached to the trap was tugged sharply by the fowler to entrap the bird. Several variations of *tākiri* emerged to snare birds from various habitats, including high trees, cliffs or near water. Variations of this design also provided an alternative method where the snare could spare time, allowing the fowler to return to collect the spoils (Downes, 1928). Māori fishing technologies and techniques ensured that *kai moana* remained abundant. Hooks and lures were crafted from bone, shells, wood and coloured stones to troll the various water types. Scoop nets and large hoop nets were lowered to the bottom of the seabed and then raised around an unsuspecting school of fish. There were also fish traps of various kinds, including round pots made mainly of supplejack for trapping crayfish and moray eels.

Māori leadership by our *tūpuna awatea* (*ancestors from the dawning of the new age*) through to the *tūpuna waka* (*our wayfaring ancestors*) demonstrated awe-inspiring feats using new and innovative technologies. *Tūpuna awatea* leadership was one of *mana* and prestige. Essentially, *Tūpuna awatea* leadership was driven by the leader's responsibilities and obligations to protect and ensure the well-being of their people. The leadership skills applied ensured that their people thrived and benefited. Our *tūpuna* and their people made decisions that actively realised the *iwi's kotahitanga* (*unity, togetherness, solidarity, collective action*) goals. In this case, it is essential to note that the personification of leadership is effectively demonstrated in the concept of *Tino rangatiratanga* (*the pursuit of self-governance and self-determination*). Hence, in the context of our *tūpuna awatea* and *tūpuna waka*, *rangatiratanga* is the concept of leading people to achieve their collective aspirations in a way that acknowledges *mātauranga* and *tikanga* Māori.

2.1.4 Māori and emerging technology innovations

The extensive historical commentary on technology-related development continued into the post-Treaty era but with many trials and acts of oppression (Prabhakaran et al., 2022). For example, Māori was the predominant language of Aotearoa pre-1840. Although the colonial oppressors wedged a divide between Māori and its language

and culture using the imperial tools of marginalisation through legislation, segregation and discrimination, te reo Māori and tikanga Māori have not died and continue to defy and resist Pākehā domination. Following the New Zealand Land Wars, the Government divided society into two distinct zones, the Māori and the Pākehā zones. The Government legislated the Native Schools Act of 1867, which ruled that English would be the only language. However, Māori children continued to use te reo in schools during non-classroom times (Cram & Belich, 2001).

Consequently, the enactment of this Act effectively demonstrated the extent of colonial regard for Māori knowledge, which at the time was little to none. Similarly, the Tohunga Suppression Act of 1907 was utilised to eradicate tohunga as traditional Māori healers with Western medicine (Stephens, 2001). In 1961 the Hunn Report described the Māori language as a relic of ancient Māori life (Hunn, 1961). Yet, te reo Māori continued to be the predominant language of the Māori in their designated sectors.

During the 1910s, most Māori still spoke Māori. Māori language newspapers continued to publish national and international news (Higgins & Keane, 2013). During the 1920s, the resilience shown by Māori to keep their language was encouraged by Sir Āpirana Ngata when he began his Māori community lectures about the need to promote Māori language use in homes and communities. By the 1930s, te reo remained the predominant language in Māori whānau. The Pākehā system added further subjugation during the 1940s with the enticement of Māori to leave their tribal homelands and move to the bright city lights. Hence, Māori urban migration began. Māori families were *pepper-potted* in predominantly non-Māori suburbs, preventing the replication of Māori communities and the practice of te reo and tikanga Māori (Harris, 2010). Māori families choose to speak English, and Māori children were raised as English speakers. And yet, Māori toughness, strength and resistance could still be observed. Education reforms during the 1970s through to the 2000s saw the establishment of Māori language restoration programmes, Kōhanga Reo (*Māori language preschool*), Kura Kaupapa Māori (*Māori-language immersion school*), Wharekura (*school*), Whare Wānanga, (*Place of higher learning, Māori tertiary institutes*) and bilingual schools around the country. In conjunction with this, political pressure created opportunities for legislation which enabled the prioritisation of te reo

Māori (*Māori language*) and tikanga Māori, as well as radio and television broadcasting sanctions and funding streams promoting community Māori language initiatives (Higgins & Keane, 2013).

While the rest of the world entered an AI winter in the mid-1980s, in Aotearoa, Māori relationships with technologies, algorithms and learning machines continued to emerge. As outlined in Table 2.55 below, the Kōhanga Reo National Trust was at the forefront of technology-related development more than half a century ago. Computer training commenced in 1986 and allowed Māori mothers to learn skills. Twelve computer systems were built and installed in each training branch to record administrative and statistical information and document, preserve, and develop Māori teaching skills (Laws, 2001). Alongside instructional videos and teaching support systems, bilingual computers aided parents' learning of te reo Māori (Rei & Hamon, 1993).

AI's intellectual, conceptual, creative, and social development continued in the 1980s. For example, creative genius' such as Gene Roddenberry introduced the world to Data, a fictional Star Trek franchise character. Data was an operations manager with the rank of Lieutenant Commander. He was also the science officer and 3rd officer aboard the U.S.S. Enterprise-D. During this time, Data made history in 2368 when he became the first android captain. Around the same time, in Aotearoa, Reddfish, a software production company led by Greg Ford, produced an MS-DOS software interfaced entirely in te reo Māori called Te Kete Pūmanawa. The software included a clock, an interactive story called Te Mahi Hangarau Ahi, an arithmetic challenge, a take on the game of *Hangman*, Kei Oha te Taniwha and a traditional game called Mū Tōrere (Keegan & Sciascia, 2018).

Still, with the underlying driving theme of the revitalisation of te reo and tikanga Māori, a collective of te reo Māori teachers created Te Wahapū, the first nationally and internationally accessible computer-based communications system with a Māori language online command system. This successful project ran parallel with the WordNet project, an industry-embraced statistical analysis project by George Miller in the Cognitive Science Laboratory of Princeton University, USA. Te Tuhi Robust, the then Principal of Motatau Bilingual School in the Bay of Islands, carried out

successful trials of Te Wahapū with Richard Benton from his home in Seatoun, Wellington, which were completed on March 25, 1990 (Benton, 1996; Robust, 2002). Te Wahapū provided a forum of exchange for teachers of te reo Māori in education and an environment for schools "to exchange creative and expository writing in the Māori language" (Ropiha, 1991, p. 47). Te Wahapū operated under the support of the New Zealand Council for Educational Research until 1997 when the World Wide Web development rendered the once cutting-edge system obsolete. Overall, Te Wahapū carried many sophisticated databases, including Māori dictionaries, a comparative database of new vocabulary in all major Polynesian languages, including an online colour-coded version of the Proto-Polynesian database and education databases on various topics.

Around the same time, Toi te Kupu was established in 1995 by Te Pūtahi-a-Toi, the School of Māori Knowledge, Massey University. Toi te Kupu was primarily a Māori language teaching and learning resources database. The database was interfaced with the internet, providing an invaluable resource for learners and teachers of te reo Māori. The aim of the database was threefold:

1. to catalogue Māori language resources,
2. assist teachers' and learners' access to these resources, and
3. provide ideas on how better to use these resources.

Notably, the website interface was available in monolingual Māori, including a bilingual Māori/English option (Keegan & Sciascia, 2018).

In the latter years of the 1990s, a significant piece of research around the advancement of bilingual speech interfaces using AI was carried out by Dr Mark Laws as part of the *Intelligent Human-Computer Interfaces* project under *Objective 3* of the *Connectionist-Based Information Systems* programme with the Department of Information Science, University of Otago. The project experimented with AI knowledge-based engineering methodologies and techniques for designing tools that utilise a hybrid system adaptably and flexibly to different speakers and languages, namely New Zealand English and Māori (Laws, 1998). This work continued into early 2000, when a Māori word translator, Ngā aho whakamāori-ā-tuhi, was developed to

deliver a single head-word translation online. Moreover, Ngā aho whakamāori-ā-tuhi provided the functionality to translate between English and Māori, and many of the Māori keywords could be played to hear the correct pronunciation. This functionality can now be seen as a critical feature in the identified dictionaries. Due to advancements in legislation, the provision of Māori dictionaries online also accelerated due to the Māori Language Act 1987 and the work of Te Taura Whiri i Te Reo Māori. Furthermore, a subscription-based collection called Te Wakareo-ā-ipurangi recognised Māori language dictionaries such as Williams, Ngata, and Te Matatiki provided an excellent resource for developing Māori dictionaries online. Also, the sixth edition of William's dictionary, the Ngata dictionary, Te Aka, a dictionary provided by Te Whanake series previously mentioned, Te Papakupu o Te Tai Tokerau and Te Reo Pūtaiao: A Māori Language Dictionary of Science are all available online (Keegan, 2007; Laws, 2001).

In 2001, the Māori Niupepa website was launched. Māori Niupepa is a significant source of historic New Zealand texts, with just under 18,000 newspaper pages collected from 35 different periodicals published between 1842 and 1933 (Apperley et al., 2002). Three facilities are provided to access the Niupepa documents, full-text search, browsing by individual title, and browsing by date making available perhaps the most significant amount of Māori language material through a bilingual interface (Keegan & Sciascia, 2018). Overall, the intention of the resources made available by Māori Niupepa was to encourage the rejuvenation of te reo.

A meaningful relationship forged by Dr Te Taka Keegan with major international computer companies was being built to support the use of technology in the rejuvenation also of te reo Māori. The translation of Microsoft Windows XP and Microsoft Office 2003 into te reo Māori occurred in 2005. These translations presented a substantial task involving over 900,000 words in over 180,000 separate strings character sequences in a new, technical, complex genre. The translation work has continued in subsequent versions of MS Windows and MS Office, Windows Vista, Windows 7 and 8, Office 2008, 2011 and 2013. Google has also released translation tools that support te reo Māori. The Google Web Search interface was available in te reo Māori in 2008, and the Google Translator Toolkit for te reo Māori was released in

2009. Google Translate began supporting, being available in te reo Māori in 2013. While the motives for te reo Māori support from these large international companies may appear irrelevant, the reality is that they gain very little revenue and very little recognition. What is apparent, though, is that te reo Māori has the potential to be operated and used in these modern software environments (Mato, 2018).

The associations with Microsoft and Google saw several innovative technologies available to Māori. After an association with Microsoft in 1998, the macron character was created and made accessible in 2003. The Microsoft Translator Hub, an online service that provides the facility for language communities to create their machine translation tool, was made available in 2013. Google's support was established in 2001 by enabling the Google Translator Toolkit in 2009, a resource that includes dictionaries, word lists and previous translations that assist translators in undertaking translation work (Keegan, 2017a). Although not an online Māori resource, Keegan (2017a) highlights an ambitious Māori language IT project launched, including the localisation of Microsoft Windows XP and Microsoft Office 2003 into Māori. This project saw the translation of over 900,000 words in 180,000 separate strings. Windows Vista and Office 2007 have subsequently been localised and free from Microsoft. This software allows a computer user to interact totally with an operating system and some application software and only ever encounter the Māori language, therefore, representing an essential enhancement to the Māori linguistic landscape that should be recognised.

As Māori teachers embraced new computer programmes, computer operating systems and applications, communication networks and Māori language translators, it became apparent the need of:

1. Professional development programmes to provide appropriate pedagogy to equip Māori teachers with these new digital tools, and
2. The development of suitable Māori teaching and learning resources

Around the same time (1998-2008), Te Hiringa i te Mahara (THM) was initiated to address the need of teacher professional development and the development of suitable Māori teaching and learning resources. Two hundred and fifty laptops were made

available for te reo Māori teachers, encouraging greater sharing of resources and expertise in ICT use (Wylie et al., 2003). From THM grew Kaupapa Awa Whakawhiti Mātauranga (KAWM), addressing critical education issues such as ensuring the full secondary curriculum was available to students specifically in Wharekura and Paerangi (*Māori Boarding Schools*) (Waiti, 2005). Furthermore, the KAWM material was delivered via hands-on workshops and video conference online tutorials (Roberts, 2009; Wylie et al., 2003).

eWānanga was first introduced into the landscape of Te Whare Wānanga o Awanuiārangi education as part of the delivery of Te Tohu Paetahi Mātauranga Māori Bachelor of Māori Education eWānanga in 2002 (Laws et al., 2009). Six years later, the eWānanga Centre for Creative Teaching and Learning was established in 2008 by Associate Professor Dr Mark Laws. Here, the main aim of this centre was to manage the *eWānanga LMS*, cultivate the *eWānanga ethos*, provide support for all online educators and students, and undertake new emerging research and development initiatives (Ferguson, 2010).

During this time of cultural resilience, social revitalisation and economic sustainability, interactive storytelling, augmented and virtual reality, and gaming platforms have been used to connect whānau, hapū, iwi, communities and Māori to their language, whakapapa, whānau, mātauranga, culture and identity. More recent additions to this landscape include Arataki Cultural Trails - a location-based storytelling app (Arataki Systems, 2021), Guardian Maia - a hybrid historical/science-fiction story (Metia Interactive, 2021a), interactive augmented storybooks like Puhaorangi and Ōrākau 300 (Metia Interactive, 2021b), Pā Wars - a tower defence app game (Adrenalin Group, 2017), and Katuku Island - a universal story of survival (Katuku Island & Callaghan, 2021). There are various other examples, firstly, ARA Journeys (ARA Journeys, 2021) have created immersive technology solutions for storytelling via Tuwhiri, a GPS/location-based story-hunt that shares information about a character called Manu and various information about the places and mātauranga of the area (AppAdice LLC, 2021). Also, Wrestler's wharehenui experience uses altered reality techniques, avatars and VR to enable virtual visits to the Mataatua wharehenui (meeting house, large house). Moreover, Whakakitenga, a virtual movie

experience that follows Ngāti Toa leader and warrior Te Rangihaeata does the same (imagineNATIVE, 2021; Te Whare Wānanga o Awanuiārangi & Lintott, 2020). Lastly, network sites like Facebook, Instagram, Snapchat, Twitter and TikTok have also been used to share these forms of information (Keegan et al., 2015; Mato & Keegan, 2013; O'Carroll, 2013).

As highlighted in this section, enshrining algorithms within learning machines with mātauranga Māori is essential to the decolonialisation of technological biases. Kaupapa Māori provides an opportunity to develop algorithms by Māori, with Māori and for Māori. Embracing mātauranga Māori has been shown to promote te ao Māori aspirations in online teaching and learning environments (Hudson, 2020). Furthermore, the notion of embracing mātauranga Māori is supported by Sheryl Ferguson (2012). Pihama (2017) advances the idea that tertiary institutes are the imperial's tool of colonisation within academia. Sheryl Ferguson (2012) advocates that how Māori do things in online teaching and learning environments promotes tikanga, engagement and participation of Māori tertiary students at Te Whare Wānanga o Awanuiārangi.

Te Whānau-ā-Apanui tribal leader Rikirangi Gage put forward an interesting question: “What if in 200-300 years I was able to be a hologram and my mokopuna could sit there and talk to me, and I could explain, for example, how the Star Compass worked? Wouldn't that be awesome!” (National Science Challenges, 2022, para 2). As a result, significant research is now taking place with the Science for Technological Innovation National Science Challenge (SfTI) - Kia Kotahi Mai - Te Ao Pūtaiao me Te Ao Hangarau. SfTI is a 10-year (2014-2024) science investment tackling Aotearoa's high-tech challenges to growing economy and prosperity through physical sciences and engineering. More importantly, several key people make up the driving force of Vision Mātauranga - Dr Te Taka Keegan, Waikato University and Dr Katharina Ruckstuhl, Otago University, lead Vision Mātauranga. Overall, Vision Mātauranga has a mission to reveal the science and innovation potential of mātauranga Māori.

In 2016 Professor Dr Hēmi Whaanga, the now Head of Te Pūtahi-a-Toi, School of Māori Knowledge at Massey University, took up the challenge and developed the

concept of Ātea. More specifically, Ātea employs new technologies and novel approaches that allow Māori to interact with their reo, whakapapa, whānau, iwi, and cultural knowledge. Ātea advisors also pose fundamental questions that must be addressed during design and development, such as whether a wairua (*soul*) or a mauri (*life force*) exists in an AI system. Collaboration with iwi groups, community and industry will scaffold the development of workable long-term outcomes. Ātea has produced a virtual 3D space of the Whareniui on Te Rau Aroha Marae, Bluff, Aotearoa. With the support of partners, the University of Otago's Department of Information Science and Canterbury's Human Interface Technology Laboratory (HIT Lab), Ātea investigated various interactive and remote presence models, i.e., holographic images of storytellers, who describe the ornate panels found in the whareniui.

In Kaitaia, Papa Reo, developing a language platform led by Te Hiku Media and Dragonfly Data Science, was progressing. Papa Reo is a reo Māori revitalisation research initiative. The research programme partners with Māori communities, world-leading data scientists from New Zealand, Cambridge and Oxford Universities, and Mozilla to forward programme outcomes. The programme aims to develop natural language processing tools and methods that encourage Māori and non-Māori to engage with technology in te reo Māori. Māori language interfaces have gained purchase in the technological landscape of New Zealand. The Social Report 2016 – Te pūrongo oranga tangata produced by the Ministry of Social Development (2016) provided a practical understanding of the interfaces and highlighted some important points:

1. Te reo Māori interfaces were challenging, even for fluent te reo Māori speakers with high technological skill levels.
2. Te reo Māori speakers were pleasantly amazed to see interfaces in te reo Māori.
3. Te reo Māori speakers enthusiastically engaged with the te reo Māori interfaces.

Keegan (2017b) asserts that the challenges facing fluent te reo Māori speakers with high technological skills included introducing new words, and efficiency was sometimes achieved more easily in English. However, it is important to note that the development of te reo Māori interfaces received resistance from Western science. From a business perspective, Western scientists could not see any commercial value

for the te reo Māori interfaces and could not justify the development costs. Furthermore, some argued that since te reo Māori speakers were bilingual, was the development of a Māori language interface necessary?

Therefore, while it was initially a challenge for Māori language interface designers to get the interfaces translated into te reo Māori, Māori users spoke highly and with excitement and pride about seeing these language interfaces and encouraged further testing and development of Māori language versions. This example of stalled development is helpful as it demonstrates how to accept that cultural diversity continues to increase, even in the face of adversity. Following this success, other strategies were also enacted to encourage te reo Māori speakers to engage with Māori language versions. Since this development, te reo Māori language interfaces have become a tool for language rejuvenation and the future survival of the te reo Māori (Keegan, 2017b).

There is growing interest in using technology to aid in cultural revitalisation initiatives among Māori and to encourage increased Māori participation in the technology industry. This section demonstrates that historical and contemporary Māori have developed and embraced new technologies. New technologies have been created to cater to the changes in tikanga Māori, and te reo Māori is becoming more normalised in new technologies. For the benefit of Māori, various technologies have been used in new environments. Not only have Māori thought creatively and divergently, but many ideas have come out of brand-new, previously unanticipated circumstances. “It is clear that Māori are unafraid of advancing new sciences and applying new methodologies in new environments” (Keegan & Sciascia, 2018, p. 370) In preparation for the opportunities and challenges that AI will provide, Māori can draw on their rich cultural legacy from their illustrious past. The ethical and social ramifications of AI can be thought about within the framework of Māori cultural values, which can also direct Māori in employing AI to better their communities. The traditional Māori worldview also strongly emphasises the interconnectedness of all things, including people and the natural world. This all-encompassing viewpoint can help one think about the broader ramifications of AI beyond technical considerations and shed light on the intricate relationships between people, technology, and the environment. The creation and use of AI might also be compared to the Māori idea of

Table 0.1: Māori innovation in artificial intelligence related development

Time	Events	Region
1986	Kohanga Reo National Trust's Māori language computer training system is set up alongside the TKR Māori teaching skills training.	National
1987	Redfish produces an MS-DOS software called Te Kete Pūmanawa.	National
1990	Te Wahapū bulletin board with supporting databases is developed.	National
1995	Te Putahi-a-Toi, the School of Māori Studies at Massey University, establishes Toi te Kupu.	National
1998 - 2008	Gardiner & Parata Ltd successfully managed Te Hiringa i te Mahara (THM) as part of the Māori Secondary Teachers' Workload programme.	National
1998 - 2001	Ngā ho whakamāori-ā-tuhi translator developed by the Department of Information Science, University of Otago.	National
2001	Māori Niupepa, a collection of just under 18,000 newspaper pages, is launched.	National
2002	eWānanga LMS was first introduced into Te Whare Wānanga o Awanuiārangi education landscape.	Whakatāne
2003-2013	MS Windows and Office are translated into te reo Māori.	National
2003-present	Māori gaming advancement has emerged and has become a significant field in AI-related development.	National
2011	2 Degrees smartphone designs and develops a te reo Māori interface.	National
2013	Google Translate is presented in te reo Māori.	National
2017	Te Mana Raraunga, <i>the Māori Data Sovereignty Network</i> , is established.	National
2018	Ātea Project, a Marae-based VR/AR/MR project, is based around Te Rau Aroha Marae in Bluff.	Bluff
2021	Text-to-speech and speech-to-text conversion for te reo Māori have been led by Te Hiku Media.	Kaitiaia
2021	Introduction of Māori language chatbots into social media spaces by LearnJam, SparkNZ and TeAka Māori Dictionary.	National

Note. Adapted from Hangarau me te Māori: Māori and technology by T. T. Keegan and A. D. Sciascia (2018), Auckland, New Zealand 2018, by the Auckland Press

mātauranga. Mātauranga strongly emphasises the value of utilising and respecting traditional knowledge, which can guide the creation of AI systems that are aware of and considerate of Indigenous perspectives and worldviews. Furthermore, the Māori concept of rangatiratanga can be applied to the use of AI in Māori communities. This

idea highlights the notion of self-determination and self-governance, which can help humans create and use AI systems consistent with their priorities and beliefs.

2.1.5 Summary: Abundance Intelligence: A Kaupapa Māori intervention

Māori informed literature is very limited in the field of AI R&D, but there is a growing awareness of the needs to develop a consistent voice in this domain, a voice which accurately reflects of learned cultural experiences. The scarcity of literature in the field has been exacerbated by the Western dominant culture that dominates the field of AI R&D. Without culturally informed literature, Māori and Indigenous peoples feel ignored, overlooked, and misrepresented. Being ignored leads to feelings of alienation and not being seen or heard. It continues the stereotyping and biases of Imperial colonisation (Blackmore, 2019; Eubanks, 2018; Rae, 2020).

It is essential to increase representation and diversity in AI R&D to address the feelings of alienation and a sense of not being seen or heard. It is crucial to involve Māori in developing and deploying these technologies to ensure that they align with Māori values and priorities and mitigate any potential negative impacts.

Concerns about the ethical and societal ramifications of AI's rapid development have been raised. These concerns include the possibility that AI could pose an existential threat, developing goals that are at odds with human values, escalating social inequalities, and the need of greater transparency and accountability in development. Other cultural worldviews, such as the Māori perspective via the lens of te ao Māori, which underlines the interconnectedness of all things and sees technology as a tool to strengthen relationships with nature, are frequently ignored in these conversations (Rae, 2020). Māori cultural principles can direct the creation and use of AI to improve communities and respect Indigenous viewpoints. In order to create and use AI systems that are congruent with human priorities and beliefs, the Māori idea of rangatiratanga emphasises the significance of self-determination and self-governance.

Through Māori viewpoints, this section offers a vision for how AI can develop, highlighting relational intelligence, self-determination, and cultural well-being.

2.2 Part 2: Artificial intelligence reforms

2.2.1 Introduction

The impact of government AI reforms on Indigenous people can vary depending on the specific policies and programmes in question and the context in which they are implemented. The effect of innovations in AI on the futures of industry, education and every human being is being felt worldwide. The building of emerging technologies such as big data, robotics and networking through the internet is driven by AI. As signalled by the growing number of global public and private AI strategies, AI will continue to be a technological innovator for the predictable future. This section aims to investigate and account for Government AI policy progress and the advancements of AI R&D in the business sector and universities. This investigation will be carried out with a critical review of selected *Literature sources* highlighted in the discussion below, followed by an in-depth examination of the impact of the Fourth Industrial Revolution (Schwab, 2017) on an assemblage of countries, which is covered by ‘Global AI reforms and trends’. The section is closed with a summary of AI-related trends in public and private sectors, including governments, industry, and education (see Section summary).

Global overview

Artificial Intelligence is at the top of international policy agendas for governments and private sector groups. The potential of AI motivates governments to see AI as their nation’s defining capability (Couldry & Mejias, 2020). No matter what websites, blogs, vlogs, magazines, journals or books we read, or what index, metric or financial measure we use, the United States of America (USA) holds a substantial global lead in AI technologies. Alongside a staggering commitment of financial recourse from the USA leadership and investment in artificial intelligence from the tech giants like Amazon, Facebook, Google, IBM, Microsoft and Tesla, the USA holds the centremost position in AI research. Moreover, Federal AI spending has reached a historic high since the arrival of the Joe Biden administration. It was calculated that by the end of 2021, Washington could invest US\$6 billion into AI R&D (Dozier, 2021; WSJ Staff, 2021, May 28). However, since the COVID-19 outbreak, China has been levelling the

field and publishing comparatively more AI-related research papers than leading countries.

Eleven of the top 20 AI-related scientific publications from China (Roberts et al., 2021; World Intellectual Property Organization, 2019), and 17 of the top 20 academic players worldwide in AI patenting are made up of Chinese research organisations. The World Intellectual Property Report (WIPO report) points out that China has effectively surpassed the European Union regarding investments. A leadership goal has driven these recent advances in AI by China to become the AI superpower of the world. To do this, the State Council of the People's Republic of China has dedicated US\$150 billion to becoming an AI global leader by 2030 (World Intellectual Property Organization, 2019). The USA and China, as the superpowers of AI, led the world into the Fourth Industrial Revolution, a term coined by Klaus Schwab, the Founder and Executive Chairman of the World Economic Forum (Schwab, 2017).

Data colonialism, a term coined by Couldry and Mejias (2020), there are now two power centres. On one side, we have the USA, and on the other, China. We are familiar with American firms, but we are less familiar with Chinese corporations, whose influence is only now starting to extend outside of China. The following discussion aids in identifying whether other countries may be rivalling the USA and China in AI R&D and also what countries are being affected by the developing AI digital divide.

Eclectic literature review sources have been used to glean a landscape of literature ranging from contemporary history to the most current AI literature. (These literature resources have been highlighted in Chapter 3, Theory, methodology and method.)

Global Artificial Intelligence reforms and trends

The impact of AI R&D on all public and private sectors - politics, education, business, and entire economies warrants the development of comprehensive and well-informed national AI strategies or plans.

What defines a National Artificial Intelligence Strategy?

This research focuses on developing countries that have released a stand-alone National AI Strategy as a component of the country's economic and well-being plan.

These strategies and plans provide information about the intention to use AI within each country and show that countries intend to grow AI technologies to develop world-class generational AI capability while ensuring equity, privacy, transparency, accountability, and economic and social impact. AI Strategies are publically available and have been categorised into groupings labelled *released*, *planned*, and *others* (OECD, 2024). Furthermore, AI strategies highlight the significant stakeholders in the plan, and in all cases, the players identified are the political authority, public and private industries and universities. Also, a strategy or plan is defined as an AI action plans with goals and objectives that impact countries' economies and well-being for simplification purposes.

Continental trends and country outliers

Leadership and economic growth are critical goals found in national AI strategies. Governments also outline objectives that seek to mitigate AI's adverse effects on the well-being of society and are evident in policy creation ranging from employment challenges to societal marginalisation. The following country's national AI strategies, as displayed in Table 2.5, will be analysed:

Table 0.2: Countries and territories by continent

Continent	Country
Africa	Egypt, Kenya, Nigeria, South Africa.
Asia	China, India, Israel, Japan, Republic of Korea, Saudi Arabia (KSA), Singapore, United Arab Emirates (UAE). <i>Asian Outliers</i> China, Japan, Republic of Korea, Israel, Saudi Arabia, KSA, UAE.
Europe	<i>The European Union</i> Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland. <i>European Outliers</i> United Kingdom (UK), Germany, Netherlands, Denmark, Finland, Norway, Sweden and Russia.

Latin America	Argentina, Brazil, Chile, Columbia, Costa Rica, Mexico, Uruguay.
North America	Canada, USA.
South Pacific	Australia, Aotearoa/New Zealand.

Africa: The Artificial Intelligence digital divide

The prospects for many countries around the globe are exciting, however, for Africa, the emergence of fears is broadening the digital divide. The literature reveals that around 28% of individuals on the continent use the internet (Houngbonon et al., 2021; International Telecommunication Union, 2020). Also, data being a prerequisite for systems functioning puts into question the inequalities of connectivity. Although data prices are falling, costs across the continent are still high compared to other countries' data plans, for instance, in 2022, the Sub-Saharan region with the most expensive 1GB of mobile data. Equatorial Guinea has the most expensive mobile data - US\$49.67 per GB in 230th place. Saint Helena follows it at US\$39.87, São Tomé and Príncipe at US\$30.97, Malawi at US\$25.46, Chad at US\$23.33 and Namibia at US\$22.37 (Cable.co.uk, 2021; Oluxole, 2021). As evident from these high costs, a negative impact disadvantages development, resulting in unreliable infrastructure, unaffordable data plans and access to technologies. All of which will exacerbate the inequalities in Africa, driving them further apart from those who can and cannot.

International digital interventions can be seen in several countries in the African continent as African leadership seeks to embrace technologies. The tech giants of IBM and Google during the early 2010s resided in Africa. IBM's Research offices in Kenya and South Africa and Google's lab in Ghana shared the same mission as their parent organisations, pursue fundamental and cutting-edge research in Africa. These research interventions saw the growth of university courses and other educational programmes dedicated to the advancements in the African machine-learning community. An elaborate project called Google Loom was introduced to solve Africa's low internet connectivity problem. The Google Loom saw the launch of solar-powered balloons to provide internet connectivity to test and seek ways to connect the African continent (Bhandari, 2020). Unfortunately, the project was unsuccessful and was concluded in January 2021. China is now one of Africa's largest trading partners and a significant infrastructure funding provider. Huawei, China's telecommunications giant, has

established a seemingly irreversible foothold in Africa (Gravett, 2020; Rae, 2020). African leaders are stressing the growing importance of a digital shift in a world of technology growth, especially amid the coronavirus pandemic. According to Cartwright (2020), 50% of Africa's 3G network and 70% of 4G base stations were made by Huawei. South Africa's largest wireless carriers, Rn and Safaricom and Kenya's largest wireless carrier use Huawei infrastructural technologies. Running parallel to this, Senegal is moving all government data and digital platforms from foreign servers to a new national data centre to strengthen its digital sovereignty using Huawei digital (Cartwright, 2020). Academic researchers Ulises Mejias and Nick Couldry have been studying the phenomenon of data colonialism. Even though the forms, scales, and circumstances may have altered, experts claim that colonialism still serves the same imperialism-building functions of extraction and appropriation, they claim that a fresh land grab is taking place, but we, or rather, human life, is being taken, not land. This continues the imbalance of power and remains a threat to Indigenous sovereignty. Informed consent, equitable partnerships and Indigenous self-determination over data is required to stop misappropriation and profiting from extracted data. The only word that adequately describes this land grab is colonialism, which refers to the collection and creation of valuable data for corporate use out of the flow of our lives (Couldry & Mejias, 2019).

AI presents positive prospects for Africa, however, necessary steps must occur before Africa can progress into this period of change. For example, Brookings Institute Africa Growth Initiative (2020) points out that (Brookings Institute Africa Growth Initiative, 2020):

1. Africa needs to develop a continental model to help direct its AI strategy drawing on stakeholders' strengths, including institutions, academia, and the private and public sectors.
2. Stakeholders need to commit to investing in the development of AI systems to ensure a sustainable economic and well-being plan.
3. It is vital that capacity building of local talent takes place to ensure the endorsement and the equity of AI systems is continent-wide.
4. It is imperative that the building of AI has an ethical focus aimed at creating a more inclusive economic and well-being plan for Africa.

The impact of AI on the African continent will be transformative for African societies. The promises of government policy and regulation, as highlighted in Table 2.3 Appendix X, around reducing inequalities, decreasing poverty and upgrading public services, have come to fruition. However, we should remember the words of Professor Rangi Matamua: Is this the new (r)evolution or the new coloniser of Indigenous people, and ask the same question of the African Indigenous people? (Whaanga, 2020).

Asia: Becoming the powerhouse of Artificial Intelligence

Today, there are 48 countries in Asia and three dependencies or other territories (UN Statistic Division, 2021). These countries extend over five geographical areas – Eastern Asia, Southern Asia, South-East Asia, Western Asia and the Commonwealth of Independent States (CIS). The CIS has been placed in the European continent as the European Commission has gleaned relevant information about AI for these countries.

This research assumes that countries doing things differently from other members are considered an outlier. For example, in the Asian continent, China, Japan, the Republic of Korea, the Kingdom of KSA and Israel are considered outliers. Firstly, as previously stated, Japan is reported to hold the highest AI patent portfolios, and Chinese research organisations are also leading AI patent holders. They are listed in the top 20 AI academic players of the world, and due to rising field enthusiasm, Japan and the Republic of Korea found themselves transpiring leaders in robotics. KSA and the UAE are focusing on using AI applications to move beyond an oil-based economy, yet Israel's obsession with their national security provides the pretext for further investigation.

China, Japan and Singapore are a group of Asian countries leading the world in AI adoption, research, and development, which is indicated by the financial investment by the government and private sector. It is also important to note that PPP, or purchasing power parity, will be used in this research to measure R&D spending. PPP is a monetary figure that measures a fixed set of consumer products and services whose price is evaluated regularly (UIS, 2021). China leads the spending in this group -

US\$346M spending in PPP\$, Japan - US\$170M and Singapore's - US\$9,626.3M estimated combined AI R&D spending being US\$525.6M.

As detailed in the opening paragraphs of this chapter, Japan is the holder of the highest number of AI patent portfolios, and Chinese research organisations make up 17 of the top 20 academic players in AI patenting while also holding 11 of the top 20 positions in AI-related scientific publications (World Intellectual Property Organization, 2019). Singapore's R&D in the new communication testbeds in 5G and beyond 5G, supported by the capacity building of local talent and newly formed relationships with China's leading AI companies, places Singapore as a significant emerging AI country (Singapore Government: Smart Nation and Digital Government Office, 2019). Hence, these critical measurements underline the prominence of China, Japan and Singapore in global AI-related development.

The sample of Asian countries comes from a variety of divergent philosophical foundations. These foundations underpin the unique political settings in each country, therefore driving each country's distinctive AI aspirations (as indicated in Tables 2.4 to 2.10 Appendix X). All the countries reviewed exhibit the desire to adopt AI as part of the country's economic and well-being plan. For example, the notions of infrastructure, access to data, skills and human capital, trust in partnerships and ecosystems and entrepreneurship are motivators. However, each country's agenda and investment capabilities are diverse. Take, for instance, Asian countries that are beginning to see the impact of their early AI interventional focuses on finance, health care, and transport sectors in their region (ASEAN, 2021). Moreover, the collaborative platform of the "Smart Cities" programme, created by the ASEAN cities, has enabled the countries to share experiences in adopting intelligent technologies for all partners to work towards a common goal of making urban development sustainable and their cities liveable. To date, high-tech, telecom, and financial services companies are a leading focus for Asian countries.

China: The Artificial Intelligence dragon

For the past decade, the Chinese leadership has believed that the future of global military and economic power can be achieved by developing AI strategies across all

government programmes, tertiary institutes, and private enterprises (as established in Table 2.5 Appendix X). An underlying philosophy is that a global hold will reduce China's dependency on international technology imports. Hence, the Chinese government's main focus tends to be on sectors relating to science, technology, engineering and math education, which aims to enhance the capacity building of the brightest prodigies in the AI environment, as well as devoting ever-increasing resources to their R&D programmes (Allen, 2019; Larson, 2018). On reflection, this has been a brilliant strategy for establishing their dominance in AI.

The arms race and international security implications have been at the forefront of Chinese leadership. Now being coined the *new oil* (Tonego, 2014), data has added a new dynamic to the potential arms control. China already exports armed autonomous devices and surveillance AI, and it continues aggressively pursuing military usage of AI. To support the economic growth of the military export market, the Chinese government has provided resources to establish a new research organisation that focuses on this AI field under the National University of Defence Technology (NUDT) (Larson, 2018; OECD AI Policy Observatory, 2023). A motivating force behind the Chinese government's focus on developing military AI is their belief that their expertise in the field will provide leapfrogging opportunities to create advantages over the USA further (Allen, 2019; Roberts et al., 2021). The Chinese government now see AI as a race of two giants, between itself and the United States (Allen, 2019).

Over the past two decades, Chinese telecommunication companies have dominated the telecom infrastructure landscape in emerging markets. Moreover, dominating infrastructure landscapes in overseas countries with Chinese technologies has been driven by the Chinese leadership initiative called the Belt and Road Initiative (BRI). The BRI advocates spreading telecommunication technology across the globe, including Europe, Africa, the Middle East, and Latin America, with the continuation of setting up 5G using Huawei telecommunications equipment (Gravett, 2020; Horvat & Gong, 2019).

Japan: The rising sun of Artificial Intelligence

In March 2017, Japan became one of the first countries to develop a national AI strategy. Dirksen and Takahashi (2020) summarised Japan's primary development strategy focus points as follows:

1. Political
2. Economic
3. Societal
4. Technological
5. Legal

The approach taken by Japanese government was the first to integrate their AI strategy into multiple ministries, calling it a Strategic Innovation Promotion Programme (Dirksen & Takahashi, 2020). From a technological perspective, Japan vowed to lead in building research, education and social infrastructure networks and strengthen AI research and development. Becoming a frontrunner in these domains would help Japan enhance its industrial and economic competitiveness. Consequently, as a global AI leader, Japan needed to consider human recourses and therefore developed a strategy to build the capacity of the Japanese people and culture for the transformative change in the labour market, which would, in turn, reverse the brain drain to attract people to Japan. Simultaneously, the Japanese government facilitated data-sharing platforms and created legal structures to govern their data. As different systems developed, the Japanese legal framework was updated, and the newest digital developments were considered (Government of Japan, 2020; OECD AI Policy Observatory, 2023). Again, on reflection, this has been a brilliant strategy for Japan as they are now considered a world leader in AI (as displayed in Table 2.6 Appendix X).

The Republic of Korea: Make or break

Many had hoped that the Republic of Korea would be motivated to investigate AI's power over humans after the nation's most famous Go player, Lee Sedol, took the only game off AlphaGo, an AI agent specialising in playing Go. However, the Republic of Korea, a once global leader in IT development, has failed to gain traction in the new age of AI-R&D. Hence, due to the lack of traction by Korea, the gap between China and the USA and the rest of the world has widened.

The Republic of Korea National AI strategy released in 2018 aimed to move the Republic of Korea into the top three nations in the world in the development of digital technologies, remembering that the Republic of Korea was once an IT powerhouse (as signalled in Table 2.6 Appendix X) (Government of the Republic of Korea, 2019). The resulting changes for the Republic of Korea also cause one to query how fast they can implement the national AI strategy plan.

Life after oil for the Kingdom of Saudi Arabia (KSA)

The cultural formation of KSA has undergone many changes over time. For example, the Vision 2030 development strategy, which has data and AI at its core to help the countries move beyond oil-based economies, is driving KSA and the UAE.

This strategy focuses on advancing AI to boost countries' economies and build expert capacity in military AI technology (KSA Council of Economic and Development Affairs, 2016; UAE Government, 2018). With AI capabilities and pursuing emerging technologies, KSA and UAE have carved a niche in the defence export market (as exhibited in Tables 2.8 and 2.9 Appendices X and X).

Israel: Artificial Intelligence to bolster National Security

Israel has adopted a similar investment path in the defence export market (as manifested in Table 2.10 Appendix X). In addition, Israel has also invested in air defence systems and cyber security (Antebi, 2021; IAI, 2021). Like their Asian neighbours, Israel's AI strategy focuses on cultural development, skills, and human capital. Work is taking place around the advancement of intelligent technologies, cross-government collaboration to promote AI research and development, the establishment of higher education programmes to support AI research, and like all countries around the world, leveraging AI in the fight against COVID-19 (OECD AI Policy Observatory, 2023).

In summary, the above Asian countries still have some catching up to do, although they are not far behind. Various aspects of cultural capital within these countries continue to develop along with their ambitions for AI strategy. Moreover, Asia may yet emerge as a new leader in the AI global market soon. Also, the governments

investing in AI-driven technologies to boost the economy and accelerate digitisation across these regions will enable Asia to reign as a powerhouse of AI.

European Union: An Artificial Intelligence powerhouse?

The European Union (EU) consists of 27 European member countries sharing political and economic ideals. As its name suggests, the philosophy underpinning the EU shares principles linked to collectivism. The European Commission (EC) is the executive branch of the EU, responsible for proposing legislation, enforcing EU laws and directing the union's administrative operations. A collegiate body within the EC is the European Council, which defines political advice for the EU. The Council of the European Union is a legislative body that assists in ratifying legislative initiatives alongside the European Parliament. For this research, the CIS countries have been placed in the European continent as the European Commission has gleaned relevant information about AI R&D for these countries.

The EC's white paper on AI was presented in March 2020, entitled, *On Artificial Intelligence. A European approach to excellence and trust* (European Commission, 2020) aimed to unite European countries to seek additional ways to ensure that people and businesses could continue to enjoy AI benefits. The EC's *Coordinated Plan* on AI was also revised in April 2021 (European Commission, 2021b). The overarching philosophy in the white paper and the *Coordinated Plan* focuses on building industrial capacity around excellence, trust, and fundamental human rights. The white paper and the *Coordinated Plan* documents also outline the importance that EU countries consider AI dependent on geopolitical issues (see Tables 2.11 to 2.34 Appendices X to X).

An example of geopolitical initiatives regarding AI R&D in green technology is highlighted in Nordic countries, where their attention to geopolitical issues has been significant throughout their development. However, EU countries tend to show divergence in their AI approaches, with some favouring a more holistic view, compared to others that focus on specific sectors. More importantly, for the EU to be an international competitor in the AI field, as its leadership aspires, investment in safeguarding the functioning of markets and the safety of people's rights is pivotal.

The European Commission (2021b) outlined the following recommendations in the hope of immediate enactment of current European AI priorities:

1. Enable the development and uptake of AI in the EU
2. Make the EU the place where AI thrives from the lab to the market
3. Ensure that AI works for people and is a force for good in society, and
4. Build strategic leadership in high-impact sectors

The report *A Comprehensive European Industrial Policy on Artificial Intelligence and Robotics* intended to outline the order of AI business for Europe in the initial phases of the legislative cycle, was adopted by the European Parliament in 2019 (European Parliament's Committee on Industry Research and Energy, 2019). The healthcare-related AI topics outlined in this report are significant. First, the healthcare theme places the EU in a unique position in the world's advancements in the AI field, as does the military export market of the Gulf States and China. Second, the healthcare export market provides a strategic pathway for the EU's economic and well-being expansion.

The report outlines the following topics:

- *Potential of AI, machine learning, big data and robotics*

The potential for AI, machine learning, big data, and robotics to analyse data and detect health threats, predict disease outbreaks, and counsel patients provide the opportunity for research innovation in medical treatment.

- *Personalised healthcare*

Research using sensors in robotics facilitates further personalised treatment and patient services.

- *EU world-leader in healthcare technologies*

EU leadership calls on its members to work collaboratively to position the EU as a global leader in healthcare technology.

- *More transparency for citizens on AI use*

As highlighted in the EC's *Coordinated Plan on AI*, transparency and trust are fundamental rights for their people. The report recommends that there is clear disclosure when AI is used.

Oxford Insights and the International Research Development Centre (IDRC) rank the UK, Finland, Germany, Sweden, Denmark, Netherlands, and Norway in the 2020 Government AI Readiness Index (Oxford Insights, 2023). The AI Readiness Index captures the current capacity of OECD governments to absorb the innovative potential of AI. All countries are members of the EU and are therefore invested in the collaborative approach to AI. A more extensive term than government, governance also refers to the public and private sectors' management and planning of nations, regions, and cities. The UK, Finland, Germany, Sweden, Denmark, Netherlands, and Norway collaboratively accomplish goals that are difficult for any country to achieve alone. This approach may be one of the reasons why these countries outrank their fellow EU members in the AI Readiness Index.

The Nordic nations

While the Nordic nations outrank fellow EU members in the AI Readiness Index, the national AI strategies for Finland - US\$7.2M spending in PPP\$, Sweden - US\$14.2M, Denmark - US\$7.9M and Norway - US\$5.8M, have a combined AI R&D spending of US\$35.1M (UIS, 2021). In short, this figure is significantly less than many of their global rivals (e.g. USA and China), so their advancement in digital competence is lagging. Like all EU members, AI strategies emphasise the need of increased digital competence at all levels of education and those already employed. Hence, to achieve ground-breaking innovations in AI, the promotion of scientific research is essential.

However, the literature suggests that the development and use of AI-based on ethical principles and respect for human rights and democracy is a critical influencer in the advancement of AI in these countries (Andreasson, 2017; Robinson, 2020). Shared values shared cultural identity and shared democratic political philosophies have underpinned AI policies for Nordic society (as ascertained in Table 2.35 to 2.38 Appendix X to X). Moreover, their collectivist approach has seen the Nordic leadership imbue trust, transparency, and openness into creating an AI culture in society. Nordic AI policies also noted ethics, data openness, secure personal data, respect, and an attempt to address explainability¹¹ and democracy. The focus on a solid data ecosystem

¹¹ Explainable AI, or Interpretable AI, or Explainable Machine Learning, is artificial intelligence in which humans can understand the decisions or predictions made by the AI

and the promotion of open data policies to address societal challenges, including climate and environmental issues and, more recently, the COVID-19 pandemic, again had been a significant affiliate in increasing the development in the AI field for these Nordic countries (European Commission, 2021a).

The German Artificial Intelligence strategy

In contrast to collectivist approaches such as those demonstrated by Nordic countries, Germany tends to exhibit individualism, which can be seen in launching the German National AI strategy. For example, in November 2018, the German federal parliament, more commonly known as the Bundestag (European Commission, 2021c).

In October 2020, the Study Commission on Artificial Intelligence - Social Responsibility and Economic, Social and Ecological Potential of the 19th German Bundestag presented a final report with specific AI-related recommendations for action. In December 2020, the German Federal Government adopted a German National AI strategy (European Commission, 2021c). Again, like many EU AI leaders, the strategy aims to prioritise the sustainability of Germany's economy while ensuring societal and environmental protection (as attested to in Table 2.39 Appendix X). The Bundestag acknowledges that AI's opportunities will be challenging and fraught with technical, legal, and ethical issues. This strategy is supported by a US\$110 million total PPP investment.

The Netherlands Artificial Intelligence strategy

The Government of the Netherlands released its strategic action plan for AI in October 2019 (European Commission, 2019). The strategic initiatives focused on increasing the Netherlands' AI competitiveness in the global market (see Table 2.40 Appendix X).

The AI strategy, as corroborated in Appendix 12, relies on:

1. The development of government and private sector policy needs to promote social issues.
2. The development of policies that support sectors of education, research, development and innovation in AI and encourage access to data sets.
3. The development of policy relating to ethical issues.

Many AI initiatives are noted in the strategy associated with regulation and infrastructure, networking, research and development, and innovation and education. The Netherlands' strategy is supported by government funding of US\$16.4M spending in PPP\$ (World Economic Forum, 2020).

UK: Brexit Artificial Intelligence strategy trends

Through a referendum voting procedure, it was decided that the UK would withdraw from the EU at 23:00, 31 January 2020 GMT. In March 2021, UK's National Artificial Intelligence Strategy was released (as evidenced in Table 2.41 Appendix X) (Gov.UK, 2021). The new strategy focuses on the following:

- Economic growth through the use of AI-related technologies.
- Artificial Intelligence ethical policies developed.
- Capacity building of sustainable AI talent.

However, it is important to note prior events leading up to the current situation. More specifically, in April 2018, the AI Sector Deal, a £1 billion package, provided foundations to foster global AI leadership for the UK. For this purpose, the AI Sector Deal strategy, as confirmed in Table 13, was to improve UK's position across five key areas:

1. Ideas - the UK as a global economic innovator using AI-related technologies:
2. People - AI talented people working good jobs and having greater earning leverage:
3. Infrastructure - upgrading the UK's infrastructure:
4. Business environment - building an industrial ecosystem that will grow businesses:
5. Places - a prosperous community ecosystem in the UK.

More recently, the genesis of the UK AI strategy 2021 stems from the Science and Technology Committee's Robotics and Artificial Intelligence Report, presented to the House of Commons (UK House of Commons, 2016). This report examines the repercussions of AI on employment, ethical and regulatory challenges around bias, accuracy, safety, accountability and plans for innovative R&D and funding. In January 2017, an All-Party Parliamentary Group on Artificial Intelligence was established. The

group aimed to pay attention to AI-related ethical and regulatory possibilities and societal and industry models for parliament. The All-Party Parliamentary Group's recommendations were the impetus for the UK Government's Industrial Strategy, published in November 2017 (UK Government, 2017).

Russia: The Artificial Intelligence sleeping bear

In 2017, Russian President Vladimir Putin declared that,

... whichever country becomes the leader in AI will become the world's ruler (Vincent, 2017).

However, China, the United States of America, and not Russia, are taking the lead in the AI race. Again, China and the United States of America are advancing in developing AI for national security. Also, the Gulf States signposted the way for advancing the military export market. In addition, the EU is making significant strides into an AI-driven medical export market. Consequently, Russia is trying to capitalise on this, yet a considerable challenge for Russia to make a mark in the AI field is the limited talent capacity. According to the OECD (2019) report, less than one per cent of Russian students studied for an information and technology-based degree. Russia's leading computer science research university, Lomonosov Moscow State University, is ranked equal 158th in the 2022 Times Higher Education World University Rankings, therefore, indicating that Lomonosov Moscow State's computer science programme may not be as robust as the top 10 ranked universities, which are filled with USA and UK based academic institutes (Times Higher Education, 2020). Compounding Russia's inability to gain a foothold in the AI race is its inability to retain its AI-related talent. Moreover, Russian specialists have tended to seek employment in the west, where their earning power is higher. Interestingly, many emigres who left Russia in 2000 lived and worked in San Francisco, New York, London, or Berlin. An example of this is Mail.ru Group co-founder Yuri Milner, who now resides in Silicon Valley (Bowes, 2017; Swaine & Harding, 2017).

A knock-on effect of the *brain drain* from Russia has been the effect on the military. In 2016 the decline of specialist computer engineers was significant, half of the military-industrial complex enterprises were experiencing personnel shortages (Dear, 2019). The private sector worldwide has found a niche market to invest in AI. However, Russia's private sector has suffered from low economic growth, poor opportunities for venture capital funding for the past decade and dominance of political interests (Seddon, 2019).

With the release of the Russia AI Strategy in September 2017 and Putin's stated plan for his nation to become the AI ruler of the world, Russia has signalled their entry into the AI race. The strategy outlines the Russian leadership's intentions to focus on the Russian military and the private sector (as affirmed in Table 2.42 Appendix X). The world's need to navigate the COVID-19 pandemic has also seen Russia outsource their research to the private sector. The COVID-19 induced economic slow-down has seen the Russian leadership increase its outsourcing of contractual projects to private companies. More importantly, this unique strategy implies that the Kremlin would not assume direct control over AI development, nor would it provide much funding. Even though Russia has extensive resources to invest in AI, the analysis of the global AI environment suggests that Russia is likely to lag behind its rivals.

South Americas

Latin America Artificial Intelligence strategy trends

The political landscape of Latin America has a direct bearing on national AI strategy development. For example, at the end of Mexico's national elections in 2018, the Mexican leadership changed. Much of the workaround digital enterprise by the previous administration halted and shifted priorities. Like Mexico, Uruguay's new administration reprioritised developing a national AI strategy published in 2019. However, it was much briefer than the broader digital transformation view in the country's previous government. In May 2020, Argentina's AI strategy was still in its planning stage. Alberto Fernández's left-wing coalition has been mandated and has since been dominated by the COVID-19 response (MIT Technology Review Insights, 2020).

Various issues impact Latin American countries, which struggle with economic slow-down and waning productivity. For example, many parts of Latin America face poor education, widespread unrest and, in some places, entrenched corruption that hinders economic progress. These factors inhibit the opportunity for Latin American countries to become the global broker of Latin American talent in AI. However, policy development around education and investment from developed countries may enable skilled professionals (MIT Technology Review Insights, 2020).

While there are several South American countries involved in various levels of AI development, each elected government is either preparing or has published public policies and national strategies to foster AI development for their respective countries – Argentina, Uruguay, Chile, Brazil and Mexico (Martinho-Truswell et al., 2018; OECD AI Policy Observatory, 2023). Nevertheless, for AI adoption to expand across the region, MIT Technology Review Insights (2020) suggests (as revealed in Tables 2.43, 2.44, 2.45, 2.46 and 2.47 Appendices X, X, X, X and X) that for progress to be made, attention to the following areas is required:

1. A focus on deepening the pool of AI talent. To help achieve this goal, strengthening education programmes at all levels is essential, and relationship building with the business community is required.
2. A lessening of scepticism around AI. This sub-culture needs to change to one of data-driven experimentation. Pilot programmes between educational institutes and the private sector may prove to those sceptics that AI can deliver. Positive outcomes from pilot programmes will then reinforce investment in further AI initiatives.
3. Ongoing investment is essential. Changing the sub-culture and communicating the belief in AI can only lead to proactive conversations with local and international business communities.

North Americas

Canada's National Artificial Intelligence strategy trends

Canada's AI strategy, the Pan-Canadian Artificial Intelligence Strategy, was published in 2017. More importantly, it emphasised responsible innovation and economic growth

grounded in the shared values of human rights, inclusion and diversity. The significant themes gleaned from the OECD.AI (2021) (as upheld in Table 2.48 Appendix X) were:

- 3 Science and research advancement.
- 4 The growth of the country's AI R&D reliance on talent.
- 5 Investment in research and talent.
- 6 Promotion of inclusive dialogue
- 7 Building public trust in AI and digital technology

As the list above highlights, Canadian leadership emphasises the importance of advanced science and research and the significance of growing its talent pool. Moreover, early investment in research now sees the country as a world leader in machine and deep learning. Canada's effort to retain and attract expert AI data specialists places the country in an excellent position to continue paving the way forward to commercialising AI technology. There is also an emphasis on the socio-economic benefits of climate change, such as directing spending and financial benefits to battery production and clean energy equipment innovation. Canada's underpinning philosophy of inclusion and the building of public trust work hand-in-hand and is of primary significance in their AI plans. Hence, Canadian leadership sees the potential of AI as a technology that serves Canadians.

The USA

With the influence of Amazon, Facebook, Google, IBM, Microsoft, and Tesla investing heavily in AI, the USA still holds a substantial lead globally in AI technologies. Although the Trump administration launched the first-ever national AI strategy a few years earlier, it was not until the Joe Biden administration took office that federal AI spending reached a historic high. The impetus behind the Biden administration's interest in AI was primarily to challenge China, its main rival in AI. The underpinning themes permeating the USA's strategic strategy are to support AI technology that will improve the quality of life for USA citizens, enhance national security, and increase prosperity (as highlighted in Table 2.49 Appendix X) (Government of the United States, 2021). Moreover, the USA's national strategy is well-aligned with the OECD AI Policy Observatory (2023) principles and takes necessary action to support the development of trustworthy AI.

Investment in AI R&D is of primary importance to the White House. Federal spending on AI R&D has doubled in nondefense AI and quantum information science. The USA administration plans to generate technological breakthroughs in AI with other non-Federal entities, international partners and allies, academia and industry. Quantum Information Science (QIS) is an interdisciplinary field. The QIS workforce focuses explicitly on the community college arena and seeks to comprehend the analysis, processing, and communication of information using quantum mechanics principles. The USA leadership values establishing a federal data strategy guiding operational governance and best practices. This strategy protects individuals' data safety, security, privacy, and confidentiality. The USA continues to forge relationships with the international business environment to ensure that the interest of the USA's AI development is consistent with the nation's values, which uphold privacy, civil rights, and civil liberties (OECD AI Policy Observatory, 2023). Like many countries worldwide, the USA encourages current and future generations to join the AI field workforce by offering pathways through apprenticeships, skills programmes, and education programmes, particularly in STEM subjects.

Australia

As shown in Table 2.50 Appendix X, the Australian AI Action Plan sees Australia as a global leader in developing and adopting trusted, secure and responsible AI (Australian Government, 2021). To achieve this, Australia plans to:

1. Seek safer, more reliable and fairer outcomes for the Australian society
2. Ensure Australians are not affected by the negative impact of AI applications
3. Make sure the highest ethical standards are practised by businesses and governments when designing, developing and implementing AI.

The Australian leadership believes that by applying the principles and committing to ethical AI practices, they can:

1. Build public trust in the organisation's AI-related products
2. Boost loyalty to the organisation's AI-related products
3. Positively influence outcomes from AI
4. Ensure that AI transformative technology benefits all Australians

With the AI Action Plan, Australia aims to lead the digital economy and society by 2030.

Aotearoa/New Zealand

Aotearoa has yet to publish a national AI strategy, however, many groups are developing a plan alongside the government. The New Zealand Government has published documentation (New Zealand Government, 2018; StatsNZ, 2020) painting the government as supporting the notion of a National AI Strategy. Furthermore, the OECD AI Policy Observatory (2023) identifies policy initiative groups offering the Government advice in developing a National AI Strategy (as highlighted in Table 2.51 Appendix X). Given that Aotearoa is the primary focus of this thesis, it is essential to reflect on the various areas concerning AI in this context, beginning with the AI forum.

The Artificial Intelligence Forum of New Zealand (AI Forum)

The AI Forum of New Zealand, launched in 2017, is a purpose-driven, membership funded association for those with a shared passion for AI opportunities. The Forum connects AI technology innovators, investor groups, regulators, researchers, educators, entrepreneurs and the interested public. The AI Forum of New Zealand (2018) also advances the ecosystem through advocacy, talent, collaboration, innovation and economic growth.

The Data Ethics Advisory Group

In 2019, the Data Ethics Advisory Group was mandated to look for ways to maximise engaging risks and harms when using data sets to maximise the potentiality of emerging AI technologies. This group is authorised to test ideas, policies, and proposals related to new and emerging uses of data and, from this testing platform, provide advice on trends, issues, and areas of concern and areas for innovation.

Māori Iwi Advisors Forum

The Māori Iwi Advisors Forum's goals are to develop the relationship and involvement between the Council and the iwi and hapū and to make it easier for mana whenua (*authority over the land*) to participate in decision-making. The Forum's objectives do not replace the Council's consultation and involvement with iwi and hapū.

New Zealand Government

In October 2018, the Algorithm Assessment Report, a cross-government review, highlighted how government agencies use algorithms to ensure that New Zealanders are informed and confident in using algorithms (New Zealand Government, 2018).

In July 2020, the Algorithm Charter, a cross-government commitment, was signed to improve confidence in the government's use of algorithms over the next five years (StatsNZ, 2020).

The New Zealand Government has also indicated their intentions to become an AI leader by developing international relations with several co-sponsorship and partnership arrangements with global forums and strategically positioned allied countries. New Zealand is the co-sponsor of the World Economic Forum (WEF) project on the regulation of AI. New Zealand has an academic fellow in San Francisco, working with the WEF team to develop a framework for national conversations on AI and develop a roadmap for policymakers on high-level principles, tools and approaches for countries who may wish to regulate AI. Pilot projects testing out aspects of the roadmap will be undertaken in New Zealand. A deliberate Digital Economy Partnership Agreement between New Zealand, Singapore and Chile was created to establish consensual digital trade, which promoted issues around inclusion in the digital economy (OECD AI Policy Observatory, 2023).

With strategic political alliances and policy enactments made by the New Zealand Government and the formation of AI advisor groups, Aotearoa is positioning itself to take a stance as an emerging AI developing country. It is also important to note that given the fledgling status and emergence of AI related policy etc., the collectivist or individualistic state of Aotearoa's plan is somewhat difficult to discern due to their early stage of development. However, Aotearoa has already shown signs of collectivism (as per work with WEF and conversations with Māori advisors). As such, AI development in Aotearoa is much more likely to demonstrate an approach that is reflective of collectivist values.

Summary: Artificial intelligence reforms

Global AI R&D expansion is being driven by trade and commerce. Therefore, Western economic ideologies appear as fundamental in the writings of global AI governance reforms. Despite this, notions of collectivism and collaboration are emerging in AI governance reforms, however, neoliberal ideologies directly conflict with historical international social conventions and tend to take a back seat in the current Western socio-political governance reforms. Sadly, it is therefore argued by this research that hegemony in global AI reforms remains untrammelled. It is therefore important for governments to work closely with Indigenous people to understand their unique perspectives and priorities and to ensure that AI technologies are developed and deployed in a way that is respectful of Indigenous cultures and values.

2.3 Part 3: Artificial intelligence in a space of Western ascendancy

Nilsson's book *The Quest for Artificial Intelligence: A History of Ideas and Achievements* underscores

underscores the long-standing dominance of Western narratives, highlighting the urgent need for Māori and Indigenous perspectives to reshape AI. Integrating te ao Māori values like rangatiratanga ensures that future technologies align with human priorities, fostering cultural inclusion, self-determination, and ethical AI development.

Nilsson's book *The Quest for Artificial Intelligence: A History of Ideas and Achievements* has provided a historical listing of projects and programmes, allowing me to scope this researcher's quest to understand AI (Nilsson, 2010). The structure of Nilsson's book offers a chronological sequence of time dating back to the Greek philosophers and storytellers.

The research by Yang (2019) constructed an extensive survey over the period 1961–2018, which focused on AI advancement. Doing so provided us with another set of references that ended the original and early history of AI evolution and began a more modern historical order linked to creating a global landscape of AI-related development.

By blending Nilsson and Yang's chronological approach, allowed us to identify the foundations of western ideologies in the space of AI R&D. It continues to follow the amplification of these ideologies into today's colonial-dominated AI systems (Nilsson, 2010). Our research's chronological approach is bulleted below and represented in Table 2.1.

- At the beginning of illumination: BCE - 1950s
- The initial phase: 1956 - 1980
- The industrialisation phase: 1980 - 2000, and
- The explosion phase: 2000 to the present

2.3.1 Overview - Artificial Intelligence chronological time dimensions

We journeyed back on the fables and legends of the ancient storytellers and study the theories of the Greek philosophers to investigate how these ancestors saw their relationships with the concepts of machines and robots. These views provide context to the definition of a Western preference for the reason of life and rational thought. This period exemplifies the development of a new plan in AI R&D forged by the West (Nilsson, 2010). (see Table 2.1: Evolution of artificial intelligence. BCE-1950s: In the beginning into illumination).

After the earliest periods of development, prominent scientists gathered at conferences, symposiums, and group discussions from 1956 through to 1980. At these gatherings, the development of algebraic application problems, proving geometric theorems and learning English were predominant (Nilsson, 2010). (see Table 2.1: Evolution of artificial intelligence. 1956 – 1980: The initial phase).

We then study the period of AI development between the years 1980 to 2000. The Japanese government allocated a vast amount of money to support AI and began the fifth-generation computer programme. The goal was to create machines that support human-machine dialogue, translation, and image recognition. Subsequently, some developed countries in Europe and the United States of America (USA) also responded and provided substantial funding for AI research. At this stage, knowledge processing became the focus of AI research (Nilsson, 2010). (see Table 2.1: Evolution of artificial intelligence. 1980 – 2000: The industrial phase).

We then investigated AI R&D from 2000 to the present. During this time, there were several significant demonstrations of AI development, including IBM's deep blue victory against a world-class chess player and Google's AlphaGo AI competitor that defeated the world champion Li Sedol. These examples let the world see some of the iconic results of AI, especially in recent years, with the internet, big data, and graphic processing units being developed. Also, AI technologies such as speech recognition and image recognition have been applied to the real-life of ordinary people (Nilsson, 2010). (see Table 2.1: Evolution of artificial intelligence. 2000 to the present: The explosive phase).

Table 0.3 Evolution of artificial intelligence. BCE-1950s: In the beginning into illumination

Time (BCE)	Events – Philosophers, Logicians, Mathematicians	Events - Storytellers	Country
<i>BCE-1950s: In the beginning into illumination</i>			
620 to around 550			
Around 600 469–399 429-347 384-322	Thales Socrates Plato Aristotle	Four presuppositions form the characteristics of classical Greek philosophy. The aim is not to change the world but to know reality.	Ancient Greek storytellers Aesop, Homer, and Hesiod, introduced machines to help humans in their stories from as early as the 12th century BCE.
Time (AD)			
Events – Philosophers, Logicians, Mathematicians			
1495	Leonardo da Vinci drew plans for a humanoid robot.	Italy	
1738	Jacques de Vaucanson displayed his mechanical duck.	France	
1590		Edmund Spenser creates Talus, the iron man, in the poem The Faerie Queene.	United Kingdom
1642	Blaise Pascal devised a machine to calculate addition and subtraction equations	France	
1646 -1716	Gottfried Leibniz was distinguished for his independent invention of differential and integral calculus.	Germany	
1762		Johnathon Swift mentions a device called the engine, one of the earliest references to a computer in his novel Gulliver’s Travels.	Ireland
1833 & 1847	Charles Babbage built a calculating machine called the Difference Engine. He then improved the engine by building	France	

Time (BCE)	Events – Philosophers, Logicians, Mathematicians	Events - Storytellers	Country
	Analytical Engine, considered the first computer.		
1843	Ada Lovelace is considered the first computer programmer.	France	
1815 - 1864	George Boole developed Boolean algebra, which is fundamental to the design of digital computer circuits.	England	
1848-1925	Gottlob Frege is understood by many as the father of modern mathematical logicians.	German	
1856-1919		Lyman Frank Baum was an American author known for his children's books, particularly The Wonderful Wizard of Oz and its sequels.	USA
1886		The Future Eve, a science fiction novel by the French author Auguste Villiers de l'Isle-Adam, has been published.	France
1890-1938		Karel Čapek was a Czech writer best known for his science fiction, including his novel War with the Newts and play R.U.R.	Czech Republic
1939	The Atanasoff–Berry Computer (ABC), the first automatic electronic digital computer, was built.	USA	
1950	Alan Turing developed the Turing Test to determine whether or not a computer can think like a human being.	USA	

Time (BCE)	Events – Philosophers, Logicians, Mathematicians	Events - Storytellers	Country
<i>1956 – 1980: The initial phase</i>			
1956	John McCarthy UK coined the term artificial intelligence.		
1957		The Invisible Boy, an American science fiction film from Metro-Goldwyn	USA
1958	John McCarthy UK developed LISP, a programming language for artificial intelligence research.		
1963	Charles Rosen USA proposes combined pattern recognition and memory capabilities of neural networks.		
1964-1966	Woodrow Bledsoe, Charles Bisson and Helen Chan's significant research on facial recognition		
1965	Joseph Weizenbaum USA developed ELIZA, a computer that could converse in English.		
1968	Terry Winograd USA wrote SHRDLU, a programme to assist in understanding natural language.	Stanley Kubrick's film 2001: A Space Odyssey was released.	USA
1969	William A. Woods designed a natural-language front end called LUNAR.		
1970	WABOT-1, the first anthropomorphic robot, was built at Waseda University, Japan.		
1970	Larry Roberts and Cordell Green initiate research into computer speech recognition.		
1977	Johan de Kleer, when he wrote a programme called NEWTON	George Lucas' film Star Wars is released.	USA
1979		Ridley Scott's science-fiction	USA

Time (BCE)	Events – Philosophers, Logicians, Mathematicians	Events - Storytellers	Country
		horror/action media franchise releases the first Alien film	
1979		Douglas Adams' novel The Hitchhiker's Guide to the Galaxy is released.	UK
<i>1980 – 2000: The industrial phase</i>			
1982		Ridley Scott releases his first Blade Runner science fiction film.	USA
1983		Director John Badham releases the science fiction techno-thriller film WarGames	USA
1984	Warning of an AI winter	USA	James Cameron's futuristic action-thriller Terminator franchise was released
Mid-1980s	George A. Miller began the WordNet project	USA	
1987		Data, a fictional Star Trek franchise character, appears on screen for the first time.	USA
1993	Olivier Faugeras' neural network research of three-dimensional vision and motion	USA	
1997	Deep blue defeats the world chess champion	USA	
1999		The Matrix is an American media franchise created by writers-directors the Wachowskis and producer Joel Silver, comes to the big screen	USA

Time (BCE)	Events – Philosophers, Logicians, Mathematicians	Events - Storytellers	Country
<i>2000 to the present: The explosive phase</i>			
1992-2006		Vernor Steffen Vinge’s literary competencies were acknowledged with the honour of winning the Hugo Award for his novels and novellas.	USA
2008		JARVIS appears in the Iron Man franchise	USA
2011	IBM’s Watson defeats US Jeopardy champion		USA
2011-2014	Virtual assistants Siri, Google Now, Cortana and Alexis developed		USA
2014		Ex Machina, written and directed by Alex Garland, is released	UK & USA
2015		Chappie, directed by Neill Blomkamp, is released.	USA
2016	AlphaGo beats Lee Sedol 4-1		USA

Note: Adapted from Artificial intelligence: A survey on evolution, models, applications and future trends. (pp. 10), by L. Yang, 2019, Taylor & Francis. 2019 by Taylor & Francis

Overall, the above tables illustrate how AI has evolved and developed. The following discussion elaborates on these aeons, beginning with the BCE – 1950s.

In the beginning into illumination: Before Christ Era (BCE) - 1950s

Many of the theories and notions that have inspired the advancement of AI have their roots in the ancient Greek thinkers. We examine some of the major philosophies that have influenced artificial intelligence.

Storytellers and philosophers

Throughout history, social norms or shared standards of acceptable behaviour by groups have been mirrored in the literary prose of the day. Science fiction, the genre of speculative fiction, has typically been the category that deals with AI within the creations of storytellers and philosophers. The imaginative and futuristic concepts, such as advanced science and technology, provided a broad scope enabling the storyteller to explore the unknown. The ancient Greek storytellers, displaying their beliefs of their state's well-known influence, social class hubris, and an individual's use of others (Gramsci, 1971), told myths and legends about the relationships between human and non-human-kin. Homer is the presumed author of the *Odyssey* and the *Iliad*, two hugely influential epic poems of ancient Greece. In the 8th century BCE, Homer writes in the *Odyssey* of pilotless ships and the *Iliad* of mechanical tripods waiting on the gods at dinner (Homer et al., 1962).

Also, the story of Talos, which Hesiod, one of the earliest Greek poets, often called the father of Greek didactic poetry, offers one of the earliest conceptions of a robot around 700 BCE. The poem describes Talos as a giant bronze man that Hephaestus, the Greek god of invention and blacksmithing, built. Zeus, the king of Greek gods, commissioned Talos to protect the island of Crete from invaders. Talos would march around the island thrice daily and hurl boulders at approaching enemy ships (Mayor, 2020). The myth of Pandora is another example of a mythical artificial being. However, many later versions of the story portray Pandora as an innocent woman who unknowingly opened a box of evil. Mayor (2020) commented that Hesiod's original description described Pandora as an artificial, evil woman. What is particularly interesting about these narratives is how the Greek storytellers exemplify the relationships between human-kin and machines.

Furthermore, Aristotle displays his hegemonic propensities when he writes about making slavery necessary if people were to enjoy leisure (Aristotle & Sinclair, 1981; Engle, 2008). Cultural imperialism is the term used to describe Aristotle's hegemonic tendencies, where either an internal, sponsored government or an externally placed

government controls the internal politics and social makeup of the subordinate states that comprise the hegemonic sphere of influence (Gramsci, 1971). These classical philosophies may be loosely defined as beliefs, assumptions, analyses of experience, and the intellectual edifice erected upon them via Ancient Greek philosophers (Nilsson, 2010).

Thales is considered the first Western philosopher through his stoic advocates and sceptics, who each responded critically to the stoic's proposals¹². Consequently, ancient Greek philosophy experienced the forging of a new way of thinking that is still evident in today's Western intellectual ideologies. We find the blueprint of the scientific explanation of the natural world by the pre-socratic philosophers or Milesian thinkers and Democritus, who believe that everything is composed of atoms. Hence, it is Socrates who presents the ethical question of what describes human living and what is best for the life of human-kin. Plato is considered one of the most influential individuals in human history. He was pivotal in Ancient Greek and Western philosophy. In addition, one of the most prolific ancient authors, Plato's student, Aristotle, writes of his investigations into the natural world. From these historic beginnings, the Hellenists, Epicurus, the Cynics, the Stoics, and the Sceptics developed schools or movements devoted to distinct philosophical lifestyles, each with reason at its foundation. More importantly, over time, Greek literaries and philosophers have dreamed and thought about machines and robots that enhanced human-kin's daily lives. These dreamers and thinkers opened the doors to consider a Western preference for the reason of life and rational thought. So, from these dreamers came the quest for AI (Nilsson, 2010).

The link between Greek theory and today's AI is not too difficult to discern (Cavarero & Bucci, 2017; Hauer, 2021; Koons, 2018; Nilsson, 2010; Reiter, 2020; Striker, 2009). For example, Aristotle's theory of syllogism or major premise characterises an argument consisting of three suggestions, two of which signal the foundation of thought and the third a conclusion that follows logically from the first two ideas.

¹² Stoicism is a philosophy that originated in ancient Greece and emphasizes self-control, rationality, and detachment from material possessions and external events.

1. *All humans are mortal.* (stated)
2. *All Greeks are humans.* (stated)
3. *All Greeks are mortal.* (result)

Here, importantly for AI, Aristotle's contribution is linked to the form of syllogism. If we rewrite the syllogism replacing *humans*, *Greeks* and *mortal* with random symbols like this:

1. *All Bs are As.* (stated)
2. *All Cs are Bs.* (stated)
3. *All Cs are As.* (result)

We can substitute anything for *A*, *B* and *C*. For example, *all vegetables are healthy*, and *all cruciferous are vegetables*. Therefore, *all cruciferous are healthy*, and so on, remembering that the result will not be true unless the things stated are true. Aristotle's theory of syllogism is regarded as a key tool for logical reasoning and has had an impact on disciplines including philosophy, mathematics, and computer technology. Furthermore, as we journey forward, we can see that the theory of syllogism and the thoughts of many Greek philosophers have impacted and primarily influenced future philosophers, logicians and mathematicians.

The synergy between literary writers and philosophical theorists has continued through the millennia and appears in tangible ways. For instance, fictional automata featured in past literature have transitioned into the theatre and eventually progressed into big-screen films. The plot devices (for example, storyline, scenery, props, characters etc.) of these mediums paralleled the human-like intelligence notions studied by the theorists, inventors and engineers of the time. At the same time, the forebearers investigated mathematical logic, and literary authors discussed the themes of utopia, emphasising the potential benefits, and dystopia, highlighting the dangers.

From the minds of Gottfried Leibniz (1646-1716), (Mitropol'skii & Lykova, 1967), George Boole (1815-1864) (Taylor, 1954) and Friedrich Ludwig Gottlob Frege (1848-

1925) (Kolman, 2000), who are philosophers, logicians and mathematicians, came the theories of mathematical logic, which was fundamental to the design of digital computer circuitry (Englebretsen, 1982; Nambiar, 2000; Nilsson, 2010; Robering, 2014; Vilkkio & Hintikka, 2006). Other notable literary figures include Edmund Spenser (1552-1599), an English poet and author of *The Faery Queene*, who sees Talus emanated, an artificial iron-made squire who travels with Arthegal to assist in the illimitation of falsehood; Johnathon Swift (1667-1745)) who told the story of a navigating device called the engine, one of the earliest references to modern-day technology; L. Frank Baum (1856-1919) created Tik-Tok, a fictional prototype robot; and Karel Čapek (1890-1938) initiated the scientific drama *R.U.R.* a story of robot revolt where he introduced the word robot to the world (Baum, 1919; Čapek, 2004; Madigan, 2012; Swift, 1762). During this time, the science writer Isaac Asimov became disillusioned that automata tended to be destructive. He devised a set of rules called the Three Laws of Robotics to remedy this. Asimov introduced the Laws in his 1942 short story *Runaround, I, Robot*. The Three Laws, quoted from the *Handbook of Robotics*, 56th Edition, 2058 AD (Asimov, 1950), are:

“Law One: A robot may not injure a human being or, through inaction, allow a human being to come to harm.

Law Two: A robot must obey the orders given by human beings except where such orders would conflict with the First Law.

Law Three: A robot must protect its existence as long as such protection does not conflict with the First or Second Laws.” (p 40)

People have dreamed of machines with human abilities since time immemorial, and these machines continue to be described in many stories and pictured in sculptures, paintings, and drawings. These three laws are more commonly associated with the 2004 science fiction action movie *I Robot*, adapted and written for screenplay by Jeff Vintar and Akiva Goldsman.

AI has been significantly influenced by the theories and notions put forwards by the ancient Greek philosophers. The development of AI has been influenced by the work of philosophers, logicians, and mathematicians, who have also contributed significant theoretical frameworks and concepts.

Inventors and engineers

The prominence of self-operated machines dates back to when ancient civilisations first observed astronomical bodies as they moved across the sky. Timekeeping devices were used to warn a person to strike the monastery bell. The action of a verge and foliot controlled weight-driven mechanical clocks. In contemporary times, one of the most notable tourist attractions is the bell-striking clock in Marienplatz' Rathaus-Glockenspiel in the heart of Munich, Germany. This historical monument presents another example of automata, where self-operated machines, inventors and engineers began their pursuit to automate puppets resembling moving humans or animals, built to impress and entertain people.

Leonardo da Vinci drew plans for a humanoid robot in the form of a medieval knight. Da Vinci's mechanical knight or robot was a humanoid automaton designed and possibly constructed around 1495. It was contentious whether da Vinci had built his machine, however, according to da Vinci's design notes, which were rediscovered in the 1950s, da Vinci said that Ludovico Sforza had displayed his machine at the court of Milan in 1495 (Moran, 2006). The robot knight clad in German-Italian medieval armour could make several human-like motions, including sitting and standing, moving its arms, and raising its visor, with a series of pulleys and cables that operated the entire robotic system. The robot has since been rebuilt, following the design notes of da Vinci and is fully working (Rosheim, 2006).

Jacques de Vaucanson was a French inventor and artist responsible for creating impressive and innovative automata. De Vaucanson was the first to design an automatic loom and build the first all-metal lathe. Maybe the most sophisticated de Vaucanson automata was the Canard Digérateur or Digesting Duck. In 1739, de Vaucanson displayed his masterpiece, which simulated many aspects of a duck,

including flapping its wings, quacking, paddling, drinking water, and eating and digesting grain.

The new and innovative ideas created and recreated across time reflect the human brain's ability for expression. The examples highlighted above demonstrate people's ongoing impulse to identify metaphorical concepts and reimagine them in tangible ways, making the timeless link between the imagined unknown and science evident.

The development of programming languages, early computing machine design, and the development of ground-breaking AI systems have all been accomplished by inventors and engineers. Their efforts have paved the way for the advancement of contemporary AI technology and contributed to establish the area of AI as a distinct science.

The amazing brain

Each of our brain's 100 billion active neurons is a virtual computer. Each neuron, in turn, transmits its messages around the brain and the body along major pathways known as axons. Each axon is covered in a myelin sheath, insulation that enables faster messaging. These brain parts are glued together by 900 billion glial cells creating a unique computer the world has ever known. Knowledge of the activity of these neurons helps us identify the brain's activities, such as perception and thinking (Dryden & Vos, 1997). Hence, the basis of human psychology is the research of what stems from the network of neurons in the human brain.

Further attempts to make psychology more scientific and less dependent on subjective introspection have been made by several psychologists, most famously B. F. Skinner (1904-1990). Skinner concentrated solely on what could be objectively measured, specific behaviour reacting to particular stimuli. Skinner saw human action as dependent on the consequences of previous efforts. In short, if the action is bad, the action is not likely to be repeated. If the action is positive, then repetition of the action is more likely (Schacter et al., 2011). His contribution is often seen as applying the principle of reinforcement (Malone, 1975). Noam Chomsky, an American theoretical linguist, and his team, including David Marr, a neuroscientist and colleague from

Massachusetts Institute of Technology (MIT), looked to overthrow the then-dominant paradigm of behaviourism that Harvard psychologist Skinner was championing. Chomsky and Marr accentuated internal systems enabling behaviour rather than external experiences of the past facilitating the behaviour. Overall, Chomsky and Marr's approach to uncovering the internal operations of human behaviour has been foundational and is similar to the work of computer scientists to unravel the inner working of software that executes computer operations (Katz & Gonzalez, 2016).

The logical computing machine

Although research into artificial neural networks did not begin until 1943, Western contemporaries continued to muse about mechanical techniques, calculating machines, and numeral systems that all eventually led to the concept of mechanised human thought in non-human beings. French philosopher, mathematician, and scientist René Descartes (1569-1650) laid the foundations for the beginnings of Cartesian Dualism, a position that argues that there are two kinds of foundation, mental and physical. Descartes is primarily responsible for the increased attention given to epistemology in the 17th century (Russell, 2013; Scott, 2016). In contrast to the English moral and political philosophy, and also during the 17th century Thomas Hobbes argued against Descartes's dualism in favour of materialism, a propensity to prioritise worldly goods and comfort more than spiritual principles (Lloyd, 2009).

In France, Blaise Pascal, a mathematician, physicist, inventor, writer and Catholic theologian, devised a machine to calculate addition and subtraction equations for his father, a tax collector, in 1642 (Rojas-Sola et al., 2021). In Britain, Charles Babbage was working on a calculating machine commissioned by the British government called the Difference Engine. However, he imagined improving it, which came primarily from how it worked to perform other calculations. After the Difference Engine project in 1833, Babbage designed a machine to perform general-purpose computing. By 1847, it had partially built the Analytical Engine, often referred to as the first computer (Lovelace, 1842). During its construction, history records that Ada Lovelace, a mathematician, translated a French article about the Analytical Engine in 1843. The calculation of Bernoulli numbers was also found in Lovelace's notes, this providing

evidence that Ada Lovelace is widely considered the first computer programmer (Lovelace, 1842).

In the 20th century, the Atanasoff-Berry Computer (ABC) was an early automatic electronic digital computer. The two designers' initials were used to name the machine. The first was John Vincent Atanasoff, a mathematics and physics professor, and the second was a graduate student, Clifford Berry. Working out of Iowa State College during the late 1930s the ABC was designed to solve linear equations and was tested successfully in 1942. Its intermediate result storage mechanism, a paper card writer/reader, was not pre-initial phase perfected. However, its progress was stalled somewhat when in the early stages of World War II, Atanasoff left Iowa State College to join the war efforts, and the ABC project was discontinued (Atanasoff, 1984). Regardless of its discontinuations, the ABC pioneered essential elements of modern computing, including binary arithmetic and electronic switching elements. Its special-purpose nature and lack of a changeable, stored programme distinguish it from modern computers.

More towards the end of this aeon, Warren McCulloch, an American neurophysiologist and cybernetician and Walter Pitts, a logician, had begun to develop artificial neural networks in 1943. McCulloch and Pitts created a computational model for neural networks based on threshold logic algorithms that drew parallels between the human brain and computing machines (Piccinini, 2004). In short, their research focused on biological processes and the operation of neural networks in artificial intelligence (McCulloch & Pitts, 1943). This initial work in artificial neural networks has been critical in laying the foundations for NLP, associating linguistics, computer science, and artificial intelligence, and setting up today's research into how computers can process and analyse vast amounts of language data.

Artificial Intelligence finds its primary objective in emulating human neurological functions, mimicking how rational human cognitive thinking occurs. The complexity and range of the AI fields are increasing at an accelerating rate today. Contextual cues provide opportunities for machines to imitate human thought. In Natural Language

Processing (NLP), machine platforms take small steps to communicate with human-like functionality.

The development of AI has been significantly influenced by the ancient Greek thinkers and the philosophers, logicians and mathematicians within the extensive era coined the beginning into illumination. The philosophical underpinnings of AI were influenced by their theories on logic, universals, causality, epistemology, and ontology, which still serve as an inspiration to researchers in the field.

The historical journey of artificial intelligence (AI) continues into the 1950s. The next section explores further the idea of creating machines that could think and learn like humans.

The initial phase: 1956-1980

The development of AI has been influenced by various factors and events on a global scale, including technological advancements, economic and political contexts, and cultural and social changes. The above discussions illustrated a timeline from the BCE era to the 1950s, the workaround mimicking human thinking. These influencers have impacted creative works. Within it, the various creative works described have been influenced by contemporary philosophers, inventors, engineers, logicians and mathematicians in dynamic ways discussed below. The invention of moving pictures saw the continuation of a platform to create or support an idea that people could inject new ideas into the viewer's mind's eye, such as machines capable of demonstrating artificial intelligence. Take, for example, the 1957 movie *The Invisible Boy*, released as a black and white science fiction film from Metro-Goldwyn, which saw the theme of AI rebellion, similar to Karel Čapek's play *RUR* (Madigan, 2012). The choice of utopia, emphasising the potential benefits or dystopia, emphasising the dangerous scenarios for AI science fiction movies, changed the wills of the movie moguls due to highly successful box office turnovers (Booker, 1994; Poole et al., 1998). Also, in 1968, in Stanley Kubrick's *2001: A Space Odyssey*, we were presented with an imposing black structure that connects the past and the future in an enigmatic adaptation of a short story by revered sci-fi author Arthur C. Clarke.

Additionally, the missions of the United States Spacecraft Discovery One crew are mysterious, which *HAL 9000* depicts. In this movie, the artificially intelligent onboard computer lethally malfunctions on a space mission and kills the entire crew except for the spaceship's commander, who manages to deactivate it. Another film director well-known for their depiction of AI science fiction films is Ridley Scott, whose AI science fiction has played out significantly in *Blade Runner* and the *Alien* film franchises (Barkman et al., 2013). The *Alien* franchise portrays an intelligent control system, which the crew call Mother, of the spaceship *Nostromo* and a set of perfect artificial persons treated as human equals. This notion is called Human dominance, where machines are designed to be submissive, as in Asimov's works, however, some argue that this could be perceived as an environment that depicts humans merging with machines (Barkman et al., 2013). Essentially, this is yet another rebellious AI film which challenges the viewer to reflect on the evolution of AI R&D (Overbye, 2018). Looking back at the literary forebearers provides a glimpse into the pen's ability, a powerful instrument providing a voice for past, present and future philosophers, mathematicians and scientists

Gatherings

Driving the cinematic theme of machines demonstrating AI traits was a generation of philosophers, mathematicians, and scientists who culturally assimilated the AI concept in their minds. The Englishman Alan Turing wrote a programme for playing chess in the early 1950s. The benchmark in machine intelligence has been playing the game of chess. Artificial intelligence-based learning capabilities became formidable foes in the game of chess. Also, artificial intelligence-based learning capabilities became essential assistants in business and robotics.

The genesis of AI discussion was signalled when Turing compiled his seminal research in *Computing Machinery and Intelligence* (Turing & Haugeland, 1950). The early 1950s were also marked by the assembling of a number of these young and promising computer and cognitive scientists, including John McCarthy and Marvin Minsky, who were concerned mainly with the research of artificial intelligence. In 1956, these men participated in the Dartmouth Summer Research Project on Artificial Intelligence Conference, which studied and explored the use of machine simulation

intelligence at Dartmouth University, United States. In McCarthy's conference proposal, he stated that the conference was "to proceed based on the conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it" (McCarthy et al., 2006, pp. 12, para. 12). Hence, the Dartmouth conference is now recognised as the origin of AI (Nilsson, 2010). Also, this period represents a dominant paradigm of AI research from the mid-1950s until the late 1980s, which saw AI solving algebraic application problems, proving geometric theorems, and learning English (Haugeland, 1989; Yang, 2019).

Puzzling

As characterised by Haugeland (1989) and Yang (2019), AI was only used for simple problem-solving, computations and simple tasks. The problem-solving function is underpinned by the identification techniques that hone a person's puzzle and game skills (Nilsson, 2010). Puzzling literature identified during this period included the puzzle books by the British puzzle inventor Henry Dudeney and Martin Gardner, who also edited a puzzle column in the American monthly magazine *Scientific American*. Several puzzles appeared in *Scientific American*, including the 15 Puzzle, a sliding puzzle with 15 square tiles numbered 1-15 in a frame four tiles high and four tiles wide, leaving one unoccupied tile position. Another, called the Tower of Hanoi, is a mathematical puzzle consisting of three rods and several disks of varying sizes, which can be placed on any rod. Solving puzzle problems manifested whether problem-solving algebraic programmes could solve real-life problems. For example, the Advice Taker was a system that found solutions by adding or removing axioms from a large set of assumptions representing the problem-solvers knowledge base (McCarthy, 1960). A further real-life solution application used the travelling salesperson problem of a salesperson wanting to visit a list of cities, visiting each city only once. Here, the Advice Taker would assist with the following query - In what order should the salesperson visit the cities enabling the salesperson to end in the city where the journey started? (Shapiro, 1966).

As alluded to in the passages above, in 1950, Alan Turing developed a method of inquiry in artificial intelligence. As it is famously called, the Turing Test helped

establish whether a computer could think like a human (Saygin et al., 2000). Turing proposed that a computer can possess artificial intelligence if it can mimic human responses under specific conditions. Initially, three physically separated computer terminals were required to run the Test. The first terminal is worked by a computer, while humans run the other two. One human was designated the questioner, and the second functioned as the respondent in conjunction with the computer. The questioner interrogates the respondents within a specific subject area using a specified format and context. After a pre-set length, the questioner is asked to decide which respondent is a human or a computer. The Test is repeated many times. In this scenario, if the questioner makes the correct determination in half of the test runs or less, the computer is considered artificial intelligence as the questioner regards it as "just as human" as the human respondent.

Interestingly, ELIZA, developed at the MIT Artificial Intelligence Laboratory in 1965 by Joseph Weizenbaum (Ireland, 2012), was an interactive computer programme that could converse in English with a person and outsmart the Turing Test. ELIZA was created to demonstrate the shallowness of communication between humans and machines. However, Weizenbaum discovered that many people displayed human-like characteristics to ELIZA. ELIZA simulated conversation by matching and substituting patterns of speech that gave the impression of understanding but had no framework for contextualising the event.

Neural networks

McCulloch and Pitts' research in the 1940s and 1950s around neural networks, particularly their biological study, provided opportunities for detecting edges of objects and sorting simple objects into categories. This period saw the first use of *computer vision* and AI R&D that trained computers in a field of AI which taught computers to understand the visual world. Digital image machines accurately identify and classify objects using a camera, video and deep learning models. Yet, processing visual images via the human brain still required further investigation, which neurophysiologists David Hubel and Torsten Wiesel focused on in their research. They performed a series of experiments, beginning around 1958, which showed that specific neurons in the mammalian visual cortex responded selectively to images and parts of

particular shapes (Nilsson, 2010). In the early 1960s, significant research around computerised neural visual networks had mainly gone unrecognised. However, Woodrow Bledsoe examined this more in-depth at his Palo Alto company alongside Charles Bisson and Helen Chan (Magdin & Prikler, 2017). During this time, these pioneers, or spies, developed techniques for face recognition supported by projects from the CIA. It is also important to note that when Bledsoe, Bisson and Chan were researching facial recognition technology, it was more innocent in that ethical implications had yet to be identified. Moreover, the history of facial recognition has always been shrouded with a dark cloak of covert control (Nilsson, 2010).

Computer vision

Much work in this short period was completed around computer vision, especially the ability to sharpen the image of objects. Here, Faugeras (1993) addressed many three-dimensional vision and motion issues, including projective geometry, camera calibration, edge detection, stereo vision, 3-D rotations and object representation and recognition.

Even though storytellers during the early 1900s visioned human-assisting machines, very little work had been done on mobile robots. A leader in neural network research, Charles Rosen wrote a memo at the Stanford Research Institute (SRI) in November 1963. He proposed the development of mobile automatons that would combine the pattern recognition and memory capabilities of neural networks but with higher-level AI programmes. The Department of Advanced Research Projects Agency (DARPA), an arm of the US Department of Defence (DoD), entered the conversation, outlining various goals, including the development of automatons:

- With capabilities of gathering information in hostile environments.
- To accomplish non-trivial missions in a natural environment.
- To accomplish non-trivial missions in a natural environment in a self-contained mode.

Like the CIA-supported facial recognition programme, the AI R&D of mobile automata went covert (Nilsson, 2010).

Robots

In their laboratory at Waseda University in Japan, Professor Kato and students initiated scientific research on humanoid and anthropomorphic robots during the 1960s. Kato and his students developed a hydraulically powered one-leg mechanism in 1966 to help map human leg motion during walking. Kato built two walking robots to mimic the human walk, one a hydraulically powered robot that simulated static leg swing and standing and sitting motion. The second robot was powered by pneumatic systems that replicated static walking. He and three other professors then collaborated to develop a humanoid robot WABOT-1, the WAseda roBOT, in 1970 (Takanishi, 2018).

Natural language processing (NLP)

Translating material and understanding human and computer languages fall into the research of NLP. During the 1950s and 1960s of AI-related research, some good beginnings were made on NLP problems. In the subsequent periods of the 1970s into the early 1980s, new work was built on these foundations. For example, SHRDLU¹³ was a programme created to assist in understanding natural language. Terry Winograd wrote the MIT Artificial Intelligence Laboratory programme in 1968-70. SHRDLU carried a simple dialogue via a teletype, with a user moving small red blocks with a gripping extension arm. Commands typed in ordinary English could be given to SHRDLU, which provided instructions. By typing commands in English, SHRDLU could then manoeuvre blocks with grippers (Winograd, 1980). Also, Winograd used MacLISP programming language, which has its genes from John McCarthy's programming language LISP, developed during McCarthy's artificial intelligence research in 1958.

LUNAR

“The eagle has landed” echoed worldwide on 24 July 1969 as Apollo 11 landed the first humans on the Moon. Commander Neil Armstrong and lunar module pilot Buzz Aldrin formed the American crew that landed the Apollo Lunar Module Eagle, while Michael Collins remained alone in Columbia. On Apollo 11's return, NASA asked

¹³ The English letter frequency order is ETAOINSHRDLU, which is represented as 1 SHRUDLU. Because of this, the keys on Linotype typesetting machines were not arranged in a QUERTY fashion but rather in frequency-ordered columns, with ETAOIN being the first column (reading downward), SHRDLU the second, etc.

William C. Woods, a young computer scientist at Bolt Beranek and Newman (BBN) in Cambridge, Massachusetts, about the possibility of designing a natural-language front-end interface that would enable databases to be searched in English and not in computer code. Until this point, much of NASA's information had been collected from previous space missions and stored in databases accessible by scientists. Woods was a Principal Scientist and manager of the Artificial Intelligence Department in the '70s and early '80s. His natural language processing and knowledge provided NASA with a tool that allowed access to the databases with a verbal enquiry instead of a traditional arcane computer code. Woods had also just completed his Harvard PhD in question-answering systems (Woods, 1967).

The AI winter

AI research up and into the early 1970s was focused on solving puzzles and games in controlled laboratory settings. However, the mid-1970s experienced a direction change in AI-related development, and research in application work facing real-world problems emerged. Successful research in NLP, expert systems, and computer vision was being seen. The DoD was a significant sponsor of AI R&D of application and specialisation. Joining the long list of newly created academic and basic research institutes to support the DoD effort were the University of Southern California, the Information Sciences Institute, and the Universities of Toronto, Rochester, Texas, Maryland, British Columbia, California, and Washington (Nilsson, 2010).

Although increased AI R&D occurred under the support of the DoD, a significant decrease in public funding, a drop in motivation in the private sector and reduced funding and interest in artificial intelligence research were noticed. At this time, Roger Schank, an AI theorist, Marvin Minsky, a cognitive scientist, and other Association for the Advancement of Artificial Intelligence members warned of the AI winter. The term was coined by analogy to the idea of a nuclear winter (Nilsson, 2010).

Speech recognition

Adding to the NLP functionalities of text input data transmutes to speech input data. For instance, the first issue needing attention is recognising an isolated word within the processing of a continuous speech stream, a further problem must be addressed in speech recognition and speech understanding. The sounds of vowels and consonants

are represented by phones, and the English language comprises around 40 phones. A phone has unique alphabets, and the International Phonetic Alphabet (IPA) is the database that contains all known languages. ARPAbet is another database holding the American English language, developed by research sponsored by DARPA. Bell Laboratories led the study during the 1930s where they made significant contributions for the next three decades, including identifying the numbers between zero and nine uttered by a single speaker (Davis et al., 1952). Also, during the 1950s and 1960s, further work around speech recognition was conducted at MIT, Japan, England, the Soviet Union, and RCA Laboratories (Juang & Rabiner, 2005). During the 1970s, DoD AI-related specialists became interested in building systems recognising speech. The then Chief of Scientists, Larry Roberts, was assigned to the Information Processing Techniques Office (IPTO) to fund and monitor AI research projects. Cordell Green, a lieutenant in the U.S. Army, was appointed to the IPTO under Roberts. Green organised a meeting in March 1970 of DARPA contractors from Systems Development Corporation (SDC), MIT - Lincoln Laboratory, Carnegie Institute of Technology (CMU), SRI, and BBN to discuss the concept of a computer understanding speech.

A study group was formed from this meeting to assess state of the art and recommend launching a major DARPA-supported speech understanding project. In 1971, Roberts headed a five-year Speech Understanding Research (SUR) programme, funded based mainly on the study group's report. After the programme, CMU developed HAPPY and HEARSAY II and began work on a speech understanding system called DRAGON. BBN produced HWIM, an acronym for *Hear What I Mean*. SRI and SDC formed a partnership where SDC developed the acoustic processing components, and SRI developed the analysing and semantic elements. Developing this neuro-language-processing (NLP) functionalities has a significant bearing on the rejuvenation of te reo Māori in Aotearoa. NLP functionalities will be discussed in Section 3 of this chapter.

The storytellers of the time

In 1979, Douglas Adams' novel *The Hitchhiker's Guide to the Galaxy* (Adams, 1995) introduced the reader to Deep Thought, a computer created to come up with the answer to the ultimate question of life, the universe, and everything, and the Paranoid Android

called Marvin, a ship's robot aboard the starship Heart of Gold. The plot of *The Hitchhiker's Guide* centres on permanently bemused human protagonist Arthur Dent, who wanders the Universe after the destruction of Earth with an alien travel writer named Ford Prefect and a crew of oddities, including two-headed galactic president Zaphod Beeblebrox, Trillian, an astrophysicist and Marvin the android. *The Hitchhiker's Guide* made it to the cinema screen in 2004.

The era referred to as the Initial phase saw substantial contributions to the creation of AI from the contemporary philosophers, innovators, engineers, logicians, and mathematicians. Their work established the groundwork for the advancement of contemporary AI technology as well as contributed to establish AI as a separate field of research (Nilsson, 2010).

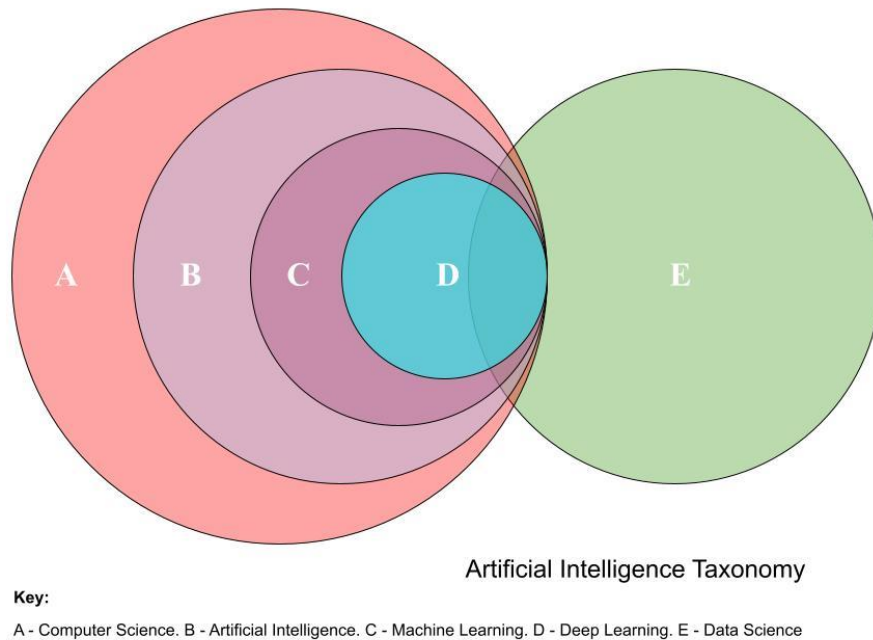
The industrial phase: 1980s – 2000s

Overall, AI experienced increased popularity and commercial successes throughout this period, but with a degree of suffering from funding cuts and a wintry season. However, AI's basic research produced many powerful new technical tools and sharpened others. New results unfolded in its subfields, including reasoning and representation, machine learning, natural language processing, and computer vision (Nilsson, 2010).

Artificial intelligence taxonomy

The 1980s saw several noteworthy projects which produced new technologies and improving existing tools. Consequently, new results unfolded in all the computer science subfields.

Figure 0.1: Artificial Intelligence Taxonomy



Note. Adapted from Elements of AI, Introduction to AI by University of Helsinki (2021), Elements of AI, Related fields (<https://course.elementsofai.com/1/2>)

The Euler diagram, Figure 2.1, places AI in the computer sciences field, yet the concept of AI sits in multiple academic areas, from the arts to music to statistics. Western science identifies the taxonomy of AI, which can be highlighted in the diagram above, plus these connections to AI are evident. It should also be noted that AI, a subfield of Computer Science, is an umbrella term now often used to refer to machine learning and deep learning. Each categorisation is connected with data science. Data science is an interdisciplinary field that applies information from data across various application fields, including Computer Science, AI, Machine Learning and Deep Learning, by using scientific methods, procedures, algorithms, and systems to infer knowledge and insights from noisy, structured, and unstructured data (MinnaLearn, n.d.). The following discussion highlights each element noted in the artificial intelligence taxonomy.

Computer Science is the study of computers and algorithmic processes and it first appeared in a 1959 article in the monthly *Communications of the Association for Computing Machinery* (ACM) journal where the article argued for developing a

Graduate School in Computer Sciences (Fien, 1959). A wide range of computer-related topics are covered in computer science, including the studies of algorithms, computation of numbers, manipulation of information and the implementation of computer hard and soft wares (Harel & Feldman, 2004). For example, computer science can be divided into academic and applied disciplines. First, the theory of computation concerns how algorithms can solve problems and how efficiently they can be solved. Second, computer graphics involves the practical development of the software, hardware, and algorithms necessary to create drawings. The study of algorithms and data structures is required to achieve geometric computation. Algorithms and data structures are at the core of computer science (Harel & Feldman, 2004). Algorithms comprise programming language theory or theories of computational processes and computer programming, which involves creating complex systems. Data structures are described as the construction of computer components and computer-operated equipment.

Interestingly, the name Computer Science suggests the study of computers themselves, however, a significant amount of computer science does not involve this. Hence, over time, alternative names have been proposed, including Datalogy, offered by the Danish scientist Peter Naur (Naur, 1966). Another alternative term, also proposed by Naur, was *Data Science*. This term is now used for an interdisciplinary field that extracts knowledge from data and creates insights across various applications.

As outlined in previous sections of this chapter, artificial intelligence refers to the simulation of human intelligence in machines that are programmed to process algorithms designed for decision-making, problem-solving, environmental adaptation, planning and learning found in humans.

AI innovations can be classified into two concepts, Machine Learning and Deep Learning (MinnaLearn, n.d.). Machine learning is an application of AI where algorithms examine data, learn from the data and then apply the learning to make a decision. John McCarthy originated the conversation that knowledge should be encoded as logical statements (Nilsson, 2010). The development of these logistics or, more specifically, the design of logical languages as a method of reasoning was

prominent during this phase and within the subfield of machine learning. Here, the monotonic machine-learning rationale was one of the initial logics to be explored. Monotonic provides a single conclusion. This conclusion will remain the same no matter how much further information is added to the existing information in the knowledge base. However, if mimicking human behaviour is the objective of machine learning, human reasoning does not usually work this way, in fact, human reason often jumps to conclusions using the points we have on hand at that time, and when new knowledge arrives, we can usually change our reasoning to be quite contradictory to the original rationale. This logic is called nonmonotonic or defeasible, which means to be capable of declaring null and void, as the new knowledge may require us to take back something that had been concluded beforehand (Nilsson, 2010). Nonmonotonic reasoning systems included Carl Hewitt's proposed problem-solving language PLANNER and the SRI planning system, STRIPS. These developments in logistics are foundational in continued research around reasoning in the subfields of machine and deep learning (MinnaLearn, n.d.).

AI researchers continued to propose new reasoning solutions throughout the 1980s. MIT student Johan de Kleer led research into qualitative reasoning when he wrote a programme called NEWTON for his master's thesis in 1975 (Kleer, 1975). This thesis continued to look at the vocabulary, which was thought to provide the best return for machine learning (Roschelle & Teasley, 1995). Additionally, Professor George A. Miller proposed an extensive virtual dictionary of English words called WordNet, and this work had its beginnings at Princeton University (Nilsson, 2010). Research around the classification of problems is called constraint satisfaction problems or assignment problems, and methods for solving them aided in the advancement of reasoning methods. Constraints can be expressed in database relations, logical formulas, equations, or inequalities (Kumar, 1992).

Furthermore, the programming of propositional logic, also known as sentential and statement logic, was a significant development in logic as none of the logical formulas contained variables. Martin Davis and Hilary Putnam initially researched systemic methods of logic. They proposed the creation of the DPLL algorithms that searched trees of possible ways to assign truth values (Davis & Putnam, 1960). Also, the

evolution of question-answering systems typically sees the conversion into computationally manageable forms used to query a computer database. Familiar examples of question-answering systems are World Wide Web search engines. (Salton et al., 1975).

From the 1980s to the 2000s, we began to see the vital role of data and machine learning techniques in distilling and using data during this period. With the large amounts of data came the development of deep learning, a subset of machine learning where algorithms repeatedly performed tasks and gradually improved outcomes, thanks to deep layers that enabled progressive learning (Nilsson, 2010). Machine learning is essentially about computers thinking and acting with less human intervention, and deep learning is about computers learning to think using structures modelled on the human brain. If one single theme links the various approaches to AI, it can be identified by the need of massive amounts of data. Whether this concerns simple puzzles or real-world problems, all require real-world data.

The above-discussed logics are techniques often simply touted as Weak or, more appropriately called, Narrow AI, as the trained AI focuses on performing a specific task (Nilsson, 2010). Narrow is a more precise word for this type of AI, as performing a particular task is anything but weak. Still, AI enables very robust applications, such as those highlighted in the above examples. Strong AI or Artificial General Intelligence (AGI) aims to create utopian intelligent machines indistinguishable from the human mind at the other end of the spectrum (Bjola, 2022). Also, the technological singularity often referred to as simply *singularity*, is a hypothesised time period when technological development will accelerate dramatically and become unstoppable, bringing about unexpected changes to human civilisation (Vinge, 1993). According to the singularity hypothesis', this is the most widely accepted interpretation. More importantly, while AI researchers in academia and private sectors are invested in creating AGI, it only exists today as a theoretical concept and in the plots of science fiction screenwriters.

The storytellers of the time

Movies continued to be a medium to learn about an AI idea and dive an AI notion into the viewer's head. Cinema patrons and now home viewers through the streaming services of Netflix, Amazon Prime Video, Hulu and Neon have continued to bring both utopian and dystopian realities to life. In 1983 we saw a young hacker who unwittingly accesses a United States military supercomputer programmed to predict and execute nuclear war against the Soviet Union in director John Badham's *WarGames* (Badham, 1983). In 1984, James Cameron's Terminator franchise took the viewer into a battle between Skynet's synthetic intelligence, a self-aware military machine network and John Connor's Resistance forces, who were the survivors of the human race. During the 1990s, we were introduced to the character of Data, an artificial humanoid working alongside the crew of *Star Trek*. In one episode, the Star Trek crew came into contact with the Borg, an alien group of cybernetic organisms or cyborgs. Also, *The Matrix* franchise arrived too the big screen, presenting the conflict between the Agents and Sentinels. Overall, the 2000s were dominated by the blockbuster movies such as Terminator, The Matrix, Alien and the new Stars Wars characters represented by the physically humanoid robot C-3PO and the humanly personable robot R2-D2.

The explosive phase: 2000 to present

The storytellers of the time

Many AI science fiction continued to cross literature, movies and television screens in 2000, 2010 and 2020. Vernor Vinge is an American-born science fiction author. Vinge is a retired professor who taught mathematics and computer science at San Diego State University. He played his part in popularising a rebellious AI theme, where AI becomes uncontrollable and changes the human world (Vinge, 1993). His novels and novellas include *A Fire Upon the Deep* (1992), *A Deepness in the Sky* (1999), *Rainbows End* (2006), *Fast Times at Fairmont High* (2002), and *The Cookie Monster* (2004). How far from the truth might Vernor Vinge's following comment be around rebellious AI and the future?

“Within thirty years, we will have the technological means to create superhuman intelligence. Shortly after, the human era will be ended.” (Vinge, 1993, p. 11)

Of significance on the big screen, JARVIS, from the Iron Man franchise, was superseded by the AI replacement FRIDAY after his demise by Ultron. This example links to the dystopian Frankenstein complex, a term coined by Asimov (Beauchamp, 1980), where a robot turns on its creator, which is also portrayed on the screen in the 2014 film *Ex Machina* and the 2015 film *Chappie*. However, the original Frankenstein movie represents the first big-screen blockbuster cinematic where artificial general intelligence turns on its creator.

The AI spring

Artificial Intelligence-related development in the Western world saw some of the iconic results of AI with IBM's deep blue victory and the world champion Li Sedol's defeat to Google's AlphaGo. With the development of the internet, big data, and graphic processing units, AI technologies such as speech recognition and image recognition have been applied to the real life of ordinary people (Nilsson, 2010).

The year 2000 was marked by the hysteria of Y2K, which stemmed from the fact that internet software was created in the 1900s, therefore, computing intelligence would come to an end, along with its internal numbering and date system. In short, Y2K saw that some computer systems would have problems formatting electronic calendar data beginning on 01/01/2000. Before 2000, systems only had to change the last two digits of the year. The change of the millennium saw the need to change all four numbers. However, the new millennium got underway after the fears of Y2K died down, and AI continued trending upward. As expected, more artificially intelligent beings were created within creative media and film, specifically about artificial intelligence and its direction. Toward the end of the first decade of the 21st century, around 2010, 2011, and 2012, the field of AI was suddenly playing with a lot of data. However, using algorithms that had gone through several generations of trial and error had produced fantastic results, leading to a pivotal moment of deep learning on the network in 2012 (Nilsson, 2010).

2.3.2 Summary: Artificial intelligence in a space of Western ascendancy

The quest will go on. What combinations of AI's techniques, supported by AI's auxiliary disciplines, will be applied in the upcoming intelligent systems? Everyone will need to remain engaged on the *search frontier* of AI because nobody truly knows.

With more advanced technology, some of the early ones created for the quest (and perhaps now forgotten) might be useful. The complete range of AI's techniques, the disciplines that contribute to it, and (yes) its history should all be familiar to researchers who desire to follow the quest (Nilsson, 2010).

The argument gains depth by concluding with a consideration of AI's Western dominance. In order to balance colonial structures and promote fairness in AI development, the research presents Kaupapa Māori involvement as not only an option but also a requirement.

2.4 Chapter summary

In order to grasp historical perspectives on technology, Part 1 of our Literature Review discusses the recent explosive rise in AI development and contrasts the leaders in the field's perspectives with Māori's relationship to their worldview (te ao Māori). This section focuses on examining how these views interact with one another. Due to Western dominance in the field, Māori cultural viewpoints are missing from AI R&D literature, which causes a misrepresentation of Māori experiences. This marginalisation causes Māori to feel ignored and alienated and maintains colonial-era prejudices (Blackmore, 2019). Improving representation and diversity in AI R&D is essential to addressing this. Participating Māori in creating technology align with their values and has a minimally detrimental effect. The exponential evolution of AI prompts ethical questions about existential threats, competing objectives, and social injustices. Discussions frequently ignore cultural viewpoints like te ao Māori, which sees technology as enhancing relationships with nature (Blackmore, 2019; Eubanks, 2018; Rae, 2020). Māori principles can potentially steer AI development that benefits communities and respects Indigenous perspectives. The Māori idea of rangatiratanga

emphasises the significance of self-determination in developing AI systems consistent with human values.

To understand the broader political and economic backdrop that will affect Māori participation in AI R&D, Part 2 of our Literature Review examines international and national AI policies as well as developments in industry and academic AI R&D. Trade and commerce are the driving forces behind the growth of international AI research and development, aligning with the Western economic ideals visible in global changes to AI regulation. Despite this, there is a notable shift in AI governance towards collectivism and collaboration, even though it goes against long-standing global societal conventions. Current Western socio-political governance reforms prioritise neoliberal ideals promoting unfettered global AI reform supremacy. This research claims that this unopposed hegemony still exists. Governments must, therefore, work with Indigenous people to understand their unique viewpoints and goals. This partnership assures that AI technologies are developed and implemented with cultural sensitivity and compliance with Indigenous values.

Part 3 of our Literature Review looks into ancient stories, Greek philosophers' thoughts, and their opinions on machines and robots. The section goes on to describe the development of AI research and the Western environment is pertinent to a Māori transformational project. The quest to discover various AI techniques applied and supported by auxiliary disciplines is vital in creating future intelligent systems. Due to its uncertain nature, this endeavour demands ongoing involvement at the cutting edge of AI research.

Early works that were previously unimportant may become important again as technology develops. According to Nilsson (2010), researchers must be knowledgeable about the complete spectrum of AI's techniques, contributing fields, and history to be successful in their endeavours.

Chapter 3 - Haere ana koe, ko ngā pipi o te āria, ka noho mātou ko ngā pipi o te whakatakere.

Kaupapa Māori theorising

Whakataukī: Haere ana koe, ko ngā pipi o te āria, ka noho mātou ko ngā pipi o te whakatakere.

*You are swept away like shellfish forced into the depth between two shoals. We remain like the shellfish buried in the channel. Following a dangerous path may lead to disaster,
but the steady conservative way ensures survival.*

This Whakatōhea whakataukī talks about strategy and methods to stay alive

Anonymous composition

3.0 Kaupapa Māori Theory and Transformative Praxis

Research Model

Kaupapa Māori theory is a framework for understanding and analysing social and cultural phenomena from a Māori perspective. It emphasizes the importance of Māori language, culture, and traditions, and values the contributions of indigenous knowledge and ways of knowing. Kaupapa Māori theory will forward our research in a way that is respectful of Māori culture and values. Kaupapa Māori theory can inform a set of factors that promote Māori well-being among our whānau. As importantly, these factors may have the potential to impact a digital solution for enhancing and maintaining connection as a whānau and their Whakatōhea identity.

One key aspect of Kaupapa Māori theory is the concept of whanaungatanga, which refers to the importance of building and maintaining relationships among people. It emphasizes the idea of connectedness and interdependence between individuals and

groups. The concept of whanaungatanga is based on the idea that we are all part of a wider whānau, and that we have responsibilities to care for and support each other. This involves treating others with respect, kindness, and generosity, and working together towards common goals. In Māori culture, whanaungatanga is a fundamental value that underpins all aspects of social and cultural life.

Another important principle of Kaupapa Māori theory is the importance of community and collective decision-making. The provision of a digital platform for enhancing our Whakatōheatanga by involving Māori communities in the design and decision-making processes and considering the broader social and cultural impacts of these technologies beyond just their technical functionality.

Finally, Kaupapa Māori theory emphasizes the importance of equity and social justice, and the need to address power imbalances and historical injustices. In the context of a digital solution, this could mean ensuring that solutions are not perpetuating existing biases or inequalities and working towards a more just and equitable society through the use of technology.

Overall, the application of Kaupapa Māori theory can inform a set of factors that promote Māori well-being among our whānau and when deployed the factors are respectful of Māori culture and values and promotes equity and social justice for all (Cram, 2017 ; Jackson, 2019; Pihama et al., 2004; Smith, 1997a; Smith, 2021).

This chapter examined the development of Kaupapa Māori as an organic theory of change. Our research is grounded in this theory, which Smith (1997a) describes as the “practice and philosophy of living a Māori, culturally informed life” (p. 453). The grounding of our research in Kaupapa Māori theory is especially relevant when one considers that Māori, as tangata whenua (*Māori people of a particular locality, or as a whole as the original inhabitants of New Zealand*), reside in a country that has been transformed around them against their will. Hence, the practice and philosophy of Kaupapa Māori reflected the stance of our research, as it is a stance of identifying as being Māori as opposed to simply being Pākēha. Here, in Aotearoa, Kaupapa Māori has grown out of struggles against the dominance of Western philosophies. A vital

struggle has been to assert the validity of mātauranga Māori, within the dominant colonial knowledge system. Also, Kaupapa Māori as a philosophy validates mātauranga, tikanga, te reo Māori and supports cultural values, practices, and pedagogies (Hohepa, 2015; Lee-Morgan, 2008; Tiakiwai, 2015). It is these principles and values that are sought by our research, factors that promote Māori well-being among our whānau which has the potential to impact a digital solution for enhancing and maintaining connection as a whānau and their Whakatōhea identity.

A crucial prior understanding of related development is that Kaupapa Māori theory provides a way for Māori to make a more authentic transforming space by alleviating colonial dominance (Barrett, 2018; Pihama, 2010; Smith, 1997a). History has shown us that when one country conquers another, subjugates its population, and exploits it, typically while imposing its own language and cultural norms on its people, this is known as colonialism. The philosophy of colonisation is based on the idea that one power should govern a dependent region or population. Therefore, Kaupapa Māori provides a platform to critically understand the tensions imposed by colonisation and create intentional social, cultural and economic change. Kaupapa Māori also provides a space for Māori to “grow their self-development and transforming ideas and actions.” (G. H. Smith, 2017a, p. 70). Māori can "expand their self-development and shifting ideas and deeds" in Kaupapa Māori (G. H. Smith, 2017a, p. 70). In these spaces Kaupapa Māori theory creates opportunities for Māori communities to develop a shared vision. This shared vision crafted through extended whānau values and practices, whānau and whakawhanaungatanga. These fundamental ideas that drive of whānau to look for elements that support Māori well-being for our whānau, which has the potential to impact on a digital platform that fosters and preserves whānau connection and Whakatōhea identity.

Our research acknowledges the impact of Kaupapa Māori theory and the subsequent explosive growth in Māori-driven initiatives which have positively repositioned the Māori language, practices, knowledge, and culture in our Pākēha dominant society. The establishment of Kōhanga Reo, Kura Kaupapa Māori and Whare Wānanga has come from the wish of Māori families to seek alternative education options for their children, since the Pākēha system was not working for many Māori families (Mahuika,

2008; Pihama, 2021; Smith, 1997a). The original research undertaken by Smith sought to understand why Māori parents opted out of conventional schooling and education and sought to establish their schools (Smith, 1997a). Smith identified key intervention elements that he calls *transformative magic*, which has come to be known as the Kaupapa Māori Key Principles. The Kaupapa Māori Key Principles are highlighted in Table 3.1 (in the next section Kaupapa Māori Theories) and are fundamental to Kaupapa Māori research (Thayer-Bacon, 2005). Our whānau postulates that Kaupapa Māori Key Principles developed by Smith (1997a) have the potential to impact the cultural well-being of our whānau and their futures.

The topics covered in this chapter range from theory to methodologies to method frameworks. The research utilises an eclectic investigation approach as the positional stance of our whānau is one of resistance against ongoing colonisation through imperial-dominating AI-related oppression, oppression including imperial dominance, bias, and exclusion. This stance reflects the need for Indigenous values, the prioritisation of self-determination, and the counterreaction against AI systems that marginalise Indigenous communities. Consequently, this research views Kaupapa Māori as a theory and transformative praxis with a Māori-centric approach to liberating ourselves from imperial oppression and exploitation (Fanon, 1968; Freire, 2005; Gramsci, 1971). Kaupapa Māori Theory offers the philosophical foundations and guiding principles, whereas Kaupapa Māori Praxis—described by Graham Smith as grounded in action and reflection - entails the practical implementation of those guiding ideas in varied circumstances. This practical dimension aligns with the notion of ringaraupa, emphasising hands-on, active engagement in transforming our realities.

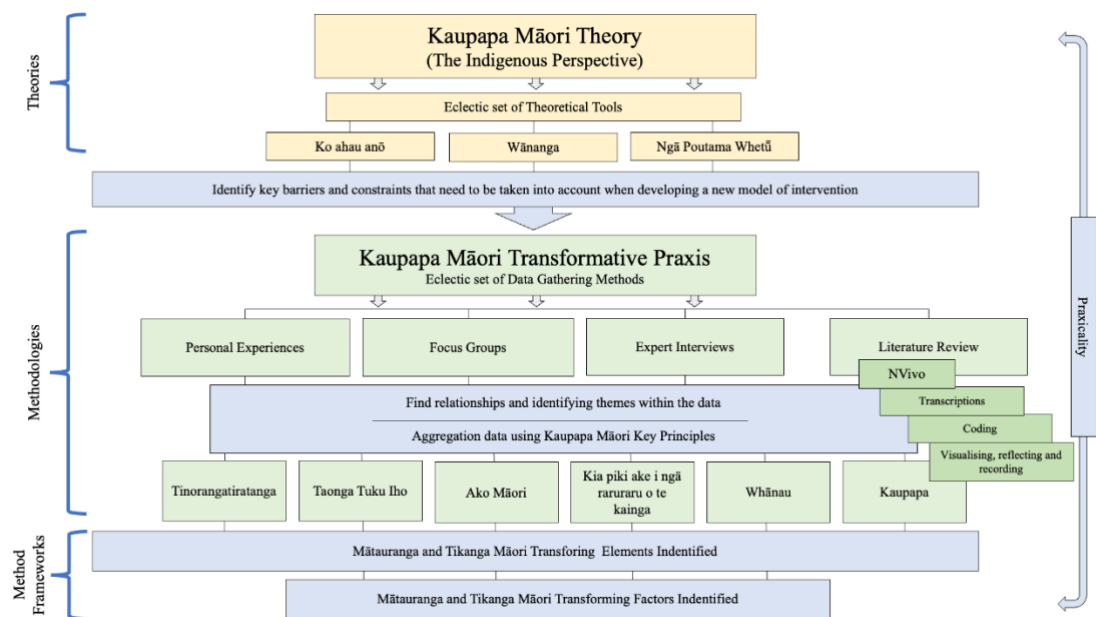
Both ideas are related and support the overarching objectives of Māori self-determination and the revival of Māori identity and culture. Here, the excitement is around the ability of Māori to ground research in a validated theory within the dominating colonial space.

In this sense, Kaupapa Māori theory provides a theoretical framework to deliver more authentic outcomes for Māori, by Māori, and with Māori (Hudson, 2020; Pihama, 2021; Smith, 1997a). Our research employs several Kaupapa Māori informed

frameworks to assist in bringing theoretical perspectives into a Kaupapa Māori AI-related intervention. A Kaupapa Māori AI-related intervention can simply be defined as an improved process that incorporates Māori values and knowledge and ensure self-determination into AI development. It empowers Māori communities to design AI systems that support collective resilience, language revitalisation, environmental stewardship, and egalitarian futures by advancing cultural well-being.

We anticipate this will provide for cultural well-being for whānau and their futures. Figure 3.1 draws attention to the eclectic selection of Māori theoretical frameworks. Kaupapa Māori Theory is positioned as the framing. In this regard, the overarching implication is that this research is undertaken from and in the interest of Māori. The frameworks of *Ko ahau anō*¹⁴, *Wānanga* and *Ngā Poutama Whetū*¹⁵ are situated below.

Figure 0.1: Kaupapa Māori Theory and Transformative Praxis Research Model



Note. Adapted from *An Innovative Response to Enhance Native American Educational Success and Advancement in Higher Education*, by Montes (2005), which incorporated *Kaupapa Māori as transformative praxis*, by Smith (1997a).

¹⁴ Me, myself and I, autoethnography, self-reflection and/or personal experiences

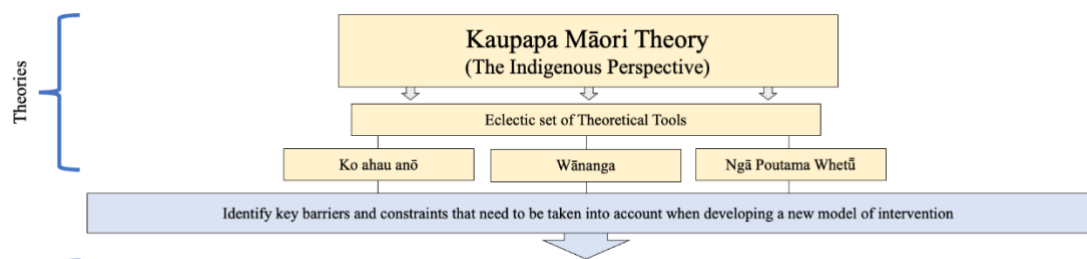
¹⁵ Culturally progressive literacies evaluation procedure

Due to its eclectic research theories, methodologies and method frameworks, our research adopted the *Kaupapa Māori Theory and Transformative Praxis Research Model* (see Figure 3.1 above). This model has been informed by Claudine Montes (2005), who originally argued the need of significant change in higher education options available to Native American students in the United States. Our whānau also wishes to acknowledge the kanohi ki te kanohi and online conversations with the Distinguished Professor Graham Hingangaroa Smith as our research model took shape (G. H. Smith communications, March through June 2022).

Firstly, this chapter discusses *theories* of transformative praxis that define Kaupapa Māori as a theory as can be seen in Figure 3.2 below, while also describing the selection of Kaupapa Māori theoretical tools that offer a setting for our research that is free from the pressures and limitations of the dominant culture (L. T. Smith, 2017).

3.1 Kaupapa Māori Theories

Figure 0.2: Kaupapa Māori Theories



Note. Adapted from *An Innovative Response to Enhance Native American Educational Success and Advancement in Higher Education*, by Montes (2005), which incorporated *Kaupapa Māori as transformative praxis*, by Smith (1997a).

The current state of Artificial Intelligence Research and Development (AI R&D) in Aotearoa has been influenced by worldwide advancements, political decisions, and private sector impacts. Not all of these advancements are positive for indigenous communities. This research is intentionally proactive in the identification of mātauranga and tikanga Māori that have the potential to speak to the development of AI systems. It seeks to find safe and culturally secure ways to protect mātauranga and tikanga Māori. Moreover, the intervention has the potential to speak to the development of AI systems that promote whānau well-being and their futures.

3.1.1 Ko ahau anō

Ko ahau anō (*me, myself and I, autoethnography or self-reflection*), or Indigenous autoethnography seeks to build narratives that arouse profound respect for the various realities and lifestyles affecting Māori peoples' modes of knowing (Whitinui, 2014). As illustrated in Figure 3.2 above, Ko ahau anō allows me to draw on my personal experiences as a whānau member, as a person with interest, knowledge and skill in the field of AI-related development, as the lead researcher and facilitator of our research, and as a sharer of knowledge through encounters with other significant Māori who have shared their thoughts and insights about their experiences with AI-related development. Investigations of the self can be seen as studies of society and the values in which the self has been enculturated (Boufooy-Bastick, 2004). In particular, Ko ahau anō can be seen as a research practice that is informed by culture and explicit to Māori in a manner that validates and legitimises as Ko ahau anō is grounded in Kaupapa Māori method of inquiry (Whitinui, 2014). This approach facilitates the systematic analyses of personal experiences via this gathering method to understand cultural experiences (Ellis et al., 2011).

3.1.2 Wānanga

Wānanga is a traditional notion of sharing, co-creating and transmitting Māori knowledge (Mahuika & Mahuika, 2020; Smith et al., 2019). It has been described as a school, a seminar, a series of discussions, a thought space, meeting places, and a form of governance, practice, and pedagogy (Mahuika & Mahuika, 2020; Whatahoro et al., 1978). Mahuika and Mahuika (2020) expand this definition by articulating that in practice, wānanga are often evocative displays of Māori oral history and philosophy in action and include songs, welcoming rituals, karakia genealogies, oral accounts, food, relationship building, proverbs, and speeches. They also have many mnemonic devices and potent illustrations of indigenous storytelling and collective memory-making. Wānanga are sophisticated and nuanced interpretive practices and pedagogies that defy simplistic definitions. Yet, these more recent definitions by authors such as Mahuika and Mahuika have been beneficial as they lift the concept of wānanga out of Western understanding and instead provide a description that more accurately reflects the dynamic nature of wānanga. There are various accounts of the first wānanga or its origin. An ancient institution was the whare wānanga, or home of supernatural

wisdom. It is told that the first wānanga was called *Rangiatea*, located in the topmost heaven of the twelve. The first wānanga was built by the embodiment of knowledge, *Rua-te-pupuke*. Throughout the winter, instruction took place from daybreak till noon. The tohunga, supported by other teachers, recited whakapapa, or religious and mythical information, which the students were required to memorise (Mahuika & Mahuika, 2020).

Although there is little literature on wānanga, Te Whatahoro tells of the Lore of the Whare Wānanga, where a sizeable tribal gathering took place in 1858 (Whatahoro et al., 1978). Today, Section 268 of the Education and Training Act 2020 designates Wānanga as tertiary institutions, and present trends focus on higher learning institutes, with the Act currently recognising three wānanga - Te Whare Wānanga o Awanuiarangi, Te Wānanga o Aotearoa, and Te Wānanga o Raukawa. In short, wānanga are dynamic places for learning and communication that may be the pinnacle of how Māori and iwi produce and share mātauranga. Moreover, they “are ongoing, vibrant, and living forms and methods of cultural knowledge transmission”, not just old structures, obsolete practises, and pedagogies lost to post-colonial progress. More importantly, wānanga are vital for community accountability, where tribal ethics allow people to understand how to act in iwi and Māori knowledge-making situations (Mahuika & Mahuika, 2020, p. 375; Pihama, 2021).

3.1.3 Ngā Poutama Whetū

Hapeta (2018) outlines a method for locating and analysing literary topics. Ngā Poutama Whetū is the name of Hapeta's Māori culturally progressive literacies evaluation procedure. To "challenge the favoured mono-cultural voice inside academic literature," Ngā Poutama Whetū, which translates to "stairway to the stars," explores power relations and prioritises Māori viewpoints (as highlighted in Table 3.1) (Hapeta et al., 2019, p. 210).

Table 0.1: Ngā Poutama Whetū

Kaupapa Māori Key Principles	Ngā Poutama Whetū (Hapeta, 2018)
Kaupapa	<i>The Principle of Collective Philosophy</i>
	Step 1: We considered what keywords and topics to include in our search to locate and identify literature. (p. 36).
Tino Rangatiratanga	<i>The Principle of Self-determination</i>
	Step 2: The principle of tino rangatiratanga (self-determination) was applied when reviewing the abstracts of the emerging literature. This principle also reinforces the autonomy of Kaupapa Māori researchers to determine which articles should be considered relevant to the review's kaupapa (p. 36).
Ako	<i>The Principle of Culturally Preferred Pedagogy</i>
	Step 3: The principle of ako (culturally preferred pedagogies and reciprocity) was considered. The process identifies this step as storing or organising information. In an applied review context, we considered if the research design and methodologies were aligned with the ako principle often underpinning Kaupapa Māori research, which is sometimes referred to as research 'by, with, and for' Māori (p. 37).
Taonga Tuku Iho	<i>The Principle of Cultural Aspirations</i>
	Step 4: The principle of taonga tuku iho (treasures to pass on) was applied to decide whether to include or exclude studies (p. 37).
Kia piki ake i ngā raruraru o te kāinga	<i>The Principle of Socio-Economic Mediation</i>
	Step 5: The principle 'kia piki ki ngā raruraru o te kainga' (socioeconomic mediation) to question whose and what knowledge counts as valid or legitimate in the 'knowledge economy' (p. 38).
Whānau	<i>The Principle of Extended Whānau Structure</i>
	Step 6: The principle of whānau is used to reveal the 'richness' of emergent concepts regarding their inter-relatedness with others and synthesise these translations into themes (p. 38).
Kaupapa	<i>The Principle of Collective Philosophy</i>
	Step 7: The Kaupapa (reconnecting with step 1) defines this as the communication phase, which seeks to express the results and findings, making them accessible to readers. (p. 39).

Note. Adapted from Kaupapa Māori as transformative praxis by Smith (1997a).

While researching this thesis, Ngā Poutama Whetū provided a method for locating and analysing literary topics as it was necessary to locate literature ranging from contemporary history to the most current AI literature. The following literature

resources helped answer the question of who is rivalling the USA and China in AI R&D and which countries are impacted by the digital AI divide:

1. Websites
2. Blogs, vlogs and magazines
3. Journals
4. Books

The above literatures are commonly considered ‘grey literature’. “Grey literature is used to describe document types produced on all levels of government, academics, business and industry in print and electronic formats that are protected by intellectual property rights, of sufficient quality to be collected and preserved by libraries and institutional repositories, but not controlled by commercial publishers” (University of Otago, 2024, October 24). The majority of academic and scholarly journals use peer review or editorial refereeing and many, but not all, academic and scholarly books to choose which works should be published. However, it is essential to note that Kaupapa Māori research approaches are directed by the methodology underpinning this thesis and the literature being reflected upon, which automatically validates these sources.

Primary literature sources used during the analysis of national AI strategies included the following:

- OECD AI Policy Observatory provides a live repository of over 600 AI policy initiatives from 60 countries, territories and the European Union (EU).
- Oxford Insights produced the AI Readiness Index, demonstrating a government's readiness to implement AI in public service delivery.
- The International Development Research Centre (IDRC) is part of Canada’s foreign affairs and development efforts, which champions and funds research and innovation within and alongside developing regions to drive global change.
- The World Economic Forum is an organisation for public and private cooperation. Leading figures in politics, business, culture, and other spheres of society are involved in the forum as they shape regional, national, and sectoral agendas.

Secondary literature sources utilised in conjunction with the sources listed above included the organisations created by the unions of countries and territories were as follows:

- The African Union Commission
- The Association of South-East Asian Nations (ASEAN)
- The European Commission (EC)

Reputable blogs and magazines are used as additional sources for this research. However, extensive cross-referencing was required:

- Journalists or professional authors of blog and magazine articles.
- Journalists' editing of blogs and magazines.
- Blogs and magazines are written for a general audience.
- Blogs and magazine articles that were easier to read and/or contained opinion or entertainment pieces.
- Blogs and magazines sometimes include more ads.

Science and AI journals were utilised as additional cross-referencing sources for this research. The quality of a journal is most commonly measured with an impact score or factor, which tends to gauge the journal's influence on the academic community. The higher the impact score or impact factor, the more important and prestigious the journal is in its particular field. These journals will be cited appropriately within the body of this research. Further distinctions can be made about journal articles, including:

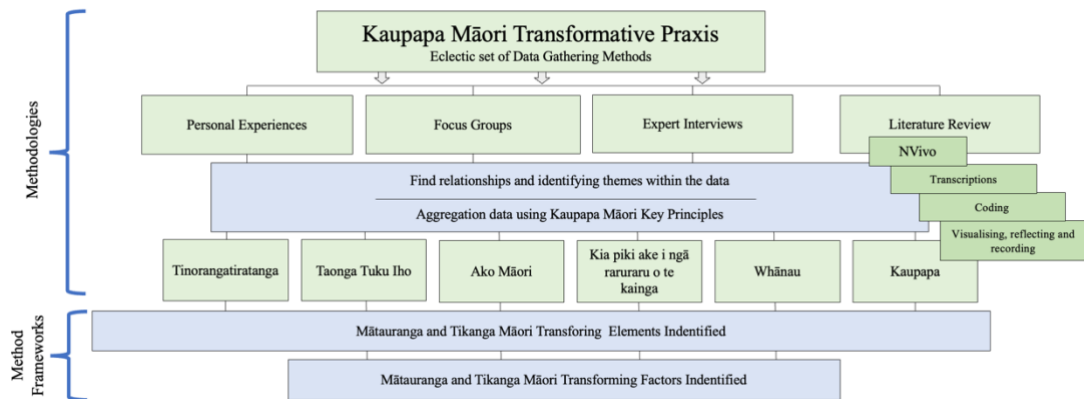
- Authors tend to be experts in their professional fields of practice.
- Journal articles are peer-reviewed by other experts or scholars in the same field.
- Tertiary academics, scholars, and private-sector individuals are likelier to trust the information in articles.
- Academic tone and technical language tend to be highly considered and appropriate within journal publications.
- Journal articles are published with the understanding that research findings are shared with other academics and professionals in a public manner.

Books are, in most instances, written by experts in their relevant field and are considered reliable sources. Such books undergo a quality process with publishers, where one or more editors manage the book's publication and recommend improvements. While this offers a robust publication process, one down-side is related to the lengthy delay that can occur due to the peer-review processes put in place to ensure academic validity and rigour, making the AI-related commentary less up to date.

3.1.4 Kaupapa Māori Transformative praxis

Smith (1997a) employs the term Kaupapa Māori transformative praxis to describe Kaupapa Māori transforming. In short, this requires a constant review cycle of engagement, reflection, and a cycle of continual reflection and renewal (that is represented by the Praxicality arrows in Figure 2). The notion of transformative praxis is crucial for our research as it requires a strategic intervention to identify the conceptual elements of Māori epistemologies and ontologies that shape the development of Māori AI. Moreover, AI techniques must promote cultural well-being for whānau and their futures. In doing so, we focussed on how the Kaupapa Māori Key Principles contribute to the optimal promotion of whānau well-being while our whānau are engaging with emerging technologies, as highlighted in Figure 4. Our research aims to identify mātauranga and tikanga Māori *Transformative Elements* of mātauranga and tikanga Māori, then reorganised into mātauranga and tikanga Māori *Transforming Factors* that we posited would have the potential to framed algorithms that will inform Māori AI systems. These mātauranga and tikanga Māori *Transformative Elements and Factors* will establish a place for the creation of natural AI-related behaviours for Māori, by Māori, and with Māori. It will also demonstrate the strategic capacity to illuminate and provide insight into the evolution of AI.

Figure 0.3: Eclectic Methodology and Method Frameworks



Note. Adapted from An Innovative Response to Enhance Native American Educational Success and Advancement in Higher Education, by Montes (2005) and Kaupapa Māori as transformative praxis, by Smith (1997a), by UBC Canada November 2006 and Auckland University 1997 for UBC Canada and Auckland University.

Personal experiences

As highlighted in Figures 3.3, I am privileging my experiences as a Māori researcher with interest, knowledge, and skill in AI-related development. I have experienced much of what this study discusses in various capacities and settings. As a child, I grew up as my dad was learning new technologies in the automotive trade, as a student experiencing the strong colonising and assimilating forces that most other Māori children did. As an internationally well-travelled adult observing the same colonial oppressive influences on the lands of other Indigenous relatives, and now as a Māori academic researcher, my experiences and reactions give me insight into what issues must focus upon for our research.

Focus groups

To find out whether technologies that use AI techniques provide for cultural well-being for whānau and their futures, a cohort of whānau, hapū and iwi members, including Māori experts, thought leaders, and data scientists were invited to participate in our research. Moreover, our research will characterise research participants as the *Research Whānau* (Berryman, 2008) and appear in the following research interest groups.

Whānau groups

Individual whānau members and whānau groups represent whānau, hapū and iwi, who work in tribal contexts, academia, local and regional governance, policy, and cultural settings. These groups will help identify the conceptual elements of Māori epistemologies and ontologies to shape Māori AI-related development through a series of wānanga. These groups can be seen in Table 3.2.

Te Uri of Raikete and Patumoana Amoamo, children, grandchildren, aunts, uncles, cousins, nieces, and nephews were invited to be Research Whānau:

Grandparents' whakapapa line:	Nanny and Nanny Pa
Aunties and Uncle whakapapa line:	Mātua/Whaea
First cousins' whakapapa line:	Whānau Rangatahi
Whānau Rangatahi children's whakapapa line:	Whānau Mokopuna
Whānau Mokopuna children's whakapapa line:	Whānau Mokopuna Tuarua

Historically, relationships with my whānau were formed through whakapapa. Patumoana and Raikete Amoamo are our grandparents, known as *Nanny and Nanny Pa*. Overall, the following conversations occurred:

- Initial conversations were had with the four remaining children of Nanny and Nanny Pa: four sisters known as our *Mātua/Whaea* whakapapa line, to introduce the kaupapa.
- The children of our *Mātua/Whaea* whakapapa line, to be known as the *Whānau Rangatahi* whakapapa line were then introduced to the kaupapa.
- The *Whānau Rangatahi* whakapapa line were encouraged to discuss the research with their children, the *Whānau Mokopuna* whakapapa line.
- As a Whānau, we are blessed to have a *Whānau Mokopuna Tuarua* whakapapa line with ages ranging from 23 to a few months old. Similarly, Whānau Mokopuna has been encouraged to discuss the kaupapa with their children.

As highlighted above in the conversation patterns, these cross-sections of whānau represents a wide variety of knowledge relevant to the research. More specifically, our Aunties, four sisters, known as the *Mātua/Whaea* whakapapa line, provided a

foundation for our research created from lifelong experiences, offering guidance and new knowledge around their practices taught and have gathered through ninety years of life. Moreover, my cousins, known as the Whānau Rangatahi whakapapa line, sit a generation below our Mātua and Whaea and, therefore, bring a first intergeneration set to the research of proficiencies and understandings. As do our tamariki, to be known as the Whānau Mokopuna whakapapa line: and the tamariki of our tamariki, who we refer to as Whānau Mokopuna Tuarua whakapapa line, all of which, bring additional intergenerational skill sets, abilities, and gifts Individual Whānau members and Whānau group wānanga strategy.

During the Pre-wānanga Phase, as outlined in Figure 5, whānau members acknowledged their expertise with the use of existing technologies but also declared that were probably only two or three of our whānau that had knowledge of AI. It was therefore decided to create a series of knowledge-sharing wānanga to explore:

- Wānanga 1: How do we use existing technologies?
- Wānanga 2: What is AI, and how can we use AI to create stories?
- Wānanga 3: How can we use AI to protect and keep our stories safe?
- Wānanga 4: What Māori interventions can be identified in the range of Māori governance settings?

Expert interviews

Wānanga were designed for experts, selected Māori experts, thought leaders, and data scientists, also to be called Research Whānau from this point forward, who are working in the area of developing new and innovative Māori interventions in Māori governance settings. The experts were chosen in some cases based on whakapapa and their knowledge of the issues and concerns in Māori AI-related development and mātauranga me tikanga Māori.

Expert Wānanga strategy

Therefore, these wānanga would use semi-structured themes to help focus the context of the various Māori interventions in the range of Māori governance settings. Governance settings included the space of marae, kapahaka, health, environmental

resources, Te Tiriti, iwi, data sovereignty, and taonga (*property, goods, possession, effects, gifts*) classifications.

Wānanga themes would include:

1. Concept of governance in the AI-related development context
2. Recent reforms impacting AI-related development context
3. Mechanisms in place to help facilitate Māori governance in the AI-related development context
4. Challenges and successes, and query
5. What might the future look like?

Twenty-seven x 45 to 90-minute wānanga mariko (*virtual*) wānanga, which involved 32 participants and will be hosted online using Zoom audio conference technologies.

The contexts of the discussions would include the following three distinct voices:

Whānau, hapū and iwi public voice of Te Uri o Patumoana and Raikete Amoamo:

- Iwi treaty claimants
- Whānau, hapū and iwi academics and researchers
- Whānau, hapū and iwi archivists
- Māori data information specialists

Whānau, hapū and iwi public voice of Government public sector voice:

- Māori environmental resources consultants
- Whānau, hapū and iwi academics and researchers
- Māori data information specialists

Whānau, hapū and iwi public voice of Private industry voice:

- Māori gamification specialists
- Māori tech entrepreneurs and strategists
- Māori data information specialists
- Whānau, hapū and iwi academics and researchers
- Māori data information specialists

These groups will help identify the conceptual elements of Māori epistemologies and ontologies to shape Māori AI-related development through a series of wānanga. These groups can be seen in Table 3.2.

3.1.5 Research Whānau profiles

Table 0.2: Profile of Research Whānau

Research Whānau	Age	Iwi Affiliation	Pre-Ethics Wānanga	How Recruited	Ethical Consent	Background Information
			Whaea/Eldest	Invite	Signed/Verbal	
Te Uri o Patumoana me Raikete Amoamo						
<i>Whānau Hera</i>						
John Poppleton	62	Te Whakatōhea	✓	✓	✓	Lives in Otaki, Aotearoa Entrepreneur, An Extra Pair of Hands, Wellington
<i>Whānau Frank</i>						
Mahuta Amoamo	50	Te Whakatōhea	✓	✓	✓	Lives in Auckland, Aotearoa Auckland Council, Auckland
Herehere Ngatai	24	Te Whakatōhea		✓	✓	Lives in Ōpōtiki, Aotearoa Studying nursing
<i>Whānau Mahuta</i>						
Mahuta Hudson	89	Te Whakatōhea	✓	✓	✓	Lives in Whanganui, Aotearoa Retired
Ria Burney	34	Te Whakatōhea		✓	✓	Lives in Whanganui, Aotearoa Online Marketing Consultant, Hemp Industries
Ken Hudson	31	Te Whakatōhea		✓	✓	Lives in Coogee Beach, Sydney, NSW, Australia Venue Manager, Crown Hotel, Coogee Beach, Sydney, NSW, Australia
Marie-Louise Hudson	61	Ngāti Hōrana		✓	✓	Lives in Whanganui, Aotearoa Tiny Nation, Early Child Care, Whanganui
Steve Burney	33	Tau iwi		✓	✓	Lives in Whanganui, Aotearoa

Research Whānau	Age	Iwi Affiliation	Pre-Ethics Wānanga	How Recruited	Ethical Consent	Background Information
			Whaea/Eldest	Invite	Signed/Verbal	
Petera Hudson	65	Te Whakatōhea	<input checked="" type="checkbox"/>			ACC Case Manager, Whanganui Lives in Whanganui, Aotearoa Lead Whānau Researcher
Whānau Patu						
Patu Imrie	85	Te Whakatōhea	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Lives in Petone, Wellington, Aotearoa Retired
Kayla Imrie	31	Te Whakatōhea		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Lives in Biarritz, France Professional athlete
Lynette Imrie	57	New Zealander		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Lives in Johnsonville, Wellington, Aotearoa Woodridge Homes, Wellington
Moana Imrie	54	Te Whakatōhea		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Lives in Petone, Wellington, Aotearoa Wellington Institute of Technology, Wellington
Mark Imrie	53	Te Whakatōhea		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Lives in Perth, WA, Australia dComm, Decentralised Communities, Australia
Michelle Kember-Imrie	52	Australian		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Lives in Perth, WA, Australia Director (corporation) at Q2, Australia
Briana Imrie	17	Te Whakatōhea		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Lives in Perth, WA, Australia Secondary School Student
Whānau Māku						
Tiwai Clark	57	Te Whakatōhea		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Lives in Sachsenhausen, Hessen, Germany Investment Banker
Ali Smeaton-Clark	53	Te Whakatōhea	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Lives in Bluehaven, NSW, Australia Community Support Worker for the Elderly
Whānau Ripeka						
Ripeka Rickard	78	Te Whakatōhea	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Lives in Kawerau, Aotearoa Retired

Research Whānau	Age	Iwi Affiliation	Pre-Ethics Wānanga	How Recruited	Ethical Consent	Background Information
			Whaea/Eldest	Invite	Signed/Verbal	
Suzanne Rickard Miller	46	Ngāti Porou, Te Whānau o Takimoana		✓	✓	Lives in Bethlehem, Tauranga, Aotearoa Secondary School Teacher – Tauranga Boys High School
Johnathon Miller	45	Ngāti Pākehā, Ngāti Hāmoa		✓	✓	Lives in Bethlehem, Tauranga, Aotearoa Callaghan Innovation, Tauranga
Māori experts, Kaumātua, Thought Leaders, Data Scientists						
Arihia Tuoro	66	Te Whakatōhea, Ngāitai ki Torere, Tainui		✓	✓	Lives in Ōpōtiki, Aotearoa Project Manager at Whakatōhea Pre-Settlement Claims Trust, Ōpōtiki
Te Kahautu Maxwell	56	Te Whakatōhea, Ngāti Awa, Ngāi Tai, Te Whānau-a-Apanui, Ngāti Porou, Ngāti Maniapoto, Tuhoe		✓	✓	Lives in Hamilton, Aotearoa Associate Professor, Ahonuku, Waikato University, Hamilton
Rangimarie Biddle	31	Te Whakatōhea		✓	✓	Lives in Ōpōtiki, Aotearoa People and Culture Administrator - Whakatōhea Māori Trust Board
Maui Hudson	50	Whakatōhea, Ngāruahine, Te Māhurehure		✓	✓	Lives in Hamilton, Aotearoa Director Te Kotahi Research Institute, Waikato University
Dayle Hunia	48	Ngāti Hokopū, Ngāti Awa, Te Whakatōhea		✓	✓	Lives in Whakatāne, Aotearoa Management Consultant, Kotuku Systems, Whakatāne
Tahu Kukutai	58	Ngāti Tīpā, Ngāti Mahanga, Ngāti Kinohaku, Ngāti Ngawaero, Te Aupōuri		✓	✓	Lives in Ngāruawāhia, Aotearoa Professor, Te Ngira: Institute for Population Research, Waikato University, Hamilton
Te Taka Keegan	58	Waikato-Maniapoto: Ngāti Porou, Ngāti Whakaue		✓	✓	Lives in Hamilton, Aotearoa Associate Professor, Computing & Mathematical Sciences, Waikato University, Hamilton

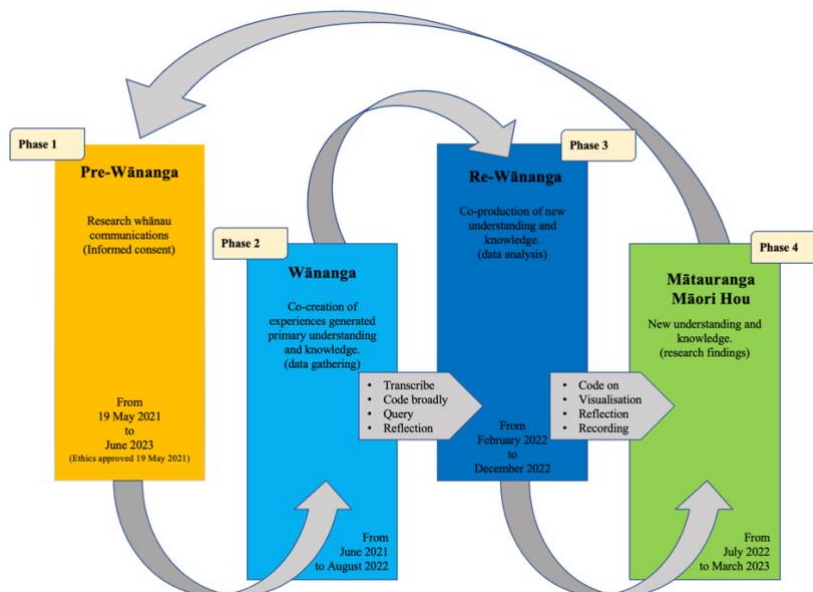
Research Whānau	Age	Iwi Affiliation	Pre-Ethics Wānanga	How Recruited	Ethical Consent	Background Information
			Whaea/Eldest	Invite	Signed/Verbal	
Kirikowhai Mikaere	42	Tuhourangi, Ngāti Whakaue		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Lives in Rotorua, Aotearoa Māori data and information specialist
Vanessa Clark	53	Waikato: Ngāti Tīpa, Ngāti Āmaru, Ngāti Tahinga		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Lives in Whatawhata, Aotearoa Research Developer (Māori Engagement), Waikato University, Hamilton
Amber Taylor	41	Ngāti Mutunga, Te Ati Awa, Ngāti Whātua, Ngāpuhi		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Lives in Auckland, Aotearoa Co-Founder CEO, ARA Journeys, Auckland
Kaye-Maree Dunn	42	Te Rarawa, Ngāpuhi, Ngāi Tāmanuhiri, Ngāti Mahanga, Kahungunu		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Lives in Wellington, New Zealand Director of Making Everything Achievable and Ahau NZ Limited
Hēmi Ruka	46	Ngāti Pakau (Ngā Puhī), Whānau taki Moana (Ngāti Porou), Waitaha		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Lives in Whangarei, Aotearoa He Puna Marama Trust, Indigital, NGEN Room, Arataki Systems kaiako

3.2 Research process

3.2.1 Whakawhanungatanga in wānanga mariko¹⁶

Research Whānau posit that *Kaupapa Māori Key Principles* (Smith, 1997a) are appropriate to be woven into algorithms that will inform next-generation Māori artificial intelligence (AI) systems, which will promote cultural well-being for our whānau and their future. The Kaupapa Māori Key Principles will be enacted at different stages of our wānanga mariko.

Figure 0.4: Research process



Note: Adapted from Can te ao Māori worldviews exist within a Western institute's online teaching and learning environment? by P.W. Hudson (2020) for Waikato University, Hamilton, New Zealand.

These stages are:

1. **Pre-wānanga**
 - a. Tino rangatiratanga
 - b. Kaupapa
2. **Peri-wānanga**
 - a. Ako
 - b. Whānau
 - c. Taonga tuku iho

¹⁶ Virtual wānanga

Post-wānanga

d. Kia piki ake i nga raruraru o te kainga

This research makes use of co-construction of knowledge, acknowledging that to co-create knowledge, shared experiences and viewpoints of participants and researchers need to take place utilising a framework of semi-structured narrative design, and spiralling interviewing discourse (Bishop & Glynn, 1999a). This framework allows participants and researchers to share their stories while directing discussions toward pertinent subjects. Spiralling interviewing discourse becomes a non-linear, interactive method to collect data. The extension and deepening of insights will occur due to the revisiting throughout the exchanges. This approach is in line with Kaupapa Māori praxis as the approach encourages respectful interactions, giving participants and researchers the opportunity to influence the research process.

3.2.2 Phase 1: Pre-wānanga

During Phase 1: Pre-wānanga, (see Figure 4, Phase 1), whānau were sent an information sheet and consent forms before the wānanga and were reminded of their rights as participants. Much of the data gathering occurred using virtual conferencing Zoom technologies. However, kanohi ki te kanohi hui occurred only after the lifting of Covid-19 pandemic regulations in Aotearoa (Ministry of Health, 2024). With each whānau wānanga, a voice or video recording was used to capture the data collected to ensure its accuracy in the research write-up. Wānanga transcriptions were used to create summary notes and sent to whānau to check for accuracy. As well as checking for accuracy, I sought final approval to use transcript information in the research manuscript. Within such an approach, the researcher no longer determines the research process or interprets the data independent of other whānau of interest. Instead, they work collaboratively with other research participants. In this study, rather than just a researcher being concerned with the methodology or extracting relevant information from respondents, the members of the whānau and the researcher were involved somatically in the research (Bishop & Glynn, 1999b).

Table 0.3: Kaupapa Māori Key Principles

Kaupapa Māori Key Principles (Smith, 1997a)	
Tino Rangatiratanga	<i>The Principle of Self-determination</i>
	The principle of tino rangatiratanga reinforces the goal of seeking more meaningful control over one's own life and cultural well-being (p. 466).
Kaupapa	<i>The Principle of Collective Philosophy</i>
	Kaupapa Māori initiatives are generally held together through a collective commitment to a philosophy or utopian vision. (p. 472).
Ako	<i>The Principle of Culturally Preferred Pedagogy</i>
	The principle of ako Māori reinforces the need of culturally appropriate teaching and learning strategies. Other borrowed cultural pedagogies are utilised within Māori alternative governance settings (p. 468).
Whānau	<i>The Principle of Extended Whānau Structure</i>
	The principle of whānau is considered an important cultural structure which allows for Māori cultural practice, values and thinking, <i>whanaungatanga</i> (p. 471).
Taonga Tuku Iho	<i>The Principle of Cultural Aspirations</i>
	In a Kaupapa Māori framework, to be Māori is taken for granted, a hidden curriculum does not subtly undermine one's identity. Māori language, knowledge, culture and values are validated and legitimated. (p. 467).
Kia piki ake i ngā raruraru o te kainga	<i>The Principle of Socio-Economic Mediation</i>
	The principle of kia piki ake i ngā raruraru o te kainga speaks to the need to alleviate the negative pressures of the marginal socio- economic positioning of many Māori families, which impacts everyday life experiences. (p. 468).

Note: Adapted from Kaupapa Māori as transformative praxis, by Smith (1997a), by Auckland University 1997 Auckland University

Pre-wānanga: Tino Rangatiratanga

The **Kaupapa Māori Key Principle of Tino rangatiratanga** (see in Table 3.3 and in Figure 4, Phase 1) is an emotional sensation that is continuously present. It is a constant resolve of sovereignty, autonomy, self-determination, and independence. Tino rangatiratanga is a self-and/or-collective determining principle. Tino rangatiratanga is the primary method of building relationships with technologies and other whānau, work colleagues and friends.

Pre-wānanga: Kaupapa

The **Kaupapa Māori Key Principle of Kaupapa** (see in Table 31 and in Figure 4, Phase 1) is the collective visions, objectives, and ambitions of Māori communities. Our whānau established our research kaupapa pre-wānanga, with the kaupapa being the identification of mātauranga and tikanga Māori that reflect a high standard of cultural appropriateness, as well as mindful of wellbeing when woven into algorithms. Kaupapa are derived from context. The origination of our research kaupapa came from the observation by our whanaunga (*relative, relation, kin, blood relation*) that technology bias is the continuation of the imperial biases imposed on Māori by the colonial oppressors. Before we began our research, Aunty Ben and Aunty Ri would visit, giving us a chance to talk and clarify *why* we wanted to undertake the research. After much korero, we came to the decision that the intention behind our research was to ensure that next generation AI is not utilised as yet another systematic force for ongoing Māori colonisation (Whaanga, 2020).

3.2.3 Phase 2: Wānanga

The narratives that form the basis of this collaborative story were drawn from 27 x 45 to 90-minute wānanga mariko between June 2021 to August 2022 and from a series of follow-up wānanga from February 2022 to December 2022. We concluded the Wānanga process with a one-day final kanohi ki te kanohi wānanga in February 2023 (see Figure 4, Phase 2). The video conferencing technology used to record online kōrero (*speech, narrative, story, news, account, discussion, conversation, discourse, statement, information*) was Zoom. In short, Zoom provides communications software that integrates video conferencing, virtual meetings, chat, and mobile teamwork. This mode of communication was emphasised in the Research Information Sheet (*see Appendix 1*), which also made clear that participation in the research was voluntary. The construct wānanga groups were a core set of whānau representatives who attended the majority of sessions. To mitigate individuals' unavailability, whānau would select a representative to attend a session and report back to their whānau about the various discussion held. None of the participant official withdraw, however some attendances were irregular due to individual circumstances, but they always had a whānau represented at all sessions. These wānanga were supported with instant messages, emails and text chats, which provided further background information on the research

and organisational direction for the kōrero. The conversations were semi-structured to allow for co-creating stories of experiences. As mentioned in Phase 1, in contrast to Western ideals regarding information gathering, a different approach was used in these whānau wānanga. For example, this was evident in how the whānau group wānanga saw changes in the core set of people remaining in the group. Also, rather than individual answers being the norm, the whānau group wānanga sometimes generated collective solutions and experienced consensus when addressing particular questions. Moreover, within the whānau group wānanga and expert individual or group hui, mutual linkage, digression, and humour were essential elements of Māori wānanga processes. Similarly, previous work by Montes (2005) suggests that different and specific techniques are required in Indigenous research methodologies that conform to Indigenous cultural expectations and contexts.

Peri-wānanga: Ako

The **Kaupapa Māori Key Principle of Ako** (see in Table 31 and in Figure 4, Phase 2 and 3) has been explained as how Māori like doing things because it is culturally intrinsic (Smith, 1997a). The practices of how our whānau engaged online were established towards the tail end of pre-wānanga and the start of peri-wānanga. Laws et al. (2009) and Wylie et al. (2003) identified Ako as being in direct dialectic tension with Western ideologies and therefore, each has included Ako as a key principle in their interventions. Ferguson (2012) identified that for students to integrate into the traditional and e-Education environments successfully, the kaiako must be visible as an ideology in e-Aorangi, meaning the kaiako's presence needs to be a physical presences as well Māori pedagogies and values. When conducting the research for this thesis, our whānau gleaned online engagement protocols from these researchers which aided in navigating the inherent Western video conferencing ideologies. Also, Amber illustrated how in gamification, the use of iwi-generated artwork is culturally preferred as the artwork is appropriate within the domain, exemplifying the culturally preferred pedagogical principle (Smith, 1997a).

Peri-wānanga: Whānau

The **Kaupapa Māori Key Principle of Whānau**, (see in Table 31 and in Figure 4, Phase 2 and 3) take place peri-wānanga. More importantly, whānau is integral to

Māori identity and culture (Smith, 1997a). The cultural values, customs and practices that organise the whānau and collective responsibility are necessary for Māori survival and achievement. Throughout this thesis there are many examples where the extended whānau structure principle comes to the fore as an essential success element in Māori education, Māori health, Māori justice and Māori prosperity (Smith, 1997a).

Peri-wānanga: Taonga tuku iho

According to Kaupapa Māori theory, being Māori is natural and taken for granted. The Māori language, mātauranga and tikanga Māori are all actively supported and recognised by our whānau. The collective philosophy principle recognises the significant emotional and spiritual component of Kaupapa Māori (Smith, 1997a). The metaphysical foundation of mātauranga Māori is uniquely Māori. As Nepe (1991) noted, this intangible foundation impacts how Māori people interact, think, and see the world. Hence, the **Kaupapa Māori Key Principle of Taonga tuku iho**, (see in Table 31 and in Figure 4, Phase 2 and 3) was observed peri-wānanga.

3.2.4 Phase 3: Re-wānanga

Wānanga kōrero were transcribed, broad themes were drafted, and a text selection from the transcripts was coded to the themes. In addition, whānau were invited to participate in a second online video session where further *meaning-making* discussions from our first hui were drawn (Kegan, 1982). At this point, the whānau started to analyse, process and theorise about these experiences, which provided an ideal opportunity to co-produce understandings and knowledge. The Kaupapa Māori Key Principles of Ako, Whānau and Taonga tuku iho were also observed in Phase 3: Re-wānanga (see in Table 3.3 and in Figure 4, Phase 3).

3.2.5. Phase 4: Mātauranga Māori hou

In Phase 4, the analysis of online wānanga around governance, specifically discussion forum activities took place. (see in Table 31 and in Figure 4, Phase 4). Kōrero was revisited and reviewed regarding the broader literature, followed by further discussions with whānau to ensure that:

1. the individual's voice was being heard, and
2. a collective understanding was shared with the new knowledge created (Mead, 2016).

Post-wānanga: Kia piki ake i ngā raruraru o te kāinga

The **Kaupapa Māori Key Principle of Kai piki ake i ngā raruraru o te kāinga** addresses the issue of Māori socio-economic disadvantage and the negative pressures this brings to bear on the well-being of whānau and their futures. This principle, *Kia piki ake i ngā raruraru o te kāinga*, (see in Table 3.3 and in Figure 4, Phase 4) acknowledges that despite these difficulties, Kaupapa Māori mediation practices and values can intervene successfully for the well-being of the whānau. Therefore, the collective responsibility of the Māori community and whānau becomes paramount Smith (1997a).

3.2.6. Veracity - positionality and creditability

G. H. Smith (2017a) addresses the issue of how to assess a Kaupapa Māori approach and suggests that a set of 5 ‘tests’ be used in two ways to assess the efficacy of work that adopts a Kaupapa Māori approach. First, using a Kaupapa Māori theory-based approach, the five elements offer a short roadmap for how one could more efficiently carry out transforming work. Second, the five components offer a method for evaluating one's contribution to bringing about effective change for Māori interests.

Table 0.4: Testing for the veracity of a Kaupapa Māori theory approach

Test	Considerations
Positionality	Where one speaks from is important; we need to locate ourselves in time and space. Why one speaks is important. Does the researcher or academic understand their own capacities and limitations? What is their transforming record that lends legitimacy to their work? What is my experience that supports the validity of my commentary? Who am I speaking to? How am I connected to the topic and to the audience? What and whose interests are served by my work? How do I engage with indigenous frameworks and theorising? (p.92)
Criticality	Does the commentary or analysis adequately account for the politics of our history? There is need to build one’s understanding of the critical context – the Māori political and historical context and the context of unequal power and social relations. Am I able to use these critical understandings and tools? More importantly, do we understand how our colonisation is being formed and reformed over the top of us?

Test	Considerations
	Do we have the critical understandings and knowledge to argue for the theoretical space for Māori language, knowledge, and interests? If we are unable to read the world critically, our transformations and interventions may come up short (p.93).
Structural and cultural considerations	There is need to work at both cultural and structural change. By cultural change, I mean those changes that people can influence via human agency. However, change is not just about changing people, as this can become deficit oriented if we see them as ‘needing to be improved’. We must also challenge the structural impediments that constrain Māori cultural, social, and economic interests. Our struggle is not one struggle, but many struggles, often in multiple sites, in multiple shapes, and taking place simultaneously (p.93).
‘Praxicality’	Praxis is an important element in a Kaupapa Māori approach. What are the practical and theoretical elements involved? Praxis requires us to constantly reflect on what we are doing (usually with our community of interest) and to make any adjustments that may be necessary. Praxis involves a continuous cycle of action, reflection, and reaction. There is a need to test our theorising against our practical enactments (p.93).
Transformability	There is a need to be transforming in our intent. What positive changes are there for Māori as a result of your engagement? Maintaining the status quo is insufficient when it perpetuates the existing situation of unequal power and social relations. It is important to focus on projects that do not simply describe our pathology but to move to enact the transforming of our condition. There is a need to move beyond the reproduction of the status quo and develop meaningful transformative outcomes (p.93).

Note: Adapted from Kaupapa Māori Theory: Indigenous Transforming of Education, by G. H. Smith (2017b), by Huia Publishers 2017.

3.2.7. Data aggregation

NVivo: Data analysis

Stories were collected during wānanga and analysed in NVivo, as seen in Figure 5. NVivo allowed me, as the Lead Researcher, to examine the rich text-based and multimedia information, categorise, sort out and order information, study relationships in the data, and combine examination with connecting, forming, probing, and modelling.

Transcription

After Phases 2 and 3 were complete (see Figure 5), each wānanga transcript was transcribed and placed directly into NVivo. Audio Transcriptions and Secretarial Services (ATS) were engaged to complete transcriptions.

Coding

NVivo allowed for the coding of different types of sources in the case of this research text document. Also, coding allowed for gathering specific topics, themes and people (Corbin & Strauss, 1990). Furthermore, NVivo provided the functionality to bring the whānau references together as a single node. Overall, nodes aided in generating ideas and helped identify patterns and theories in the research material. In essence, I read through the transcribed data numerous times and started to create tentative labels for chunks of data that summarised words and phrases.

Visualising, reflecting, and recording

NVivo provides a suite of visualisations, converting data into visual formats, which helps gain deeper insights from the data. Here, mapping was used as the visualisation tool in this research. The use of visualisations suggested commonalities, patterns, and themes that whānau could compare between the transcript sources.

Further data aggregation

The data from whānau wānanga was the accumulation of transcriptions from whānau kōrero. It was the intention to recognise mātauranga and tikanga Māori that that have the potential to inform AI systems that promote the cultural well-being of our whānau and their futures. Kerr (2012) compared and contrasted theorists and practitioners who she believed have contributed to the development of Kaupapa Māori theory or who have written about the theory as praxis in research. Kerr identified the following five principles:

- A. Control principle (Māori control/ownership)
- B. Challenge principle (analysis and mediation of power relationships)
- C. Culture principle (Māori as normative, including the survival and revival of Māori language and culture)

- D. Connection principle (relationship-based knowledge sharing and generation whānau/hapū/ iwi etc., plus creation of new knowledge through local and international relationships)
- E. Change principle (transformative for Māori)

Our research used these principles to organise identified mātauranga and tikanga Māori. Our research posits that these principles have the potential if enshrined in algorithms that will, in turn, inform AI systems that promote the cultural well-being of our whānau and their futures. (see Chapter 5: Findings)

3.3 Chapter summary

Past research experiences for Māori have been mixed, with the historical relationships between Māori communities and Western researchers being significantly problematic. Hence, much Western research has negatively impacted Indigenous people, which has tended to define names in a manner that presents Indigenous peoples' views through the lens of Western philosophy (Montes, 2005). Fortunately, Māori researchers have made significant advances in creating more positive ways to conduct research, which are often referred to by prominent Indigenous researchers for Māori, by Māori, and with Māori (Smith, 1997a). Similarly, in the context of this study, our research has chosen to use a Kaupapa Māori theory and transformative praxis so we can work to free ourselves from colonial cultural AI-related oppression. Furthermore, the design of our research prioritises the well-being of the whānau during the research process (Hammersley & Traianou, 2012).

A completed application for ethical consideration from the University of Waikato and Massey was sought and granted on 19 May 2021 by Te Manu Taiko: Human Research Ethics Committee Faculty of Māori & Indigenous Studies, Te Pua Wānanga ki te Ao, Waikato University (see Appendix 1), and further ratification by Massey ethics committees on 26 July 2022. (see Appendix 2). In the next section, we share the findings related to the identification of elements of mātauranga and tikanga Māori that can be woven into algorithms that will inform next-generation Māori AI systems, which will promote cultural well-being for our whānau and their future.

Further discussion regarding transformative praxis which is used to explain Kaupapa Māori as a practice to transform and define the *methodologies* used when conducting our research will be discussed in the next chapter, *Chapter 4: The research, findings, and discussion: Whānau wānanga*. Also, in Chapter 4 we provide a summary which explains how *method frameworks* have been applied to aid our fight against imperial oppression in AI-related advancements and, more importantly, how our research evolved into a model of Kaupapa Māori transformative praxis.

Chapter 4 - Te Whakatōhea tohea te ako.

The Findings and Discussion: Whānau wānanga

Whakataukī: Te Whakatōhea tohea te ako

This Whakatōhea whakataukī encourages our people to pursue education because within the research are the findings.

Created by

Dr Te Kahautu Maxwell

4.0 Introduction

We now move onto look at the focus group of the Uri o Patumoana and Raikete Amoamo and selected Māori experts, thought leaders, and data scientists from around the motu, including members of Te Uri o Patumoana and Raikete Amoamo whose intention it was to identify mātauranga that promote Māori well-being for our whānau and their futures. In this chapter, and again, it is emphasised that our research aimed to identify factors of that promote Māori well-being for our whānau and their futures. In particular, we are looking at ways of helping our whānau who live outside the tribal homelands of Te Whakatōhea to connect, reconnect and remain connected with whānau living at home on our turangawaewae (*domicile, standing, place where one has the right to stand*). Our research has discovered that imperial-dominated technologies are permeated with colonial ideology, and these permutations are now proving to amplify biased stereotypes in AI systems. A reminder that we also posit that if Kaupapa Māori Key Principles (Smith, 1997a) were to be enshrined in an algorithm, the AI system would then promote cultural well-being for our whānau.

Two distinctively different wānanga were created to take our Uri o Patumoana and Raikete Amoamo on a knowledge journey around the kaupapa of AI. Selected Māori experts, thought leaders, and data scientists from around the motu, including members of Te Uri o Patumoana and Raikete Amoamo, were invited into our whānau wānanga.

Data was analysed from 27 x 45 to 90-minute wānanga mariko (*virtual*) wānanga, which involved 32 participants and were hosted online using Zoom audio conference technologies. The contexts from where the discussions include the following three distinct voices that were heard during our whānau wānanga:

1. Whānau, hapū and iwi public voice of Te Uri o Patumoana and Raikete Amoamo:
 - Iwi treaty claimants
 - Whānau, hapū and iwi academics and researchers
 - Whānau, hapū and iwi archivists
 - Māori data information specialists
2. Whānau, hapū and iwi public voice of Government public sector voice:
 - Māori environmental resources consultants
 - Whānau, hapū and iwi academics and researchers
 - Māori data information specialists
3. Whānau, hapū and iwi public voice of Private industry voice:
 - Māori gamification specialists
 - Māori tech entrepreneurs and strategists
 - Māori data information specialists
 - Whānau, hapū and iwi academics and researchers
 - Māori data information specialists

Whānau shared a variety of applications of interest that supported their engagement with AI R&D, including hobbies, occupations, endeavours, pastimes and leisure interests. Our whānau were able to place their technology usage and their wishes for emerging technology applications into six themes:

- Education
- Communications
- Entertainment
- Whānau projects
- Smart Technologies
- Cloud Technologies

Education

Education was the most broadly discussed topic by our whānau when talking about their engagements with technologies. Technology is a powerful tool that offers easy-to-access information, alternative learning and teaching opportunities and resourceful and practical ways that support and transform their educational experiences. The online learning and teaching programmes list were too vast and varied but encompassed many life experiences from the womb to the tomb.

Communications

Our whānau defined communications as using digital devices for any type of communication relying on technology. Our whānau identified broad, overarching categories of digital communication tools such as email, phone calls, video conferencing, SMS, *short message services*, blogs, podcasts, and recorded and streamed videos.

Entertainment

Our whānau categorised entertainment applications as interactive activities enjoyed during leisure time – music and playing games, to communication applications – social media, instant messaging, streaming media and VR, AR and MR (virtual, augmented and mixed realities). Our whānau discussed how some of the entertainment applications crossed over into the other emerging technology applications themes, as did the themes cross over each other.

Whānau projects

These projects include a series of wānanga themed around specific points of interest, with the wish to integrate emerging technologies, such as exploring and mapping sites of whānau significance, whakapapa, preservation and protection of whānau taonga, and the sharing of mātauranga whānau.

Smart technologies

Our whānau defined smart technologies as those that can be made to perform specific tasks. Examples include smartphones, smart refrigerators, smart locks, smart watches, smart cars and smart thermostats, just to name a few.

Cloud technologies

Our whānau described cloud technology as our ability to store or process our data anywhere other than on our devices. These services can be provided as public, private or hybrid (combined public and private) clouds such as Dropbox, Slack, Microsoft 365, AWS Elastic Beanstalk and Windows Azure.

Whānau have shared varied experiences, which suggests that a relationship with colonial imperialism is a feature of the whānau's lives as well as an aspect of the broader politics of their lives. The following sections highlight the six key areas aligned with Kaupapa Māori principles.

4.1. The Findings

4.1.1. Kaupapa Māori Key Principles

Our whānau posited that the Kaupapa Māori Key Principles developed by Smith (1997a) have the potential to impact the cultural well-being of our whānau and their futures. Thus, Smith's research has become an important baseline for this research project. The Key Principles are conceptual notions that allow viewing our world through the lens of Māori. The whānau identified Kaupapa Māori Key Principles as critical practices that influenced the promotion of Māori cultural well-being when engaging with AI R&D. Kaupapa Māori Key Principles also helped the whānau navigate colonial ideologies that besiege AI R&D and plague Māori cultural and institutional spaces and places. The originating conversations between the Te Uri o Patumoana and Raikete Amoamo members included the kōrero around keeping our treasured stories safe. The question of why Siri and Alexa were built with female voices, the racial bias of technology systems such as facial recognition software, and why Google translate got Māori translations so wrong were also discussed. In response to these points, one of our whanaunga stood up and said:

Deja vu whānau, history repeating itself, this technology bias continues the imperial biases imposed on Māori by the colonial oppressors.

There was consensus from other whānau members, with nods of heads and expressions of agreement. Similarly, Professor Rangi Matamua’s question reinforced the statement made by our Whanaunga,

“Is AI the new (r)evolution or the new coloniser for Indigenous peoples? Can intelligence, or an artificial one at that, be used to colonise something or someone else?” (Whaanga, 2020, p. 35).

Further data aggregation saw a set of *Mātauranga and Tikanga Māori Elements* emerge. These Elements portended positive and successful emotional sensations when whānau described the Kaupapa Māori Key Principles when engaging with emerging technologies. These Elements were assigned a commonalities group, as illustrated in Table 4.1.

Our whānau have taken the liberty to extend the work of Smith (1997a) and aggregate the set of *Mātauranga and Tikanga Māori Elements* into six *Te Whakatōhea-a-Iwi Factors* as illustrated in Table 4.1:

- Whakapono Integrity, prestige, authority, control, power, influence, status, spiritual power, charisma - mana is a supernatural force in a person, place or object. Mana goes hand in hand with tapu, one affecting the other.
- Moemoeā Vision, To pierce, spear, challenge, stab, poke, jab, bite.
- Āhurutanga Comfort, warmth, Māori culture, Māori practices and beliefs, Māori way of being.
- Whanaungatanga Connections, relationship, kinship, sense of whānau connection - a relationship through shared experiences and working together, which provides people with a sense of belonging. It develops as a result of kinship rights and obligations, which also serve to strengthen each member of the kin group. It also extends to others with whom one develops a close familial, friendship or reciprocal relationship.
- Koha - Turning, conversion, changing, transformation

The following discussion highlights each of the *Kaupapa Māori Key Principles* in relation to the *Mātauranga and Tikanga Māori Elements* and *Te Whakatōhea-a-Iwi Factors* as illustrated in Table 3.3. The first being Kaupapa Māori Key Principle being Tino Rangatiratanga.

Table 0.1: Kaupapa Māori Key Principles and Transformative Praxes

Transformative Praxes	
Mātauranga and Tikanga Māori Elements	Te Whakatōhea-a-Iwi Factors
<i>Decision making processes functioned purposefully</i>	Whakapono <i>Integrity</i>
<i>Ability to be in control</i>	
<i>Collective vision, aims, and goals</i>	
<i>What might the future look like?</i>	Moemoeā <i>Vision</i>
<i>Mechanisms in place to help facilitate Māori governance</i>	
<i>Appropriate ethical practices are in place</i>	Āhurutanga <i>Comfort</i>
<i>Spiritual affirmations were made</i>	
<i>Social, cultural and te reo Māori were encouraged</i>	
<i>Māori concept of governance</i>	
<i>Tikanga and Mātauranga Māori are affirmed</i>	
<i>Whakarongo, titiro... kōrero</i>	Whanaungatanga <i>Connections</i>
<i>Whakapapa</i>	
<i>Ahikā</i>	
<i>Tūpuna</i>	
<i>Tuakana / teina</i>	
<i>Whenua</i>	Koha <i>Change</i>
<i>Constructive work outputs are experienced</i>	
<i>Opportunities for success</i>	
<i>Continuous and intentional progress is made</i>	
<i>Impact on recent reforms</i>	

Note: Adapted from Kaupapa Māori Theory, by Smith (1997a) by Evaluation Journal of Australasia.

Tino Rangatiratanga - The Principle of Self-determination

Tino Rangatiratanga is a principle of self-determination and refers to sovereignty, autonomy, self-determination, and independence. In short, this principle speaks to how Māori must be in command of their culture, aims, and future (Smith, 1997a). It must be emphasised that tino rangatiratanga is a pre-whānau-wānanga, a pre-thesis, a pre-my-being-born existential phenomenon, which will be discussed in Chapter 5: Discussions. However, observable opportunities of Tino Rangatiratanga were

demonstrated in our whānau wānanga and will be revealed in the following discourse. As Māori, we are in charge of our land, resources, and goals, according to the concept of tino rangatiratanga. It concerns Māori managing our affairs independently and with authority. While also living in accordance with our tikanga and making every effort to protect the properties, lands, and practises of tino rangatiratanga. Furthermore, it is about ensuring that our communities may live happy, healthy lives. It is essential to also consider and draw on cultural norms and ideals pre-colonisation before the arrival of the British, as tino rangatiratanga was all-inclusive. With plenty of resources, Rangatira, Māori Chiefs and Leaders bore responsibility for the health and well-being of their whānau, hapū, and iwi.

Our whānau members still display the characteristics of responsibility for whānau well-being exhibited by our tūpuna. Moreover, the intrinsic motivation of tino rangatiratanga creates opportunities for our whānau to demonstrate leadership qualities of self-determination to lead the reassertion of a collective self-governance that promotes cultural well-being for our whānau and their futures. The following section describes the experiences of the fulfilment of the expression of Tino rangatiratanga experienced by our whānau.

Te Whakatōhea-a-Iwi Factors of Whakapono

Our whānau identified that when the fulfilment of Tino rangatiratanga was experienced, decision-making processes were functioning purposefully. In my role as researcher, I contributed the following personal reflections, which highlight the decisions made by whānau around how the sharing of transcripts from our wānanga progressed:

If you want access to our entire conversation, the video recording will be there for you. Or, if you wish to, I know some prefer to have just the written kōrero, so you can go back and look, as that will also be available to you. We can then make decisions around where that kōrero takes us and then, eventually, how we look after that kōrero.

Personal reflections stressed the importance of conversations about emerging technologies, specifically about how AI R&D will help determine more efficient, effective ways of communication for our whānau and, therefore, happier and healthier lives:

Mum uses a tablet to access Facebook Messenger to talk with her sister Aunty Ben and her niece Mo. Mo is learning te reo Māori, so Mum and Mo type to each other i roto i te reo Māori.

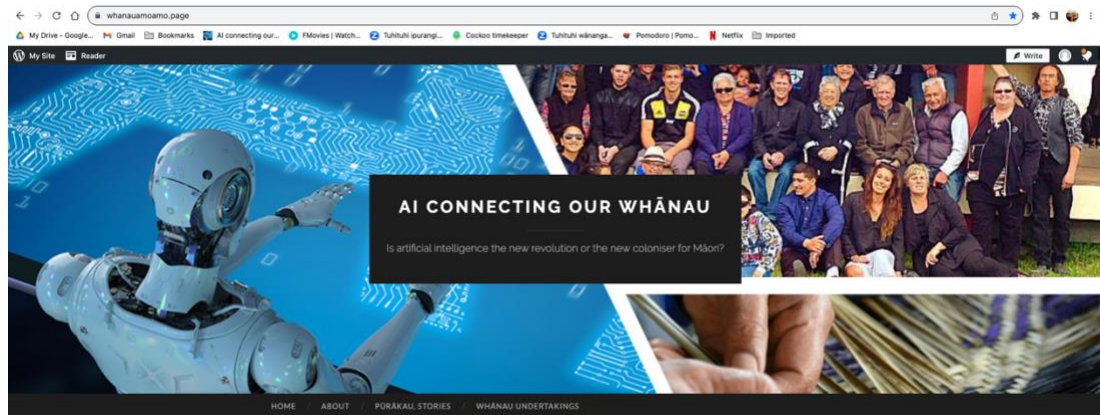
Experiences around decision-making practices are shared by Kaye-Maree when discussing data sovereignty:

We cannot overlook the fact that data belongs to uri beneficiaries. So, we need to ask our people, do we have the right as an iwi to do whatever we do with the data? And that's the area that every single iwi needs to work out, gaining that consent.

Social media belongs to the set of social networking services (SNS) and was used as a tool of whanaungatanga to further the development of relationships between our whānau members. Whanaungatanga supported whānau online and continued to support whānau offline in everyday life. Whānau identified SNS to include Facebook, Facebook Messenger, instant messaging, and blogging as digital resources to support the whānau while in online wānanga. Mahuta commented on how easy SNS is for messaging and keeping in contact with other whānau members, yet it remains an individual's choice of whether to use the services:

Facebook, Instagram, Zoom and other social media apps it's the person's ability of how they want to connect or engage with the whānau. Technology has been around for a while now. We all know how to do it, and we all know how it empowers us... It's whether we want to.

Figure 0.1: Whānau Blog site

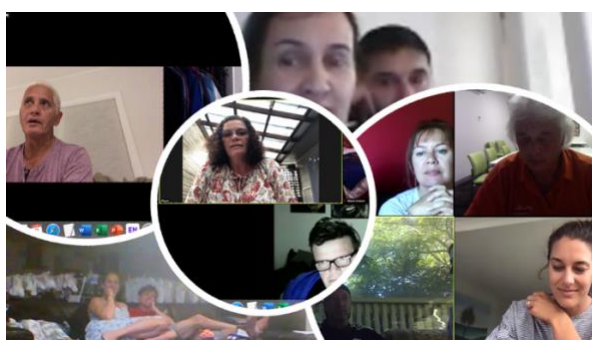


Note: Whānau Blog site used to share research progress and stories. URL: <https://whanauamoamo.page/>

The different SNS helped facilitate our whānau wānanga mariko, *virtual* gatherings. SNS provided tools to talk with each other, exchange and share information, share ideas and news, and support each other while participating in our whānau wānanga mariko.

Mum uses a tablet to access Facebook Messenger to talk with her sister Aunty Ben and her niece Mo. Mo is learning te reo Māori, so Mum and Mo type to each other e roto i te reo Māori.

Figure 0.2: Whānau Zoom Wānanga Mariko



Note: Whānau used Zoom technologies for wānanga mariko

Ria explains how her choice of work as an online marketing consultant has been more productive due to the evolvement of the internet and SNS:

I couldn't do either of my jobs outside of being a mum without the internet. I can work from home because we have the internet, and everything is internet-based. I'm answering customers who have contacted me via the internet. I'm working alongside my work teams in NZ Hempres and Isagenix. We aren't based anywhere physically. I can just ask them questions on Messenger or via email, and that's how we all communicate. So, the internet is the basis of my whole job.

Continuing to grow the capacity of skilled and knowledgeable Māori in AI is essential for Māori to be in control. The universal commonality in the varying contexts of governance settings is capacity, where non-Māori agencies have been utilised to aid in developing Māori AI. Te Taka emphasises this issue, stating:

Māori need to build more capacity. We cannot ship everything off to non-Māori because they're the experts. We need to build more capacity in this area.

Dayle also stresses the need for capacity building in her field of expertise:

Opportunities are constantly arising for Māori environmentalists, but it always comes down to an issue of capacity and capabilities... An example is when regional and district councils have to consider that [capacity and capabilities] when developing objectives and policies for freshwater management. The national policy statement on freshwater sounds all ideal, but what's happening is that hapū just don't have, particularly now with Covid, the capacity, the resources, the time or the technical access needed to do that.

Similarly, Kaye-Maree does not hold back when discussing the need for capacity building:

I think a challenge is when we get into the higher levels of engineering and the demanding challenges that we face as people around the science, the mathematics, the more profound engineering minds, the architectural minds needed for emergent tech so that we're not hiring in that talent. Still, we're

building that depth of talent in our children and communities. That is where we need to invest more time, effort and money.

Kirikowhai also concurs that for Māori to have a place in the space of AI R&D, capacity building is required:

I think that one of the biggest challenges has been and will continue to be and as a focus for us is the lack of capacity and capability in te ao Māori in this space. The reality is we can't compete with the Crown. However, in terms of, I guess, pūtea (money), what we can do is we can provide just that whole different set of enlightenments with the particular leaders and the kaupapa that we're trying to drive.

The continual growth of Māori capacity and expertise in governance is required. Māori experts become the caretakers of the gifts provided for use by our tūpuna. Maui expands on the need by sharing:

What is it being directed towards, and what is our ability to use it? Once again, it comes down to that capacity. We need people who understand those tools, which is part of the challenge.

Zoom was the preferred audio-conferencing technology to host whānau wānanga. Becoming effective and efficient users of Zoom technology required complicated navigation. An example of this was when Ryan was experiencing trouble getting into the wānanga during our Whānau Pātu wānanga. The extract below outlines the problem faced by the whānau:

Moana: I think Ryan's still on, but he can't hear us. He's on his phone. Does anyone have any ideas of what he should potentially push so that he can listen to us?

Kayla: Could he exit the programme and then re-enter the room? Because Petera, you'd have to invite him in, wouldn't you?

Michelle: Has he got his microphone on and his speakers on?

Moana: Okay, I'll tell him to go out and come back in again.

Kayla: Yeah, just tell him, like on the bottom left-hand side of his... oh, he's on his phone, right? Not the computer. They're very different.

Due diligence was put into finding a solution to the inability of whānau to access our wānanga mariko from a mobile device. Discussions were had with various whānau members who use online technologies for work and looked at alternative technology platforms or virtual conference solutions to solve the problem (Zoom, 2022). The communicate below outlines our findings, and the solution offered to the whānau, which also ensured we remained in control of our online mariko intentions:

Figure 0.3: Solution communication for mobile devices

The image shows a screenshot of a document titled "Zoom" with the following content:

Zoom
Our first whānau hui worked well on the Zoom platform for those of us using lap and desktop computers, however, we had issues bringing mobile cell users into the hui.

After talking with whānau members and reading up about other video conference platforms I've elected to stay with Zoom. Zoom, compared with FaceTime, MS Teams, Google Meet, Skype and GoToMeeting all have similar functionalities as each other and their own individual quirks.

For our research project it came down to a couple of things;

1. the free version only allowed us to meet for a max of 1hr;
2. the free versions have a limit to number of participants;
3. each platform has a cost to up-grade.

Through the university I can use the up-graded Zoom version for free.

Zoom is accessible via mobile devices ie: phones, pads and pods, both Mac and Android, however, you will need to download the app. Follow the links to download free Zoom apps:
Link: <https://zoom.us/download>

Zoom Mobile Apps

Start, join and schedule meetings; send group text, images and push-to-talk messages on mobile devices.

Download in App Store (Apple logo) Download in Google Play (Android logo)

We can coordinate a practice session prior to our scheduled hui dates to make sure our mobile device users can get on.

Note: The information in Figure 6 (above) was originally sourced from Zoom's webpage and reproduced as a PDF that was then sent out to all whānau members.

The action of being in control of the context you are working in or experiencing is an expression of Tino rangatiratanga. The new global currency is data, which has become a significant factor in power decisions. Tahu recommends concentrating on the data issues that Indigenous people face and the relationship between data, tribal sovereignty, and power. Tahu suggests that if Māori reflect and learn about the

development of the United States Indigenous Native Sovereignty Network model, data sovereignty may progress toward tino rangatiratanga of Māori data sovereignty. Tahu considers how Māori can be in control of their data with these suggestions:

Data governance is commonly understood to be important when considering Māori data. The United States Indigenous Native Sovereignty Network has a great model that clarifies data governance's dual nature to people. One is around data which is essentially still sitting in colonial settler state architecture, and the other is data for governance, and that's our pathway to nation-building. That's about whānau, marae, hapū and iwi. That's a perspective to consider when we build Māori data governance.

Te Taka shares his viewpoint around the kaupapa of self-determine control of Māori data:

My view is that AI works on data. So, if you want to govern the AI, you need to govern the data. Whoever has control of the data governs the AI. For example, the stuff that the police do that's all based on police data, and that's the issue we have with Māori. Māori data has been collected, and it used to be that if somebody collects some data about you, you have the right to see what it is and correct it. But with how data is gathered, there's so much of it. It's happening so quickly, and we no longer have that right. If we don't have that right, then we don't have control over the data, if we don't have control over the data, then we don't have control over artificial intelligence from that data.

Te Taka expands on his kōrero above and explains how Māori can achieve tino rangatiratanga in the field of AI, stating:

So, the area that Māori need to be looking into is, what is our data, the data that's ultimately ours? How can we build AI systems for us from our data? Because then, when the systems are created, it's like these are the things we're looking at. This model is okay because it seems to show these things. Māori must

have governance over their data, and then the algorithms must be built from their perspectives.

I think the Crown is starting to understand that what it has previously been doing and what it is still doing isn't correct. I know what they're doing isn't appropriate for Māori. So, they're beginning to acknowledge a Māori perspective, a Māori way of doing things, beginning to recognise that actually, mātauranga Māori does have value in Western science and that there is value to it.

Te Taka apportioned the blame directly on the Crown when Māori suffer the loss of control when knowing how things should be done when Māori are concerned. He shares:

The Crown does what it thinks is suitable for all New Zealanders. But what's good for all New Zealanders isn't necessarily what's good for Māori. The pandemic is a classic example. The Crown put in controls to control the pandemic for all of New Zealand, but clearly, that hasn't worked for Māori. Māori have said, this isn't going to work for us. You need to do things differently.

Yet, the voices of Māori, for the most part, went unheard. Also, Te Kahautu expresses his view around tino rangatiratanga as a leader in Te Hāhi Ringatū¹⁷:

Te Hāhi governs itself, and at Te Rere Marae, it governs itself. As Whakatōhea and the parishes within Whakatōhea, they govern themselves, and we talk about whatever we want to talk about.

Kaupapa Māori efforts are kept together by a group's collective commitment to a philosophy or utopian ideal. The community described below avow a collective whānau benefit when discussing the development of a smart electrical grid with Graeme:

¹⁷ Ringatū (the upraised hand) a faith founded by Te Kooti Arikirangi Te Tūruki

Any marae, any community can assert to install solar on their whenua and get a collective of whānau to be part of that collective. As long as you're generating a sufficient amount of energy from the solar systems, you could show benefit to your whānau.

Graeme describes the system for his whānau,

We're looking at about 23 families to be involved in this project as a pilot, but we can scale to 40 families. We can duplicate the project. There's nothing hard about it. You put solar on a building, connect it to the grid, and have a bit of smart material and smart technology that distributes the energy around and balances it all out. The software we're working with in the future will be AI-enabled, and that will manage our grid very effectively. Hopefully, that will be a Māori developed AI management. Now that's called a Smart Grid, a small one, what they call a localised grid, but if you put enough of those grids together and increase the size, they will fundamentally change energy supply and demand.

Te Whakatōhea-a-Iwi Factors of Moemoeā

Power relationships are examined by our whānau, investigating ways in which to resist hegemonic dominance. Our whānau occupy strategic positions that seek to challenge imperial-dominated AI-related systems.

What might the future look like?

Whāia e koe te iti kahurangi ki te tuohu koe, me he maunga teitei

This whakataukī (*proverb, significant saying*) speaks to the Māori perspective of tenacity and endurance, not giving in to setbacks while working to achieve your objectives. The whakataukī translates to 'look for the treasure you cherish most, if you lower your head, let it be to a towering peak.'

The next set of kōrero highlights the dreams and aspirations underpinning our Tino rangatiratanga for our whānau and how they position themselves to attain self-determination, sovereignty, independence, and autonomy for whānau futures. For example, Amber controls the vernacular by stating:

We're going to change the world.

Also, Te Kahautu posits:

The future looks very healthy. Our pae tapu, our rangatahi in their 20s, probably 30s now, can maintain the pae, go from, and cook. Especially at Waioweka¹⁸, everywhere really, everywhere.

Kirikowhai describes how an iwi data platform tailored specifically by iwi for iwi can exercise tino rangatiratanga by controlling the making of decisions and planning for a better future of our whānau:

One of the other things that we've got, Te Whata, which is an iwi created and iwi designed data visualisation platform for all of our iwi, and we pump data out as much as we can, and we're using that as a tool, particularly the month doing the roadshows with our iwi, but we're using that as a tool to try just to build capability, data literacy and capability with our iwi.

Te Whakatōhea-a-Iwi Factors of Āhurutanga

Āhurutanga addresses cultural practices and beliefs, that is, appropriate ethical ways of doing things that then influence tino rangatiratanga needs to be addressed. As Graeme questions the benefits to Māori by stating:

The Crown established legislation in 2017, the private sector has boomed. We needed this legislation to create a space-enabled economy, and predominantly the value of the space economy today through those actions is around 5.4 billion

¹⁸ Waioweka is a rural community in the Ōpōtiki District and Bay of Plenty Region of Aotearoa's North Island.

dollars. I ask, what is the value to Māori? It's basically a pittance. So now the Crown has created this imbalance because they put in legislation that recognised kawanatanga but did not rebalance it to recognise tino rangatiratanga and the value that would have come with that.

Our whānau around the affirmation of wairua Māori made further comments. Some people define wairua as the ability to have faith, religious convictions, or a belief in a higher power. Some people would characterise wairua as an internal link to the universe. While there is no right or wrong way to see or experience wairua, it is crucial for maintaining our mental health. My Mum conducted karakia tīmatanga (*opening prayer*) and whakamutunga (*closing prayer*) in several of our whānau wānanga mariko. Whether karakia was performed kanohi kitea (*face to face*) or wānanga mariko, this ritual, when used correctly, will help whānau stay in control of their lives. she reflects:

We've got to do it right. When Ali goes to the wedding, she goes safe. I read from my book night and morning, and it takes me about ten minutes to read just some of the prayers. But there's a beginning and an ending to the karakia. But I can't remember it. I've got to have my book.

To know one's whakapapa, to practice one's cultural rituals and social practices and to learn one's reo continues to be encouraged. Arihia points out that members of Te Whakatōhea iwi asked to ensure treaty settlement financial recourses were put aside for cultural revitalisation:

Whānau said to make sure you ring-fence some of those dollars, yes ring-fence some of those dollars that need to start going out immediately for cultural revitalisation.

The governance goals in Māori organisations will consider how Māori relate to the assets and how they are utilised. In some cases, even while the organisation is run for profit, protecting the assets for future generations may be balanced with the

organization's commercial goals. Dayle highlights this reality of Tino Rangatiratanga by making this statement:

In governance structure, at a national policy development level, the question has to be asked whether Māori are adding value or are we just a tick in the box so that the governance setting can say they've engaged with Māori when they haven't at all.

Mātauranga refers to Māori knowledge. Mātauranga is present in our language, whakapapa, technology, legal and social control structures, trading structures, forms of expression, and many more settings. Te Kahautu shares his thoughts around mātauranga and tikanga affirmation:

Te reo Māori, our language, was our tikanga and still is our tikanga. Yeah, it's to sing, to haka, and to maintain the language and te taha wairua. So, that's the tikanga and building the succession. My first point of call was to go to Richard Mitai and Eric Kurei. They are the musos (musicians). I'd create the words, and they'd create the music. The poi experts would create the poi, and I would create the haka movements and those sorts of things.

Te Whakatōhea-a-Iwi Factors of Whanaungatanga

Intergenerational relationships refer to relationships between ageing parents, adult children, grandchildren and great-grandchildren. Kirikowhai sees the work that she and her team do is not just for the living generations but also mana motuhake of our future generations:

When we sit down to wānanga 'He kura ka huna, he kura ka whākina'¹⁹ strategy when we come together as a kāhui (company), we always have a guided meditation before we start and to align us all. Because everybody is so busy, often you go into hui and wānanga, and your head is either five meetings here or three meetings back. So, we do that intending to bring us present to a space.

¹⁹ We have hidden talents and gifts, we have gifts that are revealed

And then we started our wānanga about this exact question, what do we want to see?

... for us, the aspiration is in seven generations' time when we ask our mokopuna, are you well? They will be well so that we, in this generation and our lifetime, are just trying to build as much of the platform as we can to hand to the next generation, the next generation, and the next generation. In seven generations, because of the mahi (work), we've all started, our mokopuna will be well, and our consciousness will be continuity.

For our research, the following definition of the Māori cultural principle known as Ahikā (*burning flames*) refers to taking whenua, (*land rights*) by occupation and use of the land. One of the conventional ways to establish mana whenua is by ahikā.

Māori recall our tūpuna from long gone, they live in our hearts, memories and dreams. Kaye-Maree describes how her tūpuna and their tikanga direct her business policy structures:

In the first instance, we have embedded our tikanga values inside our constitution and went to quite the nth degree to establish that. So, we had to do that in partnership with our legal counsel. Still, it was vital that beyond us as the directors, we had embedded those approaches, which included acknowledging the memories and the voices of our old people, being good stewards of Papatūānuku (Earth, Earth mother and wife of Rangi-nui) of operating in a mana-enhancing²⁰ way. You know, we talk about all kinds of fundamental tikanga often. So that was important that we put that in there and, also, the selection of well-equipped trustees who understood tikanga Māori, te reo Māori, both from a commercial perspective but also from a practical and cultural lens as well, so we have both a wahine (female, women, feminine) Māori

²⁰ A process where we can close the space between different understandings, while building trust and mutual respect.

directors and also a tangata (human, individual) Samoa who brings his kind of Pasifika faith and direction into the team, which I think is fantastic.

The relationship between a tuakana (*elder brother/sister/cousins*) and a teina (*younger brother/sister/cousins*) individual is referred to as a tuakana/teina relationship in te ao Māori. Tuakana/teina may happen peer-to-peer, younger to older, older to younger, or more able/expert to less able/expert in teaching and learning environments. Te Kahautu is pleased with the progress of capacity building within Te Hāhi Ringatū, ensuring the caring of the ritual gifts left to us by our tūpuna:

The building of capacity. Our younger ones can do the whaikōrero, and they do the karanga, and they can carry out the karakia. I don't facilitate the karakia anymore, the young ones do it. They ring the bell, and they know who's going to do the karakia. So, when I die, I know I will have a fabulous tangi (-:

Whenua, the Māori term for land, the land of which we are kaitiaki (*trustee, minder, guard, custodian, guardian, caregiver, keeper, steward*), also refers to the placenta. According to this belief, all life originates from Papatūānuku's underwater womb. Her placenta is the lands that appear above the water. Dayle explains that:

We're all behind the project, but the outcomes are not measured by the number of possums caught, it's actually the growth in those rangatahi put through the experience of not just learning about predator-free and driver's licenses, and they're doing cutting edge technology. It's actually them being on the whenua.

Te Whakatōhea-a-Iwi Factors of Koha

Thoughtful and regular feedback can enhance the productivity and the direction of the work environment of an individual and of the community the individual is a part of. Aunty Ri describes her experience of the production of our whānau's first reunion book:

When I produced that first reunion book, Word processing allowed me to write up our whānau stories. These word processing skill sets come from when I was

working in the School office as we were very fluent in using the technology of mahi at school.

Success may be explained in one word, opportunity. Opportunity is something that humans either naturally receive or must independently seek out or create. Opportunity is that doorway to achievement, and finding, perceiving, and pursuing it to its logical conclusion will demand skill and abilities. Workplace successes are genuine examples of being in control of the experiences of Māori and their communities. Hēmi contributes to the kōrero around opportunities for success and the connections to Tino rangatiratanga:

That kaupapa was also spawned out of a wānanga delivery that we were doing, which was essentially the same project, except I think the real crux of that success was going to the marae.... The authenticity and the x-factors are there. On the marae, you can't beat it.

Continuous progress refers to learning according to a sequential and developmentally appropriate continuum of knowledge. The word *intentional* adds a sense of strategic and planned knowledge acquisition. Wānanga were designed to share knowledge around the kaupapa of AI and the challenges facing our whānau, as Amber highlights in her this statement,

In the mahi we do, the biggest challenge is a lack of understanding of the space, the tech space, and the advantages it can bring to the collective. When we go into what we're doing, the relationship builds from the offset, it's good that we have these early adopters who know little about what we're doing or proposing we'd do. But then it's like when we start meeting with the elders and the kaumātua (adult, elder, elderly man, elderly woman, old man - a person of status within the whānau), or the committee representatives, and it's being able to educate the people that we're working with around the positives and the negatives well.

Reform frequently offers the chance to restructure businesses or the entire economy in ways that contribute to achieving long-term goals like sustained long-term economic development and employment, improvements in income distribution, and increased access to basic necessities. Vanessa emphasises the need for Māori to be at the centre of these reforms to ensure Māori voice is represented in all governance policy settings:

When I think about reform affecting AI, the fact that we have an AI charter, to me, who wrote that? Where was the Māori input? Te Mana Raraunga²¹, we're going back three or four years now, I was invited to speak for Te Mana Raraunga to the group that was putting together the AI charter, and none of the stuff we contributed turned up in it. Similarly, Callaghan Innovation put out a document around AI five years ago, and our seven contributions, a two-hour interview, were reduced to one sentence in an eighty-page document. And so, the recent reforms, I think, have a long way to go. Are they on the right journey?

Kaupapa - The Principle of Collective Philosophy

Kaupapa are typically collective visions, aims, and goals of Māori communities. The kaupapa refers to the community's ambitions and goes beyond the scope of the collaborative context. The strength of the kaupapa is its capacity to express and relate to Māori goals on a political, social, economic, and cultural level. Therefore, intervention systems are an essential and incremental part of the entire kaupapa (Smith, 1997a). Our research established our research kaupapa before our wānanga, and therefore the observable actions by our whānau will document below. Despite our pre-wānanga engagement, tangible examples of Kaupapa were presented, and they will be discussed in the following discussion.

As stated at the beginning of this section, Kaupapa Māori Key Principles help whānau navigate Colonial Ideologies. One of our whanaunga drew our attention to the issue of biased impositions of AI and encouraged us to strategise how we as a whānau

²¹ The purpose of Te Mana Raraunga is to enable Māori Data Sovereignty and to advance Māori aspirations for collective and individual wellbeing

wished to ensure that AI became a new revolution, a new evolution for us and not a new coloniser for us as Māori.

Deja vu whānau, history repeating itself, this technology bias is the continuation of the imperial biases imposed on Māori by the colonial oppressors.

Our whānau highlighted the significance of communications pre-wānanga that helped create our collective vision, aims, and goals. These communications outline the initial kaupapa of our research and provide a platform to continually develop the kaupapa of our wānanga. The kaupapa gave our whānau the “why” we wanted to undertake our research. Initial conversations with Mum allowed us to lay the kaupapa foundations for our research. Aunty Ben and Aunty Ri would visit before the start of our research, which again provided the opportunity to talk to establish the “why” of our research, as shown in the picture below.

Communications platforms included social media networks, specifically Facebook, Facebook groups, Facebook messenger, and instant messaging. Information and instructional material were written and sent to whānau via these social media channels. A whānau blog was created to share appropriate knowledge. Mobile phone calls were also made to help with wānanga clarifications. When planned and spontaneous whānau gathering opportunities occurred, further foundational kaupapa kōrero occurred. So, for most of our whānau, our kaupapa or the reason for us as a whānau to wānanga was clear.

Figure 0.4: Whānau gatherings prior to Whānau Research (own photos)



Note: Celebrations including birthdays allow us to gather promoting the opportunity to discuss our research.

Ahirau's Facebook group page was established to centralise our whānau kōrero.

Figure 0.5: Ahirau Facebook Whānau page



Note: Ahirau's Facebook space was established to centralise our whānau kōrero.

An introduction letter was sent out to whānau (see Appendix 4) to lay the foundation for the kaupapa of our research and continues the discussions around “why” we are undertaking our research.

Te Whakatōhea-a-Iwi Factors of Whakapono

Our whānau recognised that the collective kaupapa of our research was the motivation, the drive to the identification of elements of mātauranga and tikanga Māori that has the potential to be woven into algorithms that will inform next-generation Māori AI systems, which will promote cultural well-being for our whānau and their futures.

Personal reflections stressed the importance of conversations about emerging technologies, specifically about how AI R&D will help determine more efficient, effective ways of communication for our whānau and, therefore, happier and healthier lives:

Kirikowhai also reflects on being in control and the need for Māori to build capacity in the field of AI R&D:

I think that one of the biggest challenges has been and will continue to be and as a focus for us is the lack of capacity and capability in te ao Māori in this space. The reality is we can't compete with the Crown. However, in terms of, I guess, pūtea, what we can do is we can provide just that whole different set of enlightenments with the particular leaders and the kaupapa that we're trying to drive.

Wherever you find yourself, whether in a whānau setting, government, public or private sectors, academia or other Māori governance positions, supporting the kaupapa is paramount, as Amber points out:

Yeah, and it's been good to see that we're only a small company. I feel very privileged that we get to have a say in some of these more comprehensive frameworks being set up, like when different people like Kaye-Maree, doing the mahi she does, Hinerangi, all of these people leading out in that space. For us, the best we can do to support them is to give voice to the kaupapa they're leading.

Dayle shares her thoughts on the importance of collaborative Māori teams to continue to hold the space and to continue the kaupapa within the work she does:

It's not just having leaders, it's having teams of whānau that can collaborate and help. Some have to tap out and do other stuff for a while, but you've got to keep that kaupapa going because there are heaps of false starts. I think Te Mana

o te Wai is an excellent example of something that could be very powerful if you've got...

The prioritisation of workload is essential as Māori capacity in many governance settings is limited. Kirikowhai discusses the method by which she and her team prioritise their work precedence:

So, when we started working in this kaupapa, sixty-five different projects were presented to us. We culled it right down to five. The lens we took was what impact each project would have in a hundred years and which projects would have the most impact on our people. So, we took a very long-term lens to the different kaupapa with intention. In the digital space, in particular, our work programme involves the kaupapa around the digital identity workstream, digital inclusion and exclusion, the New Zealand Digital Strategy, the Government Cloud programme, and then there are a few kinds of other minor things that we engage in across the big digital workstreams as well.

Te Whakatōhea-a-Iwi Factors of Āhurutanga

Tino rangatiratanga, being Māori, doing things the way Māori do things is an underpinning notion of being Māori. Future-proofing Māori space in an AI R&D space requires practising ethical practices. Graeme shares his thoughts on ethical practice in his work:

I think the trick here, which I'm finding is a bit difficult, is that all research applications have to identify a mātauranga, there's a mātauranga Māori component to it. What I'm seeing that riles me just as much as not being included is they make broad statements like, we will develop a tikanga-based AI system. They don't really understand the work that needs to go into that development because they think in a very process orientated way, you know, you put some mathematics together, and you do this, and if you use the current methodologies they use and then through some magic lens tikanga will guide you through that process. Again, it's not that I don't think we could do it and given the time and

the opportunity to think about that, but I worry when institutions, particularly academic institutions, are forced to put through their own, you know, they're not capacity, is forced to put in these broad conceptual terms, and try to leave it up to Māori to try to develop them application when we're still stepping through the process. And as you say, very thin on the ground. I worry that sometimes that could just lead to a lot of dead ends in terms of bringing people into a process that actually isn't well thought through.

An affirmation is a statement of truth one desires to incorporate into their spiritual life. Affirmations are active and valuable, they are not just wishful thinking. They function because they are founded on higher truths, which are customary in how Māori do things. Kaye-Maree suggests that the context of the industry of Māori digital platform developers requires:

They think about tikanga around whakapapa and putting it into the platform. I reflect on my and my team's whakaaro (thought, opinion, plan, understanding, idea, intention, gift, conscience) which I believe is always of interest, was the developers being very mindful about the tapu (be sacred, prohibited, restricted, set apart, forbidden) nature of the work. So, they have been discussing things like the special karakia they use when coding.

Kaye-Maree expands her kōrero by declaring that:

I know they're keen to have wānanga about tikanga in technology and how we think about this tool as an enabler for our aspirations around the continuity of our consciousness, the protection of our kawa (Māori protocol and etiquette) and tikanga and, just like it's the well-being of our people.

Our ability as Māori to identify with our culture helps our whānau to know where we belong. Aunty Ri's whānau concur with this notion and articulate by sharing:

Our Cousin Mo was talking about a feeling. She spoke about how we can be connected when we live far away. There's an opportunity for people to feel more

engaged with what's happening here. Or perhaps feeling more empowered to contribute or have some ideas ...

The high-level activities that go into governance include planning and making decisions that will help Māori realise their goals within the context they are involved with. Te Kahautu shares his experiences around the kaupapa of restorative justice within the context of kapahaka:

Restorative justice, restore the equilibrium. If you don't have that balance, things go wrong, but you need good leadership, good strong leadership and visionaries. The leadership needs to be accommodating, and the leadership needs to be open to criticism, open to new thought systems, and open for review. Leadership also needs to know because leadership always needs to be cognisant of the future and the needs of the future. Leadership needs to be prepared to service the needs of the future, even the unforeseen future, the unknown future. The leadership needs to be a good communicator as well as a good listener. That's all about being part of that safe community, safe environment.

Rangimarie is working on the achieving of taonga Māori for Te Whakatōhea iwi and shares the way she navigates the tensions between the cultural differences between Pākehā and te ao Māori viewpoints around labelling systems and points that Māori:

...have to establish Tikanga Knowledge Labels to ensure they suit us, our taonga, and our iwi.

The ability to develop understanding to identify a position from which to talk by seeing, listening, and then, possibly, speaking provides a space for creating a better understanding with whom you are talking. Kaye-Maree shares an experience where listening to people has helped find a solution to a collective kaupapa:

So that's been part of how we govern, and I think our approach is very much community orientated. I've learnt that people don't really give a shit about how the internet works, all they want to know is that the thing works. So, whilst we've

gone out into the community to explain to them what this technology is and how it operates, really, people just want to have a tutu (play) and get on with it and use it. That means that their experience helps to design, develop and refine the technology better because we're getting that direct feedback from our people. So, the other important factor is ensuring the user experience is included in our decision-making as responsible directors.

Te Whakatōhea-a-Iwi Factors of Whanaungatanga

We value whakapapa because it ties us to our tūpuna, whānau, whenua, iwi, and marae. It's how we discover our whānau's past and track our ancestry and how we come to understand who we are, where we came from, and where we are going. Te Kahautu

Capacity building, like Richard's kids, are the musicians, Richard Mitai's children, Thomas and his brothers. So, they get together as a whānau, as Richard gets together with his kids to create music, and so do his children. They still get together with dad and the children. I'll sit with them or the Williams brothers, Fred and Jimmy Williams. The music families, you know, the Kurei whānau. But we have to be open for, as I said, criticism if the tune sucks, it sucks

Suzanne's understanding of the multiple roles held by ahikā, including the authority as kaitiaki of their lands and taonga, and their significant contribution to authority as kaitiaki is highlighted in this statement:

Because I think when you're far away from your home, I mean like, you know, all of the whānau who live, for example, who live near our marae, they are going there regularly because there are always things on. But when you're far away, it can be a long time between getting home or, you know, going to a celebration or going to a tangi

Our research believes our collective vision is similar to our tūpuna's. John reflects on the use of photos of our tūpuna as a form of storying,

You would have known I took many photos in the meeting house the last time we were there. And I guess my vision was that you could go on a virtual walk around the meeting house and see all the elders there virtually, online. So the stories will carry on, and we're using their resting place in the meeting house as the starting point of the storytelling.

In the past, John's experiences around the question of tūpuna photographs being displayed online were discussed rigorously. Whether he could place these photos online to share with whānau was often denied.

A Māori system of connection is the tuakana/teina relationship. Our whānau wānanga was intergenerational, which meant that in some wānanga, we had grandparents, children and grandchildren in the same space. At times, our grandchildren were more knowledgeable, could offer solutions that engaged emerging technologies, and spoke confidently and humbly about the kaupapa. Our Aunties sometimes told stories around the tikanga our Nanny and Nanny Pa practised when preserving food or rotating crops. Intergenerational respect was again at the forefront of our minds as I reflect below:

Intergenerational knowledge within our whānau will be crucial because we know from the change of technologies that the philosophies of why and how we use the technologies have changed. We'll need to share the knowledge of the generations with all of us.

The notion of whakapapa connecting us to whenua was as significant as whakapapa connecting us to whānau. Whenua means *land* or *state* or *domain* and *after birth* or *placenta* (Hiroti, 2019). There was no expectation of which definition of whenua our research would follow. However, the understandings our whānau considered when considering the metaphorical analogy of the *after birth* or *placenta* were to be reflected upon as the *land* or *home* or *house* in which babies are nurtured before they are born which becomes a term for a place of significance.

Te Whakatōhea-a-Iwi Factors of Koha

Mātauranga Māori underpins the purpose of constructive work outputs. Synergy is a powerful technique for making things function while using less time, energy, and resources without compromising output quality or quantity. It is created through a collective vision. Kaye-Maree and Hēmi share their collective vision

I want to see targeted and intensified investment into Māori technology across the spectrum. I want to see more money invested. I want to see organisations like Te Matarau that Lee's leading out, and on the STEM programmes, the coding clubs, I want them all to be fully funded to actualise and enable what they're doing. I want to see the Crown-funded programmes to help staircase or scaffold young people into technology jobs. I want those to be fully supported. And I think that I'd like to see in the future iwi becoming less reticent and less fearful about investing in technology and for us to have a whole series of Māori VC funds, Māori investment collectives, Māori or iwi also establishing within their commercial systems ones that are just dedicated solely to technology.

Recognise people's future aspirations and how joining our collective vision will help realise those aspirations serving to amplify success and increase participation. Maui articulates his understanding of collective vision:

It's a kind of interesting one. There's a distinction between AI and data because we did that report around Trust and algorithmic decision-making. We're making the things we don't see as being separate, the data, and then the things that get used to doing it, partly because we feel more comfortable talking about the data than AI. AI is just the how it then gets used, and that's been using these different automated tools to do these things on our behalf, so I don't necessarily have a problem with that, what is it being directed towards and the ability for us to make use of it is, once again, that it comes down to that capacity one. We need to have people that understand those tools, which ends up being part of the challenge. The people that understand those tools aren't necessarily the ones that know the cultural context. Then the ones with the strong cultural context know enough, so if you want to do these things, you have to know how to bring

those different people together and have them work together to allow that to happen.

We are witnessing Generation X, those born between 1965 and 1979/80 and Millennials, those ages 22 to 37 in 2018, exhibiting more racial and ethnic diversity and demonstrating employment and financial freedom. Millennials and Generation X are also stalwarts of mātauranga me tikanga ōna te reo Māori. Affix this competency with a Generation X and Millennial mindset; we are bound to see generational cohorts of younger and older adults holding different viewpoints. Rangimarie shares this experience that illustrates the voice of intergenerational cohorts:

We do, but in terms of pushing through those intergenerational barriers of being reliant on a system that we've somewhat been made to believe works for us, and then we see otherwise. Well, actually, no, that system used to segregate and oppress our people, like we want to do it differently, but then it comes back to the whole tikanga. Well, who are you to say that our elders? Who are you to question that? We're like, "Well, for how many generations has it not worked for our people?" We come along and can see a solution, but you're stopping us from implementing that solution because you're scared to let go. It's time to try something different.

The ability of Māori to create a lasting impact on our economy and well-being can be seen here when Arihia speaks about Te Whakatōhea Treaty claims:

*So, there are two paths. ... we go through that Tribunal process... start the settlement negotiations... but single handedly, Whakatōhea have changed the Crown's policy and are proceeding to do them simultaneously.
#changethenarative*

Ako - The Principle of Culturally Preferred Pedagogy

The Principle of Ako emphasises the importance of employing ways of doing things and sharing how to do culturally sensitive things. A further distinction is that the ways

of doing and sharing things can be actioned as an intentional act of doing things. This principle acknowledges teaching and learning practices inherent and unique to Māori and practices that may not be traditionally derived but are preferred by Māori.

Amber provides an example of how in the arena of the technology of AI in her field of gamification artwork provided by iwi members, the preference being the Principle of Ako, the Principle of culturally preferred pedagogy:

With the work we're doing with Tūwhiri²², a lot of the art content and the game assets have been created as part of that kaupapa from iwi-given content, content that's been given to us by iwi ... we actually can package that up now and create ... an educational piece, so we explain to them how it works, what it looks like, where it sits, how they benefit from it and how it safeguards their copyright concerning that content we've created for them.

These intentional Māori ways of knowing, acting, and comprehending the world are viewed as legitimate in and of themselves within a Kaupapa Māori paradigm.

Te Whakatōhea-a-Iwi Factors of Āhurutanga

With our Mums and Aunties using social media, it became apparent that not only do tamariki and mokopuna need to safeguard conversations around the internet and while using technologies, but so do our kaumātua:

Having the ability to look after our vulnerable, whether it be a 90-year-old or whether it's our 15-year-old tamariki or moko, is a priority. Again, these conversations will help us determine our whānau safety and well-being.

The action of Spiritual affirmation being made should also be noted as a preferred way Māori like to do things. Therefore, the positive and successful indicator of Spiritual affirmations were made has been placed in Ako - The Principle of Culturally Preferred Pedagogy.

²² The Tūwhiri app uses the voyage of the ancestral waka Te Winika to tell the story and includes interactive rewards such as discounts on park merchandise.

Karakia are said to invoke spiritual protection and direction. They are typically employed to strengthen a group's spiritual ties to boost the likelihood of a successful outcome. The discussions around the impact of Christianity on pre-1840 Wairuatanga are wide and varied but also fall outside the purview of our research. However, Christianity has firmly established itself among Māori, and the traditional sources of the marae continue to give it life, giving my whānau the strength to alter our culture, aspirations, and destiny. In a similar vein, Dawn Hill (2004) discusses the importance of karakia during her mahi kapahaka and the ability of karakia to impact tino rangatiratanga:

Karakia plays a crucial role in the operations of Ōpōtiki-mai-tawhiti Kapahaka. It determines the protocols for all our gatherings.

If karakia can help determine our culture, aspirations, and destiny, can we not expect the same determination in a virtual world? Here, Te Kahautu suggests Ako, a preferred and intentional way of doing things, also operates in a virtual space. However, he enlarges the kōrero by declaring:

... nobody, nobody is doing the research. There's a huge gap within Māori tikanga on hāhi²³, but Te Whakatōhea feels we can maintain our values and have now moved to another realm where the Ra²⁴ are practically online now.

Several Māori practices emerged from research wānanga, including respecting the preferred meeting practice of kanohi kitea. The custom of kanohi kitea is about the importance of face-to-face meetings with people. An essential value in Māori society is that people meet kanohi ki te kanohi so that whakapono, (*trust*) and the whakawhanaungatanga can be further built upon. Even though our whānau wānanga were conducted online, it was observed that our whakapapa provided connection, and the connection provided kanohi kitea experiences. These experiences facilitated

²³ Religion

²⁴ Ringatū faith days

beneficial and productive online wānanga. From personal observations, I saw that because we already have a set of protocols to use when we're in face-to-face meetings, we know the cues and what to look for, and these cues help us with protocols, for example, who might talk next. It might just be raising an eyebrow or somebody's eyes open up, and you think, they have something to say. In an online meeting, we often miss these cues.

The Whānau discussed tikanga Māori that would assist us while engaging with emerging technologies. These tikanga Māori included:

- *Respect tikanga*
- *Become familiar with the platform*
- *Depending on the size of the wānanga, utilise the mute function if or when required*
- *Use the raise hand function*
- *Respect the participants*

The Imrie whānau acknowledged that it is:

... very cool, very cool that distance is not an issue with this technology, but we can't embrace and hug and all those sorts of wairua stuff you do face-to-face. But if we can't meet face-to-face, this has got to be the next best thing.

As a reminder, Herehere emphasised the fact that even though we can gather online, her preferred way of meeting is kanohi ki te kanohi, stating:

Well, lately, I've used it mainly for school and connecting to my teachers and whatnot since Covid. I didn't like it because, face-to-face, you get more... yeah, it's different.

Taking these ideas further, Kirikowhai develops the notion that mātauranga and tikanga helped unshackle the bonds of colonial oppression by sharing:

... we can't compete with the Crown... what we can do is provide different enlightenments with the particular leaders and the kaupapa we're trying to drive.

The whānau agreed with Kirikowhai's reality and conceded that the coexistence of fighting the Crown and providing pathways for the betterment of their people needs expert navigation. More importantly, many of the whānau had physically been in the presence of each other and having met kanohi kitea provided a bridge for the whānau to feel emotionally connected when in the online environment. The tikanga of kanohi ki te kanohi was seen to assist with furthering whakawhanaungatanga between participating whānau while online. Also, acknowledgement and respect for cultural practices were required when planning emerging technologies such as online wānanga.

Ako practices were a very observable Kaupapa Māori Key Principle during whānau wānanga. Ria discusses her educational experience and says:

As for me, it's about education, right? So like, I turn to the internet if I don't have an answer for something or if I'm looking for anything, I'll ask the internet a question, and you know we're not based back in Ōpōtiki, we're not based around the marae, I don't have the education around... If you're not immersed in it, you don't know what's happening. I don't know if there's just information I can go to if I need it... The experience of being on the marae during a hui or a tangi or something is never going to be able to be duplicated, I don't think by an online environment, but the knowledge around how those things work would be good to... like, just being able to learn.

In contrast, when considering tikanga and the principle of Ako, Ken reflects on his online gaming experiences and gives detail about the building of different modules in mixed reality entertainment and how these modules provided self-determining options for the gamers, commenting:

You could build modules inside of modules, which allows you to explore in a virtual reality world, inside the meeting house at the marae and then gives you the option of listening or finding out, diving into that story, or moving on to the next one. And then, once you click on yes or no, it opens up a new module of that story. That's a pretty standard feature in a lot of games, especially ones that are based on history: if you wanted to dive into that storyline, you could, and then you'd follow the path that they'd lay out to tell that story in whatever manner you feel like doing it in.

As a group, our whānau also acknowledged the importance of Ako when crafting tikanga around personal data protocols, with the following comment by Maui summing up that discussion:

So again, just sharing this one here of governance and intellectual property, one piece of information to somebody will have a different protocol of rules, so each person has that right to protect the data however they might want to do that, and that protocol of protection is tikanga Māori or the excellent practice. And all the words thereof manaakitanga, looking after things, rangatiratanga of having individualism about something, there's a wairua or spiritual considerations that need to take place. Kaitiakitanga, the full guardianship, reasons why they should be and how we can become good guardians of those.

Graeme discusses the notion of smart-energy-marae and how the generation of surplus electricity can be determined by whānau and shared with those in need to address the issue of high energy costs:

If I think about it in a grid, since the kaupapa for our grid, or our particular thing is, we have five marae, three whare that we have put solar on. The marae, where we use that energy and any excess energy, is delivered to whānau suffering from energy poverty. So, the idea is to share and lower bills and lower the costs to the marae, and that tells us that's the premise.

Graeme develops his kōrero by adding:

One of them is about a Smart Māori Grid. I've been working on that. They've got this idea, and I wonder how that could work. But they have an idea to develop an AI to manage the Smart Grid, and what I've seen them talk about in that is a tikanga-based AI. For me, that's a bit beyond where I would go, but they've inserted that.

When I was thinking about that, I was thinking about the work you're doing and whether that is... and as I say, it's a long-term stretch, one focused on a Māori grid, they think that there is some potential in developing a ground-up AI based on a tikanga Māori approach, and I'm not sure whether that's been done or whether that's doable, something we could do, but it isn't an area that I am strong on, yet I am pretty interested in the application component.

When discussing issues around Ako, another example came from Hēmi, who acknowledged the importance of having governance of our Māori data and ensuring that the repositories built to house data are designed by Māori, with Māori and for Māori:

The government uses several data centres in Aotearoa, including Amazon, Microsoft and Datacom. So, Kelvin Davis MP is adamant that we should have our own, and the maraes want to build their own.

Similarly, Vanessa speaks to the well-known issue of Māori data sovereignty, Māori empowerment, and putting indigenous data back in indigenous hands:

A real technology-oriented analogy is to look at a stack of data as the layering of a cake. If we don't have our data, it doesn't matter what you're doing, you don't have your data to make your decisions. We would not be able to put the right sorts of care and protection into that stack of data that we want so that it's available for the next group that comes along after us.

When reflecting on the existing frameworks for data sovereignty, Māui identifies dialectic tension between what governance models are set in place, asking the question of whether these models are culturally appropriate:

In these spaces, different sorts of governance sit in place. Ways that people make agreements about what things can happen with data and what things can't happen with data, often driven by commercial imperatives or legislative responsibilities and regulatory things, and privacy issues. They usually have things in place, and there's a merging between what that looks like and whether cultural sensitivities need to be managed. Then, governance has been one of the opportunities to participate in those processes.

Data gathered and used by ARA journeys remain in the guardianship of the iwi or individual iwi members, which was affirmed by Amber:

Our IP strategy is pretty straightforward and has been from the get-go. The company owns the IP generated from creating the platforms we're making, including the code, the software, and anything happening in that space. In terms of content, that's always owned by iwi or the person who gives us that content to put into the three platforms.

Moreover, Kayla, who resides in France, shares her thoughts about the importance of our stories by articulating:

I agree, too, you know, like all the stories I hear from the reunion, they're pretty cool because I don't even get to go to the marae that often ... I guess people have to put time aside to educate us in our whānau history. I feel like the stories before us are just as important as ours.

Another element of Ako that emerged from the wānanga included the social and environmental changes that can affect Māori and often result in the ongoing evolution and adaptation of whānau identities. Here, our research has identified:

1. whakapapa, and

2. whenua, as vital themes to be fostered to ensure positive and successful engagements

with emerging technologies. Furthermore, our whānau specifically distinguished stories as our prioritised taonga tuku iho. Hence, affirmative validation around our taonga was heard during our whānau wānanga. Steve upholds this notion, stating:

The strength of the culture is sharing stories.

Michelle supports Steve's thoughts by declaring:

I feel that the stories before us are just as important as well, not just ours.

Michelle, who resides outside of Aotearoa with her immediate whānau, also recalls that:

At the last reunion, we went around the grave sites and heard all the stories, that's cool stuff!

Michelle goes on to expand the kōrero by adding:

... but that's available when we're at the reunion, but imagine just turning up today on your own or, you know, just the three of us, for instance, and seeing all these grave sites and going, Oh, I wonder who this person is and who that person is? I'd be lucky to know who a lot of those people are! But if Brianna turns up in ten years on her own with her partner and children or whatever, if you had QR codes or something on the headstones, you could just go, boom, and there's all the information about this person.

Continuing the theme of storying, Mark, who currently resides in Australia, articulates:

When we have all the aunties together, and they're all telling us stories about, you know, Mum will tell stories about when they would go to school, you know,

their feet were cold, and they'd stand in cow pats and things like that. You see, it's cool to have some way of recording little stuff like that.

Mark also argues that:

We've got to do it (collect our stories) from more than one place, wherever we can, written or recorded in whatever form - electronic, in the video, in whatever way we can. The more platforms we have stories on, the better.

Tiwai, who resides with his whānau in Germany, corroborated the importance of recording our stories and keeping them safe as he can, stating:

I can only remember seeing Nanny and Nanny Pa maybe five times in my life, and people must be writing stories about Nanny and Nanny Pa. I think I was 14 when Nanny Pa died or something like that. So, I couldn't write a story about them. I could write about when I saw them at Christmas because the only time we went to New Zealand was at Christmas, so all the cousins were coming, but there was not quality time in that sense, with our grandparents. And so, it is cool to read about what you guys who spent lots of time with Nanny and Nanny Pa thought and felt about them.

In addition, Tiwai shared his keenness to contribute to the recording of whānau stories, noting:

... that's also a good opportunity that we have when our stories get passed down from generation to generation by mouth, every generation puts their interpretation on the story or changes little bits of it or forgets bits and so, in this sense we'll be keeping it true to the person who told the story, or the person who experienced it.

One particular issue related to Ako includes discussions around tikanga, colonial control and the prevalent imperial theories and practices that occurred while our whānau engaged with emerging technologies. Here, the whānau unanimously voiced

their respect for tikanga Māori from our past and present practices. These were significant factors in navigating colonial ideologies while engaging with emerging technologies. The following comment by Maui aids in defining how tikanga has been implemented by the whānau, commenting:

... tikanga relates to customs, the practices, so what you find is it's a particular instance where a business is working with a group where they create their thing and develop their tikanga around how to make it work.

In addition, our whānau commented in solidarity on their agreeance that tikanga Māori helped the whānau remain in te ao Māori while also enabling whānau to navigate the colonial impositions experienced while engaging with emerging technologies. Kirikowhai supported this reflection by articulating that:

Regarding the AI space and the digital and data space is that (we need to pay) respect to tikanga.

Kirikowhai continued her kōrero around the contextual use of tikanga in an online space by explaining the need to pay attention to tikanga around intergenerational wānanga and asserted:

We need to have wānanga with all the different cohorts of our people and other age groups.

Across private and public sector organisations, mātauranga, tikanga, and te reo Māori advisory groups provide strategic advice to management with an essential assembly of experts. Amber imparts to us how critical their company's mātauranga, tikanga and te reo Māori advisory group is, noting:

I rely heavily on our (tikanga) advisory board and mentors. The board comprises a whole heap of skills, expertise and capability that we don't have sitting in the team as employees, so we're lucky to have this kind of round table

meetings with people. (The) board guides our company regarding tikanga and the tech space, ensuring that we operate safely and respectfully.

Similarly, Te Kahautu talks about a modification in tikanga which allows for greater flexibility within a practice that enables further transformation:

A place of learning, that's a good one. Or the pure innocence of a child and probably saw the state of the hāhi, that there weren't many young people following, and allowed for this, what would I say... a slight change, I suppose to the tikanga or the flexibility. Allowing tikanga to be flexible enough to allow me to go and enter. I don't know what Himiona was saying. He was probably saying karakia about protecting me from the breach, allowing me to remain and be part of and feel safe.

Te Kahautu went on to develop his kōrero further by emphasising the need for leadership in the process of tikanga transformation:

Then it comes down to, like Monita, who came in after, and he showed that same leadership, role modelling, same leadership and the softening, I suppose, of those stringent rules to allow for the growth ... and then there's, of course, Auntie Bella and them. It's about accommodation. It's about seeing the unseen future, allowing change within the tikanga and knowing that you're allowing a change, an adaptation, but the tikanga is still being maintained.

That's not a new thing. I looked at the wharemate²⁵ when I was young. They (the whānau of the deceased) were fed in the dark, early in the morning, and late at night. And there was no eating between that. Then the practice changed, and I remember right up to around the time when Moewaka was living at Te Rere. But with the passing of Moewaka, Auntie Bella would maintain that, and then there was a softening of the rules where the whare mate would eat with everyone else,

²⁵ House of mourning

but they would have a separate table set aside with all the good foods, because they've starved for the whole day.

The Māori culture has had a significant impact on Aotearoa society. Our whānau, in unison, have voiced the need to affirm the ways Māori prefer to do things. However, our research has also identified challenges that need careful navigation, including the following categories of accessibility.

From the wānanga findings, the various discussions highlighted the importance of Ako (*the ways that we like to do things*) involved specific criteria for successfully engaging with technology. For instance, it was determined that for researchers to experience positive and successful aspirations, the following four categories of accessibility pertaining to emerging technologies must be observed:

1. Affordability
2. Users' capabilities
3. Access to a robust network
4. Personal need

In particular, these four areas were reflected on by the whānau in the following ways:

Affordability

Researchers acknowledged that financial considerations were needed for purchasing mobile and desktop technologies and data plans. Decisions around these considerations were impacted by how much each whānau member could afford, for what purpose the device or data plan was required, account arrangements that suited the whānau member, and the coverage area.

User capabilities

The dynamic of intergenerational online wānanga highlighted a wide variety of capabilities. Our Matua/Whaea generation line has traversed the vast expanse of emerging technologies. Aunty Ri described the frustrations of her use of new desktop technology:

Oh, you know, it only took three hours and was dead. Then it decided to lose the keyboard so that you couldn't do anything.

Also, Suzanne reflects on her Dad's annoyance with new applications:

Yeah, we used to use Skype. But people don't use that anymore. I think dad probably really misses the landline. Like that very basic technology (of a landline), for Dad... that's how he would keep in touch with all his whānau.

John considers his own experiences around his emerging technology capabilities:

So, we then had to find the person with the right tools to get me online, or this conversation wouldn't be happening. If you didn't have an iPad, which I haven't got, I mentioned the phone before, this would be so much harder, be useless on my phone because my phone is not as robust as an iPad. So, yeah, Google is the backing. It's enabled this conversation today. Tomorrow will be much more sophisticated, and the discussion will be much more different.

Access to robust networks

The digital divide in Aotearoa can still be seen through the lens of location. Rural areas still have poor internet coverage. Frustration was also experienced when things did not go to plan. It was decided that most of our whānau wānanga would be hosted in Zoom, not kano hi ki te kano hi. This decision caused problems for some researchers as the location they planned to attend had limited internet connectivity. Ripō advised:

We are heading to Māhia this weekend, and our internet signal is weak. I'll try to come in, however...

Also, Anaru, who was travelling back home to join our wānanga, had the following experience, causing him to leave the following message:

Kia ora whānau, I'm on the train going home, but my signal keeps jumping in and out. Sorry, whānau am probably not going to make it home in time to jump in)-:

In a similar vein, Herehere discusses the issue of rural internet connectivity:

We live up Dunlop Road. We're situated in an internet outage area, so everywhere on either side of us can get the available internet, the fibre. Around on either side of us can get it, but right where we are, it's unavailable. So, we're still on just 3G or 4G, whatever. We get a slow network up here.

Herehere went on to voice her frustration around rural connectivity issues:

I think we just have to put up with it at this stage. I'm unsure if they're (Spark) bringing anything out towards us because down below us, where the trucks are, they can get it, Paerātā²⁶ can get it, and on the other side of the ridge, they can get it. Up Woodland²⁷s, they can get it. It's just on the Spark internet map, it shows the one ridge where we are, we don't have good internet coverage for some reason.

Herehere also reflects on her navigation experiences in Zoom while enrolled in her undergraduate studies:

We have one paper that is predominantly online because our kaiako is down south, so she teaches us through Zoom, and even from her class, it shows that it's not working because a lot of us are not engaged. It's hard to communicate with her because of internet problems, and then people miss her lectures because they can't get on where they live.

²⁶ A part of Ōpōtiki, on the outer edge of Ōpōtiki

²⁷ A part of Ōpōtiki, on the outer edge of Ōpōtiki

Yet, Herehere draws on a contrasting point by highlighting some of the more positive accessibility aspects that have arisen out of Covid, stating:

They also have lousy WIFI, but at the same time, it still allows sick people to attend class. Because before that, it wasn't an option. But since COVID, they've made it more accessible for Zoom for people who are at home sick.

Another whānau member, Michelle, commented on the accessibility increasingly built into online applications, highlighting job recruitment as an example. Here, she suggests how an AI application can promote jobs in Te Whakatōhea:

Question: This is the one that I just thought I'd share – animated trending systems. I know it works well in business regarding looking at finance trends, mortgage trends, housing trends, and those types of things. Outside the box in this one, how could those trending AI applications be shifted to a storytelling environment?

My mind goes to your cousin Sharon, who is looking for ways to support jobs in the region, seeing actual trends in the economy, the uptake of employment, and Māori people in the area. It might help to give information to people who are thinking about investing in certain areas in the Whakatōhea.

Authentic Māori governance is enhanced when delivered by Māori, with Māori and for Māori. Tahu shares her thoughts about governance:

There's a lot of data governance per se, mainstream models, nothing fits our context. There's a lot of Māori governance mahi and rangahau that's been done, you know, there's that big book that just came out by our colleague, Robert Joseph and others. So, we've got colleagues digging deep into governance with a big 'G'. Some of that injustice, too, has come out of our relationship with the kawanatanga, and as we stand up these entities, these entities have resources. We need to have robust governance around it. That kind of stimulated a lot of thinking in that area, and there's stuff we can learn from that.

Vanessa also provided an example of when Māori governance is called for:

To get to AI development, I guess for me, it's a general recognition, it's software development. We're not talking secretive stuff, it's still fundamentally software development. My view is probably that the foundations could guide the context. So, suppose there are some foundations around software development and some governance that goes around that. In that case, that sits in a Māori domain. To me, it's an extension, and how do you use some of those foundations, or how might they apply to AI-related contexts?

Similarly, Marie-Louise comments:

There are differences, but there's a consensus now that the language is like this, that the language is going in this direction. The nuances of each tribe or each hapū, iwi and whatever, there are different little nuances within the languages and tikanga and kawa of each one, that's one thing that I think there's a danger within an overall internet type-based learning that those differences will disappear.

Marie-Louise extends her kōrero by proposing that:

... mātauranga, te reo Māori, and whakapapa can all be used in conjunction to understand an internet system and help us create a Māori internet system that is viewed through the lens of te ao Māori.

As highlighted by the above comments, whānau discussions often developed as we listened to each other's kōrero and strengthened the debate's kaupapa by furthering with the word 'and' rather than the word 'but'. The term 'and' tended to add complimentary support, as the word 'but' had the habit of negating the kaupapa of the kōrero.

Moreover, it was agreed that our whānau were confronted with the imposition of colonial imperialism in wānanga mariko. However, the whānau experiences underlined around whakapapa exemplify the critical role whakapapa plays in mitigating power and control imbalances in our wānanga mariko.

Te Whakatōhea-a-Iwi Factors of Koha

Ria describes her relationship with things on the internet and how the factions and facilities of the internet create constructive and positive work output:

You know, things like that. It's almost like I have to find the time to be physically present and online at the same time, you know what I mean? Because it's almost an instant... I can send the parents what the kids are doing right now, and they can interact with it immediately, like I often do. That might be in the middle of when we went to the Easter Hunt and stuff like that, so I'm sending little video clips to the parents immediately, and they're sending messages back to their kids. If we didn't have IT, we wouldn't be able to do any of that.

Kaye-Maree outlines how she and her team work collectively and intentionally that provides pathways for Māori as they navigate the structures of the Crown

I think the Crown can be your friend or your foe, depending on the time of the day. And I've worked exceptionally hard to utilise the Crown where they need to be used, particularly in resourcing kaupapa that are driven by us and for us. An area that's emerging for us is the development of digital identity. So, I've been hammering on the digital ... because we've got the whakapapa piece in the archival system. Still, the next bit of work is in how we identify ourselves digitally and how we use systems that you would not be prevented from participating because you don't have access to a birth certificate or a passport. So, two years ago, I was very intentional. We did another accelerator programme that the government funded, and we got supported by the Department of Internal Affairs to unpack what this kind of Māori digital identity looks like and what it could be for us.

It is challenging and exhausting fighting the Crown to ensure that progress continues, Kirikowhai shares,

Fighting the Crown is my reality every day, and it's exhausting. However, we are making a lot of progress... the progress by individuals and groups is threatening some people, who then develop into multiple attacks on what we're trying to do. And because we're trying to make a change, people feel uncomfortable.

However, this has become normal, rightly or wrongly, but...

... and so all that comes with it are personal challenges we must try to navigate.

Dayle enhances Kirikowhai's comments by sharing her experience with governance structures in her field of work, Environmental resources,

So, governance structures are problematic, I don't think there's any perfect model. It's always about putting the right people in the right roles. And it's a struggle, particularly for commercial entities, because if they're going to be tuturu (staunch), they still need people in those entities that understand those connections to whenua, and values and things because it is all connected.

Amber empathises with Kirikowhai and Dayle but is consoled by the fact that other Māori whānau are doing the mahi and are on the same kaupapa:

The two or three other whānau working within the private sector have tended to be on a similar kaupapa. You are out there in the front of that envelope-pushing that envelope, and the government is managing to catch up.

Māori need to be at the discussion table at the seeding of all governance policies so that the values of Māori are woven into the policy. Graeme emphasises this fact in this kōrero:

That's the thing, life's a journey, too. What I know now is very different to what I knew 30 years ago. But unless you are on the journey, you can either get to a point where you can contribute some of those higher-level thinking, you know, the fact that I took the journey with the Treaty, you know, it was to leverage the Crown. But it's now allowed me to rethink things like what we're leveraging. What gives the Crown the power to create this value, wealth, and decisions around resources? And we keep being on the back foot, so, you know, consolidating around this idea that everything must remain in balance, why the Crown doesn't force its hand with legislation, you know, it's not until the Crown does, and often we react.

Dayle sees opportunities to develop sustainable policy when Māori are included in collaborative discussions:

They are sort of opportunities, but it always comes down to an issue of capacity and capabilities. It was a political attempt at the time, back in the days of the Māori Party and Iwi Chairs, where they managed to hustle this whole concept of Te Mana o Te Wai²⁸. There's an entire case study; you can look at all angles. As a planner, I always felt uncomfortable because it's not a term that sits well with me. But if I acknowledge that it's a lever for more robust engagement, maybe collaboration, but better models for freshwater management, then, of course, I support it.

It must be noted that observing appropriate ethical practices is a preferred way Māori like to do things. So, the positive and successful indicator of an Appropriate ethical approach has been placed in Ako - The Principle of Culturally Preferred Pedagogy.

²⁸ Te Mana o te Wai refers to the vital importance of water. When managing freshwater, it ensures the health and well-being of the water is protected and human health needs are provided for before enabling other uses of water.

Whānau - The Principle of Extended Whānau Structure

The foundation of Kaupapa Māori is the concept of whānau. Whānau recognises the connections that Māori have with one another and their surroundings. Whānau and the process of whakawhanaungatanga are fundamental to Māori society and culture. The Principle of Whānau accomplishes whakawhanaungatanga by offering a culturally focused *people* structure to aid in the relief and mediation of social, economic, parenting, and other everyday life challenges. The Principle of Whānau enables the use of Māori cultural values, traditions, and behaviours to organise collective responsibilities. Therefore, in this cultural setting, problems are not found in specific people or homes but in the entire whānau. The whānau assumes the collective duty to help and act. The whānau structure suggests a network of support for each member but also places mutual responsibility, duties and obligations on each member. In this sense, individuals are culturally obligated to aid and support members in their whānau and extended whānau structures (Smith, 1997a).

Te Whakatōhea-a-Iwi Factors of Āhurutanga

Whānau inclusiveness, as Kayla points out, rather than only as individuals, has a strong emphasis in our Research:

Is there a way that we can apply that to artificial intelligence? Because I guess if we can apply the knowledge in that book to artificial intelligence, it's much easier to update it, and it is, like we said before, remote. If new whānau is born into the whānau, we get given the information almost instantly, a notification or something like that. And people could attach stories to that too, I don't know how it would work, but I think when I look at the storytelling, the one thing that is physical in my world that I can always go back to is that book, which is really, really cool. So how could we apply that and have someone working alongside, maybe like a kaumātua that could be the guardian of this artificial intelligence space, which links people and stories altogether? I don't know, you could do the same thing with the computer vision or the AI thing, I just don't know how you'd link the whānau stories if you're in a physical space, trying to get, I guess, like the history as well, or would it be separate?

Kaye-Maree provides context to her and her team's affirmations around supportive karakia practices in the workplace:

So, there was a tikanga around whakapapa and putting it into the platform. Still, the other part, which I think is always of interest, is the developers being very mindful about the tapu nature of the work. So, they have been discussing things like special karakia used when they do the coding. They have considered fasting so that they're not mixing kai and their mahi, so I think that's important concerning the management of tapu and noa around that space.

Te Kahautu reminded us that Māori are the guardians of our culture, and the way Māori do things is the legacy of their ancestors:

We've gone through some testing times looking at ways to mitigate that and how to navigate your way through to make sure to restore that restorative justice and restore balance. Sometimes the perpetrator returns because whānau members are there, and you must say you can't be here. No matter how skilled that person is, I would love that person to contribute to creation and design.

Amber recognises that whānau well-being is closely linked to whānau working collaboratively:

Two or three other whānau working on similar kaupapa work within the private sector. You are out there in the front of that envelope, pushing that envelope, and the government is tending to catch up.

Aunty Ri highlights the importance of remaining connected as we navigate the colonial impact on mātauranga and tikanga Māori:

An example of keeping connections is when I get a visit from my sister, from Patu, every time she walks through my door, straight behind her comes our cousin Gina. It's pretty beautiful to watch that connection. It's as if they've lived

beside each other for years. The conversation just carries on. To me, that's one of the finest connections I've ever seen.

Whānau discussions often developed as we listened to each other's kōrero and then strengthened the kaupapa of the debate by furthering with the word 'and' rather than the word 'but'. The term 'and' tended to add complimentary support, as the word 'but' had the habit of negating the kaupapa of the kōrero.

Yes, our whānau were confronted with the imposition of colonial imperialism in wānanga mariko. However, the whānau experiences underlined around whakapapa exemplify the critical role whakapapa plays in mitigating power and control imbalances in our whānau online wānanga.

Te Whakatōhea-a-Iwi Factors of Whanaungatanga

Our whānau acknowledged that our partners, wives and husbands were inclusive in all wānanga conducted during our Research. Guidance around this kaupapa was observed with this statement,

That is cool, and you know, whānau, whānau, whānau. Our concept of whānau has been taken control by how European families look. But our whānau, when we talk whānau, speak about the inclusiveness of our whāngai (foster child, adopted child) and our hoa wahine (wife or female partner) or hoa tāne (husband or male partner). You know, whānau is whānau, so I'm pleased that we can all represent.

Ali cemented the importance of whānau when she elaborates on their whānau's arrival in Auckland for the first time:

So, when we finally arrived in Auckland, I just remember seeing all these new faces and a big, huge, loving, beautiful whānau, so it was a joyous occasion for me.

The whānau are advantaged by having whakapapa. We are familiar with each other through our whakapapa. Knowing each other was influential in forging and shaping relationships in wānanga mariko. Whakapapa was vital in mitigating power and control imbalances in our whānau online wānanga. Māori are confronted with the imposition of colonial imperialism in our everyday lives. So, the question was asked why we would not expect the same thing in our online experiences. Whānau has identified whakapapa, as a significant theme for the whānau.

Amber recognises the creation of pathways for our future generations:

It was good timing because a big part of what I want to do this year is to take the company internationally. So, we've got connections over there. Manu's in a few countries, but now it's looking at how our other First Nations people bring their stories and start preserving these smothered generations, especially with the loss of language worldwide.

Kaye-Maree shares her thoughts about building a future for the next generation:

There's this absolute focus on future generations and enabling whānau to access this mātauranga and continue to build and grow from there.

Aunty Ri's whānau discuss how they engage with emerging technologies to ensure moko can remain connected to their grandparents

Johnathon: I think you use Messenger sometimes because I must send you pictures of the kids.

Aunty Ri: Oh, yeah.

Suzanne: And videos.

Johnathon: And sometimes we have a little bit of banter.

Suzanne: You see Messenger more so than texting, it's the Messenger.

Aunty Ri: Yeah, because you're able to get the photos.

Suzanne: And the videos. Sometimes video calling is a bit harder, but not so much.

Aunty Ri: Yeah, I don't know why. Not so much.

Suzanne: At times, like in the past, it was Skype, and we Skyped for a little bit, but we haven't used the video function on Messenger.

Johnathon: We might send a video of the kids doing kapa haka or something like that.

Aunty Ri: Yeah.

Suzanne: Yeah, we'll always send photos, videos, and things.

Aunty Ri and I have a personal connection around the importance of intergenerational conversation to remind us of who is in our whakapapa and on what generational levels we sit:

And I'm still thinking, 'oh no', so I think it is also very important to keep reminding our tamariki and mokopuna of our generational lines within our whakapapa. Not the individual but who they represent because Aunty Ri, you're in that generation of my nanny's children, but there were times when you and I could have been cousins on the same line, eh, mum.

Pre-ethical determination conversations were essential for our whānau to be involved. If we did not get affirmation from our whānau about forwarding the research, the research would be dead in the water. Pre-ethical determination caused tension with the ethical requirements of the University's ethical application procedures. Whakapapa is a tool to understand the connections of relationships and how the relationships develop over time. The comment was made by our whānau, which recognised the notion of tika and pono, the idea of *correctness*,

Get something not quite right and feel the wrath of the angry aunty!!

John also discusses the need to navigate the tension of tikanga around the taking of photographs of our tūpuna being and the hanging of those photographs on whareniui walls and the unwillingness of some whānau to allow the photos to be placed online:

You know that I took a shitload of photos in the meeting house the last time we were there, and I guess my vision was that you could go on a virtual walk around the meeting house and see all the elders.

In the past, John's experiences around the question of tūpuna photographs being displayed online were discussed rigorously. Whether he could place these photos online to share with whānau was often denied.

Kay-Maree reflects on the requirement of tikanga to help navigate imperial ideologies,

...as indigenous peoples and our values firmly established within those spaces and that comes to your own practise, the way that you treat others, the way that you treat your team, the way that you conduct yourself online should be precisely the same as you would conduct yourself in real life. I think that our tikanga Māori approaches can help us navigate the future successful

Rangimarie reflects on how her tūpuna guides her and her whānau during hard times:

I very much love to believe that my tūpuna guides me. When things are hard, then you're going down the wrong pathway. I was like, you know, there's a certain level of when things are just permanently blocking you, you're not meant to be doing that and so being able to know and determine when you need to take a step back and take a different path and being humble enough to be okay with that, is what has probably guided me the most.

During our initial wānanga, whānau began to ascertain various skill sets and knowledge that each other possessed. Michelle, Brianan and Mark shared their knowledge sets and emerging technological capabilities,

We all have different skill sets that maybe each other doesn't know, or different knowledge areas like Mark was just suggesting, Mo, you might know areas about trusts... Marc has incredible knowledge around so many other things to do with trusts and all sorts... Brianna has become quite an excellent editor. She

has been editing videos. You know, my world is in technology and online communications. I guess I'm saying that we don't know what we don't know, and everyone has areas they might be able to bring to the table, do you know what I mean? Or from a technology perspective or a knowledge perspective.

Taonga Tuku Iho - The Principle of Cultural Aspirations

The legitimacy and centrality of te reo, tikanga, and mātauranga Māori are affirmed by this premise. These Māori ways of knowing, acting, and comprehending the world are viewed as legitimate in and of themselves within a Kaupapa Māori paradigm. It is possible to consider spiritual and cultural awareness and other factors by recognising their relevance and validity.

Te Whakatōhea-a-Iwi Factors of Koha

Within Ako, the Tikanga of Koha is important to highlight as it considers elements of change. For example, Ria describes her relationship with the internet, where connecting and exchanging data with others has become easy. This relationship includes how factions and facilities of the internet facilitate change via constructive and positive work output. She commented:

You know, things like that. It's almost like I have to find the time to be physically present and online at the same time; you know what I mean? Because it's almost an instant... I can send the parents what the kids are doing right now, and they can interact with it immediately like I often do. That might be in the middle of when we went to the Easter Hunt and stuff like that, so I'm sending little video clips to the parents immediately, and they're sending messages back to their kids. We couldn't do any of that if we didn't have the internet.

In another workplace environment, Kaye-Maree outlines how she and her team work collectively and intentionally to provide pathways for Māori as they navigate the structures of the Crown:

I think the Crown can be your friend or your foe, depending on the time of the day. And I've worked exceptionally hard to utilise the Crown where they need to be used, particularly in resourcing kaupapa that are driven by us and for us. An area that's emerging for us is the development of digital identity. So, I've been hammering on the digital ... because we've got the whakapapa piece in the archival system. Still, the next bit of work is in how we identify ourselves digitally and use systems ... So, two years ago, I was very intentional. We did another accelerator programme that the government funded, and we got supported by the Department of Internal Affairs to unpack what this kind of Māori digital identity looks like and what it could be for us.

Similarly, Kirikowhai reflects on her experiences working with the Crown, accentuating how challenging and exhausting it can be to fight to ensure progress continues. Kirikowhai shares:

Fighting the Crown is my reality every day, and it's exhausting. However, we are making a lot of progress... the progress by individuals and groups is threatening some people, who then develop multiple attacks on what we're trying to do. And because we're trying to make a change, people feel uncomfortable.

However, this has become normal, rightly or wrongly, but Kirikowhai goes on to rationalise:

... and so all that comes with it are personal challenges we must try to navigate.

Amber empathises with Kirikowhai and is consoled that other Māori whānau are doing the mahi and are on the same kaupapa. Amber stated:

The two or three other whānau working within the private sector have tended to be on a similar kaupapa. You are out there in the front of that envelope-pushing that envelope, and the government is managing to catch up.

The above quotes effectively demonstrate the uneven power balance in various workplace settings. As such, Māori need to be at the discussion table and the seeding of all governance policies so that the values of Māori are woven into the policy. Graeme also emphasises this fact in this kōrero:

That's the thing; life's a journey, too. What I know now is very different to what I knew 30 years ago. But unless you are on the journey, you can either get to a point where you can contribute some of those higher-level thinking and the fact that I took the journey with the Treaty, it was to leverage the Crown. But it's now allowed me to rethink things like what we're leveraging. What gives the Crown the power to create this value, wealth, and decisions around resources? And we keep being on the back foot, so, you know, consolidating around this idea that everything must remain in balance, why the Crown doesn't force its hand with legislation, and it's not until the Crown does, and often we react.

Overall, regarding the Tikanga of Koha, it must be noted that observing appropriate ethical practices is a preferred way Māori like to do things. So, the positive and successful indicators of an appropriate ethical approach have been placed in Ako - The Principle of Culturally Preferred Pedagogy.

Whānau - The Principle of Extended Whānau Structure

The foundation of Kaupapa Māori is the concept of whānau. Whānau recognises the connections that Māori have with one another and their surroundings. Whānau and the process of whakawhanaungatanga are fundamental to Māori society and culture. In particular, the Principle of Whānau accomplishes whakawhanaungatanga by offering a culturally focused *people* structure to aid in the relief and mediation of social, economic, parenting, and other everyday life challenges. The Principle of Whānau enables the use of Māori cultural values, traditions, and behaviours to organise collective responsibilities. Therefore, in this cultural setting, problems are not found in specific people or homes but in the entire whānau. The whānau assumes the collective duty to help and act. Also, the whānau structure suggests a network of support for each member but also places mutual responsibility, duties and obligations

on each member. In this sense, individuals are culturally obligated to aid and support members in their whānau and extended whānau structures (Smith, 1997a).

Te Whakatōhea-a-Iwi Factors of Āhurutanga

In her discussion around cultural practices, Kaye-Maree provides context to her and her team's affirmations around supportive karakia practices in the workplace, which share an alignment with Whānau principles and structure:

So, there was a tikanga around whakapapa and putting it into the platform. Still, the other part, which I think is always of interest, is the developers being very mindful about the tapu nature of the work. So, they have been discussing things like special karakia used when they do the coding. They have considered fasting so that they're not mixing kai and their mahi, so I think that's important concerning the management of tapu (be sacred, prohibited, restricted, set apart, forbidden) and noa (to be free from the extensions of tapu, ordinary, unrestricted, void) around that space.

Te Kahautu reminded us that Māori are the guardians of our culture, and the way Māori do things is the legacy of the ancestors:

We've gone through some testing times looking at ways to mitigate that and how to navigate your way through to make sure to restore that; restorative justice and restore the balance. Sometimes the perpetrator returns because whānau members are there, and you must say you can't be here. No matter how skilled that person is, I personally would love that person to contribute in terms of creation and design.

When considering how colonial ideology can impact the structure of the nuclear whānau, it is essential to acknowledge how this same ideology can impact the typical structure of Māori whānau, which Smith (1997) refers to as the extended whānau structure. In the context of this research, our whānau acknowledged that our partners, wives and husbands were inclusive in all wānanga conducted during our research.

Similarly, Amber talks about the creation of pathways for future generations:

It was good timing because a big part of what I want to do this year is to take the company international. So, we've got connections over there. (Our) Manu (software is) in a few countries, but now it's looking at how our other First Nations people bring their stories and start preserving these smothered (oppressed) generations, especially with the loss of language worldwide.

Kaye-Maree also shares her thoughts about building a future for the next generation:

There's this absolute focus on future generations and enabling whānau to access this mātauranga and continue to build and grow from there.

The above korero provides excellent examples of how necessary it was for this whānau to consider pre-ethical conversations, which determined essential aspects for our whānau to be involved in. For instance, if we did not get affirmation from our whānau about forwarding the research, the research would be dead in the water. However, it is important to note that any pre-ethical conversations caused tension between the whānau and the University's ethical application procedure, which is discussed more in-depth in the Methodology chapter of this thesis. We found that the University's ethical application procedure did not fully consider the role and purpose of whakapapa as an ethical determination. Recognising the significance of including cultural viewpoints and practices in ethical application methods is crucial. Whakapapa is not only important but also at the heart of moral decision-making in Māori culture. The distinctive cultural viewpoints and values of the communities involved in research or other projects must be recognised and respected. Because of this, it's crucial to make sure that the processes for applying ethical principles are inclusive, sensitive to cultural differences, and that they take into consideration the unique cultural viewpoints and values of the groups concerned. This can assist to ensure that research is conducted in a way that is respectful, ethical, and meaningful for all parties involved. It can also help to create trust and respect between researchers and the communities they are working with. In short, for both myself as the lead researcher and the wider whānau, whakapapa is seen as a tool for understanding the connections

of relationships but also aids in developing culturally appropriate and ethical relationships over time.

Similarly, Kay-Maree reflects on the requirement of tikanga to help navigate imperial ideologies in the workplace. She comments:

...as indigenous peoples and our values firmly established within those spaces and that comes to your own practise, the way that you treat others, the way that you treat your team, the way that you conduct yourself online should be precisely the same as you would conduct yourself in real life. Our tikanga Māori approaches can help us navigate the future successfully.

When thinking about tūpuna, Dayle ponders the proverb “ka mua, ka muri”²⁹ - *walking backwards into the future* in this assertion around what whānau can glean from the past lives and experiences of our tūpuna:

For me, it's sort of back-to-the-future stuff, like we don't live like our tūpuna lived; but we can get some good clues from them about what we might do in the future. So very few of our marae ever floods, those types of things, and there's a reason for that, they didn't put them in silly places.

Taonga Tuku Iho - The Principle of Cultural Aspirations

The legitimacy and centrality of te reo, tikanga, and mātauranga Māori are affirmed by this premise. These Māori ways of knowing, acting, and comprehending the world are viewed as legitimate in and of themselves within a Kaupapa Māori paradigm. Hence, it is possible to consider spiritual and cultural awareness and other factors by recognising their relevance and validity.

²⁹ "Ka mua, ka muri" is a whakataukī that many will know means "walking backwards into the future" - the idea we should look to the past to inform the future.

Te Whakatōhea-a-Iwi Factors of Āhurutanga

The ethical concern is increased in best practices to fit with whānau practices. Our tūpuna have already created these practices, and as Rangimarie explains these practises can be brought into our whānau practices in the world of AI R&D:

I looked through all the relevant things. They (Archives New Zealand) teach you how to take care of your taonga, whether digital, physical or storage.

Mum also offers the following comment, which affirms her beliefs of how karakia supports positive and successful aspirations when the gifts from our tūpuna are used:

I'm just getting my karakia book to close our wānanga, which will help our goodbyes. I read from my book night and morning, and it takes me about ten minutes to read just some of the prayers. But there's a beginning and an ending to the karakia.

Moreover, our Patu whānau emphasised that when our gifts from our tūpuna are used or practiced, we as a whānau will prosper. Whereby online spaces and apps will assist us in using our taonga tuku iho:

I found that apps that I've been using lately for education. Quizlet has become my new friend for learning new kupu; really, really enjoying that. When you were talking about waiata, perhaps, we could sing our Whakatōhea song at the very beginning of our session. I had that song on my phone, which I think both Mum and I downloaded it following our whānau hui then. The Whakatōhea Waitangi Tribunal team travelled all around the motu and talked about the Waitangi Tribunal process. I've never been into it yet but understand that their presence is heavy on social media networks, and that was another cool thing that I thought.

Another example of te ao Māori practice came from Amber, who describes the tikanga Māori best practices she and her team utilise when building gaming platforms:

Everything that's built from an architect's point of view is done from scratch within the company. We don't use external contractors, we don't outsource any part of our mahi in terms of the underlying platforms that are built. In terms of the safety and the storage of content, that involved heavy negotiations with our Cloud partner to actually get them to rethink the way that our data was stored.

In another professional discipline, Rangimarie is leading the repatriation of taonga from the public centres of archive. She describes the need for navigation when working with contrasting archival systems:

I will need to build relationships with people in governance, and it does say this in all the documents from Archives New Zealand to help you through that process. They discuss having a person in governance work alongside you to figure out that. I think the good thing, at the moment, because we're working on Tikanga Knowledge Labels, it's an indigenous system and structure, so we're simultaneously implementing that cause that definitely would help build the digital library. But then again, because the Trust Board is very heavily involved in a Pākehā system, we have two contrasting systems, opposing systems happening simultaneously. So, I'm the one stuck right in the middle, trying to navigate both spaces so that it works.

The Māori practice of 'whakarongo, titiro... kōrero or look, listen... speak'³⁰ demonstrates the value placed on our behaviour (Cram, 2009; Smith, 2021). Aunty Ben's whānau, when reflecting on issues concerning healthcare, suggests that before making a health diagnosis, they (both whānau and healthcare professionals) need to learn to listen better to whoever is unwell as people typically know how they are feeling. In particular, Aunty Ben's whānau notes:

³⁰ Look, listen and then, later, speak. Researchers need to take time to understand people's day-to-day realities, priorities and aspirations. In this way the questions asked by a researcher will be relevant.

Mum has her complete health information online with her doctor. So, she can see when her prescriptions are ready, her blood test results and when her appointments are.

As highlighted in this quote, the whānau emphasises how much healthcare has shifted to the online space and the degree of independence and agency that comes with this shift.

Te Whakatōhea-a-Iwi Factors of Koha

Rangimarie shares that when working alongside Archives New Zealand provides constructive work outputs as the working relationship with Archives New Zealand is one of collective heritage, which in turn, is suitable for a collective Aotearoa:

I found that, thankfully, when we made a trip to Wellington in May to build working relationships with institutions, we created one with Archives New Zealand. We built one directly with the Māori team that worked there. They sent us all the documents, which made the process a whole lot easier in terms of being able to collect and preserve taonga. They sent us all their documents to help us through our own processes, policies and strategies, which was cool.

Similarly, when considering mechanisms of change, Ria suggests that we look at a blockchain model that will help decentralise and share information with all parties that can access the blockchain:

Maybe creating a blockchain rather than on the regular worldwide web. So just pulling our stories away from centralisation and the public. Rather than our stories being in a public data storage space, maybe be on the blockchain so that you know we own it.

Rangimarie furthers this discussion by emphasising that intentional and continuous progress signals changes. She notes:

I've discovered that we hadn't done any of that. At the moment, in terms of governance, because of the structure of the Trust Board, governance and operations have their roles - it's not saying that we're not allowed a relationship, but we can't work directly with each other and so all the strategies and policies and stuff have to be created and accepted and implemented through governance. But in this particular info tech space, even though that's what they're meant to do, it's not even thought of at the moment.

Kia piki ake i ngā raruraru o te kāinga - The Principle of Socio-Economic Mediation

This principle states that Māori communities must gain something positive from Kaupapa Māori intervention and recognises the value and effectiveness of Māori-derived projects as intervention strategies for resolving present socio-economic problems. Here, Smith (1997a) argues that positive experiences affect ngākau, *emotional* and wairua, *spiritual* elements of Māori well-being. Hence, our whānau discuss this kaupapa in the section below.

Te Whakatōhea-a-Iwi Factors of Whakapono

Vanessa reminds us of that Māori participation in decision-making processes around AI R&D will ensure that Māori influence will not be disadvantaged in going forward in AI research and development:

It was about putting indigenous data back in indigenous hands, it was really basic. If we don't have our data, it doesn't matter what you're doing, you don't have your data to be able to make decisions, to be able to put the right sorts of care and protection that we would want so that it's available for the next group that comes along after us.

As highlighted by Vanessa's comment, the ability to assume control over processes is an important consideration, and following this, Amber talks about collective vision, aims, and goals as a way to remain in control.

The kaupapa or collective vision, aim, and goal of Māori communities can be witnessed within our Māori business sector. Amber's company creates digital platforms which are designed to share the stories of Māori and Indigenous cultures; during post-colonisation times, she shares that her company's values remain unmovable to ensure that successful and positive experiences are had by Māori when participating in a digital platform she and her team are developing:

The last four years have been really good because it's allowed us to get our company's foundations down, look at the broader landscape in terms of technology, what's happening here, and then look at the international ecosystem and what's happening overseas. The biggest thing I've found is that we bring a smaller organisation and a small company that is very set on how we operate, so we don't change how we work for anyone; our values are our values.

Te Whakatōhea-a-Iwi Factors of Moemoeā

Any attempt to hold to values typically presents challenges, which this section looks at in more detail. For example, Te Taka remains cautiously optimistic when he discusses the capacity of Māori in the field of AI:

There is a promise, but Māori need to build more capacity. So, we can't ship everything off to non-Māori because they're the experts. So, we need to build more capacity in this area, but certainly, there's a willingness to engage with Māori by the government that I haven't seen before. I'm cautiously optimistic.

Te Taka goes on to elaborate on his cautionary outlook, stating:

I'm cautiously optimistic that things will get better. We've got, I guess, the work that's happening through Ātea, the work that's happening through the Tikanga in Technology programme, and a bunch of stuff happening that shows promise. We need more Māori working in this area. It's challenging for Māori to get into because, traditionally, it hasn't been a priority.

While Te Taka raises valid points, Te Kahautu was more concerned with the mechanisms that are put in place to help facilitate Māori governance:

A hui needs to be convened to talk about those issues and confront the issues because if you allow those issues to carry on, things will turn septic. There's always the potential for that to happen, and it does happen, but you have to identify it quickly and deal with it quickly and provide a solution to it. If parties aren't willing, the majority must maintain the line, and whoever is the perpetrator or aggressor needs to be dealt with. It becomes, 'what do they call that... restorative justice?' Yeah, 'restorative justice; restore the equilibrium'. If you don't have that balance, things go wrong; but you need good leadership.

Te Whakatōhea-a-Iwi Factors of Āhurutanga

Kia piki ake i ngā raruraru o te kāinga or Māori continuing to attain positive experiences, the following segment highlights beneficial outcomes via cultural practices. For instance, Ria comments:

Because we have a set of protocols already that when we're in face-to-face meetings, we know what to look for, it might just be a raise of an eyebrow or something, or somebody's eyes open up, and you think, 'Oh, well, they want to say something,' so you sometimes miss those cues. But it's just a new norm, right? Like, imagine having the social signals that we had now a hundred years ago. Like, if we were to go back, people wouldn't understand, or we wouldn't understand what was going on. Jump forward a hundred years...

Similarly, the cultural practice of taking time to greet others and show respect is essential. Combined with competencies like karakia, pōwhiri and whakawhanaungatanga, they create physical and spiritual safe spaces for wānanga mariko. Dawn points out that:

Karakia is performed to protect the whānau in the Kapahaka and the resources they use, all costumes, including kākahu, piupiu, maro, tātua, koikoi, poi and all other accessories.

Dawn also emphasises that whatever tikanga to care for our whānau and our treasures, passed down from our ancestors, is in place when we meet kanohi ki te kanohi, there is no reason why these tikanga cannot be practised in an online space.

When discussing Āhurutanga, it is essential to reflect on the tikanga of kanohi kitea, a historical practice that has endured during the times of our Nanny and Nanny Pa. This practice is now evolving into meeting in te ao mariko. Given this longevity, it is reasonable to expect that it will continue to develop during the journey into generations into the future. Here, during one of the research wānanga, I state the following:

But it's just a new norm, right? From the social cues we observed a hundred years ago, people wouldn't understand or understand what was happening if we were to go back. Jump forward a hundred years, and this could be the norm, and there'll be social cues within this that we just don't get right now.

On a similar note, Vanessa discusses her own experiences of AI development concerning the concept of Māori governance:

So, when it comes to AI-related development, I don't think we are active enough there. I don't think we're active enough in - as Māori, this is - expressing and asserting our aspirations and desires and accountability of our Tiriti partner in things like trade agreements; you know, our IP has been given away when you start looking at the trade agreements. So, because there isn't a defined way to understand how mātauranga Māori show up, if indeed it should, the discussions are still to be had, but how do we protect it? And then if we were to protect it and there was IP, call it new IP, informed by mātauranga Māori, it's been given away in our trade agreements anyway, or the Patriot Act means that there's still a clawback.

Moreover, Āhurutanga is affirmed by Dayle, who states:

So, we had a raupatu in 1866, and I'm just talking for Ngāti Awa³¹, but a separation and a disconnect, a deliberate placing of hapū where they weren't before, is a massive disruption to our relationships with whenua.

Te Whakatōhea-a-Iwi Factors of Koha

Kia piki ake i ngā raruraru o te kāinga, or the principle of socio-economic mediation, was evident in other areas of *transformative practices of change*. For example, Rangimarie talks about the constructive set of relationships between Archives New Zealand and Te Whakatōhea:

Archives New Zealand's systems to assist with the repatriation of taonga help form a clear path for what we want to do as Whakatōhea. Archives New Zealand has given us exactly what we want and need to do to achieve it.

Professional work environments such as Archives New Zealand highlight intergenerational taonga and the level of reciprocity, responsibility and obligation within Āhurutanga, which are essential for successfully achieving constructive work outputs. However, Rangimarie also comments on the problematic navigation she needs to use to make things proceed more smoothly in her workplace:

We're like, 'Well, for how many generations has it not worked for our people?' We can see a solution, but you're stopping us from implementing that solution because you're scared to let go. It's time to try something different. The cool thing, though, is that because we've been brought up the way we have, on a marae, and that has become deeply embedded in our culture, we know all the other things.

Mahuta, like Rangimarie offers similar discourse around the disenfranchisement of our younger generation due to the disconnect with the older generations, who tend to hold the power in our Māori communities, and the structures of ineffective engagement with our younger generation.

³¹ A Māori tribal region based in eastern Bay of Plenty, Aotearoa

Similarly, productive life and work outputs were experienced when sets and capabilities were recognised, the establishment of whānau roles could be shaped, and many times these roles could be transferred into our work situations. Amber explains:

I rely heavily on our advisory board and mentors in this space. The board comprises a whole heap of skills, expertise and capability that we don't have sitting in the team as employees, so we're lucky to have this kind of round table meetings with people. But they each hold their own in their space. They're very quick to tell us no, and don't even hesitate about doing that with some of the ideas we start generating.

Amber expanded her thoughts around ways to ensure constructive work outputs were experienced. Here, I ask her:

Within the realm of governance and regulations and law, etc., what do you need to consider regarding the recent reforms that have impacted the development within your work context?

To which Amber responds:

I don't know that any have fully impacted us because we go about things differently. I guess for me, it's like we have to straddle both worlds. We have to straddle Māori as well as the Western world. So, it's looking at taking what we can and then restructuring everything to fit within our company's values and missions. Everything we do in this space needs to meet the company's values, which are heavily focused on the betterment and improvement systems for our people.

Amber extends her kōrero by sharing:

The most significant learning for me when I moved into that space, especially the research and innovation of emerging tech, was there is no Māori. No Māori

academics or researchers were there, doing their mahi and working on their projects, but they were always part of these other research groups led by non-Māori and often acted quite siloed. So, a part of my role was ensuring visibility across the university within all the projects happening so that our new researchers coming through the system could start tapping into some of these networks and furthering themselves in that academic space.

Workplace successes highlight genuine examples of positive experiences for Māori and their communities. Kaye-Maree contributes to the kōrero around the kaupapa of providing opportunities for success by confirming the following:

I believe that the Crown took a punt and invested heavily in digital enablement, so I think that's been pretty powerful because the work that Lee and Hēmi have been doing to engage our marae communities, our kuia, kaumātua, is a signal of what's been happening across the tech space generally, where we're focused on exposing our people to tech, creating opportunities to learn, creating supportive environments for whānau to ask questions because they're really struggling with even just navigating technologies generally, or even getting onto the internet.

This research demonstrates how whānau continues to look for positive outcomes for Māori, even in challenging times. Opportunities for positive outcomes can be found. Rangimarie stresses the fact that allyship with experts is necessary to ensure positive results by remarking:

We primarily work with digital form, so that's audio, video, and documents. Most of that is digital. We don't have the capacity or the capabilities to care for physical taonga at the moment.

Rangimarie expands her experience with allyship and describes one of her encounters with New Zealand Archives:

The other thing is because it's such an open relationship with these institutions, and our taonga are well taken care of. It was a surreal experience because we contacted the main guy, and he was like, 'Oh, I'm going to take you on a tour of this private room that we don't just let anyone in'. The sheer number of Māori taonga in this room is massive. I can't even describe it, but it's enormous and full of different Māori taonga, like all physical Māori taonga everywhere. He said, 'We don't often allow people to see this room because of how tapu it is'. He says, 'but because you are Māori and you understand, and you're travelling as an iwi, I already know that you know what's required to go around these rooms'.

Kirikowhai underlines the need for relationship investment, again to support positive and successful outcomes for Māori:

Some of the biggest successes in which we've invested a lot of time include our relationships with the different government departments. So, it got to a point - and it's still a work in progress - but got to a point where there's respect and recognition of both parties' expertise. So, for us, it was critical that when we come to the table under that equal explanatory power, there is respect and recognition given to our knowledge system and the lens we bring. And it should be given equal mana because most other things just default to that Western knowledge system to make the final decision.

Productive life and work outputs were experienced when sets and capabilities were recognised, and the establishment of whānau roles could be shaped. Many times, these roles could roll into our work situations. Amber explains:

I rely heavily on our advisory board and mentors in this space. The board is made up of a whole heap of skills, expertise and capability that we don't have sitting in the team as employees. So, we're lucky to have this kind of round table meeting with people. But they each hold their own in their space. They're very quick to tell us, no, don't even think about doing that with some of the ideas we start generating.

In another professional area, Marie-Louise talks about the positive impact emerging technologies have had on her Early Childhood Home Centre:

Even though my work is very hands-on with the kids and all the rest of it, throughout the day, I'm constantly talking to the parents or talking to my upline teachers, posting photos, taking photos, you know, finding information on a policy if there's something that I need to check on and I get it all on my phone and the little tablet; and as well as using the tablet for quiet time, you know, things like that, and it's all early childhood centred stuff on the tablet that I can use. And then just the drop-offs, pick-ups, and messages to the parents are via the tablet or my phone. You know, things like that. It's almost like I have to find the time to be physically present and online at the same time; you know what I mean? Because it's practically an instant... I can tell the parents what the kids are doing right now, and they can interact with it immediately like I often do. That might be in the middle of when we went to the Easter Hunt and stuff like that, so I'm sending little video clips to the parents immediately, and they're sending messages back to their kids. If we didn't have IT, we wouldn't be able to do any of that.

Aunty Ri also considers her own positive life experiences, commenting:

I did too. I was just thinking the other day, I've had a good life, you know, from growing up, I was a kid on the farm and then getting a job and a good job, and I got a husband, was a good husband. I had a house, and now I have someone to look after me.

Furthermore, Arihia Tuoro suggests that when continuous and intentional progress is made, positive experiences are had. However, she does pose the question about the mindset tensions that can arise when discussing traditional whakapapa reciting compared to written organisation of databases with whānau. She notes:

... should the building of up-to-date whakapapa-linked tribal registries, keeping whānau connected to their whakapapa and whānau or telling stories to be facilitated by technology?

Although we do not have an answer to the question above, it does present tensions that need further consideration.

4.2 The Discussion

4.2.1 Kaupapa Māori Key Principles

To further the diversity of AI R&D and the reform of systems that support and maintain predominantly Western ideologies, our research presents a set of mātauranga and tikanga Māori that have the potential to, when woven into algorithms, inform next-generation AI systems, that promote cultural well-being for our whānau and their futures.

Transformative Practices of Change: Te Whakatōhea-a-Iwi Factors

Smith (1997a) determined *Kaupapa Māori Key Principles*, which was utilised to identify the twenty-one (21) *Mātauranga and Tikanga Māori Elements*. These Mātauranga and Tikanga Māori Elements were reorganised into six generalisations, which are referred to as *Te Whakatōhea-a-Iwi Factors* in the context of this thesis' study. Moreover, these *Te Whakatōhea-a-Iwi Factors* have grown as a result of practice and are comprised of:

- Factor: Whakapono: *Integrity Prestige, authority, control, power, influence, status, spiritual power, and charisma. All of which are elements of – mana; a supernatural force in a person, place, or object.*
- Factor: Moemoeā: *The vision.*
- Factor: Āhurutanga: *Māori culture, Māori practices and beliefs, Māori way of life.*
- Factor: Whanaungatanga: *Relationship, kinship, sense of whānau connection - a relationship through shared experiences and working together which gives people a sense of belonging.*

Factor: Koha: *Practices of change*.

There are no evaluation methods for judgement around each *Whakatōhea-a-Iwi Factor's* amount, number, or value. Moreover, there are no criteria and no governing standards. Our research does not attach a system of determination or assessment of merit or worth of the Factors. The purpose of the comparing and contrasting was to advance the emergence of commonalities of themes fundamental to the Factors. It is also important to note that while the scope of this thesis does not cover the debate around evaluation, it holds fast to tino rangatiratanga over how and why we compare and contrast these Factors.

Whakapono

It is well known and documented that there is control of data by New Zealand Government agencies which influences operational activities and services. The integrity of data is in question as the control of the data lies in the hands of the hands of the Government and not the individuals of which the data represents. More complex algorithms are being developed to enhance human decision-making, extract information from complicated data sets, and uncover insights that would be difficult for human analysis to discover on its own (Accident Compensation Corporation, 2018; AI Forum of New Zealand, 2018; Blackmore, 2019; Maclaurin et al., 2019; New Zealand Government, 2018; StatsNZ, 2020). As highlighted in the previous chapter, Ria explains that the evolvement of the internet and SNS has helped make her job as an online marketing consultant much more productive. Here, it is evident that the simulation of human intelligence has primarily promoted the foundation for current internet and SNS effectiveness through computation. Moreover, algorithmic processing can now make decisions, problem solve, make environmental adaptations, plan, and learn characteristics; all of which used to be abilities unique to humans only (Nilsson, 2010; Saygin et al., 2000).

Cultural imperialism is the term used to describe Aristotle's hegemonic tendencies. In cultural imperialism, either an internal sponsored government, or an externally placed government, *controls* the internal politics and social makeup of the subordinate states that comprise the hegemonic sphere of influence (Gramsci, 1971). The

marginalisation of Indigenous people by current AI systems is well documented (Couldry & Mejias, 2019; Eubanks, 2018) and the consistent call coming from this whānau was to examine further the growth capacity of skilled and knowledgeable Māori in AI R&D. Moreover, a further categorical statement made by our whānau emphasised capacity (i.e., having enough skilled and knowledgeable Māori in-place), as an essential element for Māori to be in control of AI related development. Great Britain has been an active country in the form of colonisation. The British Empire was the largest of its empire kind in history, once covering about one-quarter of all the land on Earth. Unfortunately, New Zealand bore the brunt of an imperial invasion and is now under cultural imperialism. Hegemonic tendencies are also evident in imperial-dominated technologies, which are now proving to amplify biased stereotypes in AI systems. In a similar manner, China's telecommunications giant, Huawei, is establishing a stronghold in Africa and creating what is being called *digital colonisation* (Cartwright, 2020; Couldry & Mejias, 2019).

AI systems making decisions, such as who gets financial aid and who owes money back to the government, have caused concern amongst many groups. But what is causing a full-on panic attack is the progress of digital colonisation, alongside evolving imperial-dominated algorithms, which demonstrate that prejudiced bigotries are amplified by AI systems (Blackmore, 2019; Rae, 2020). An example of this kind of extreme reaction was evident when our cousin stood up at our whānau reunion and said:

Deja vu whānau, history repeating itself, this technology bias continues the imperial biases imposed on Māori by the colonial oppressors.

Our research is suggesting that we opt out of the Western scientific approach to emerging technology research and development, and increase the control and responsibility of our own AI R&D. This action will continue to signal the crisis circumstances in which Māori find ourselves, despite the flattering tenor of the Government's assurance of Māori inclusion at all levels of AI R&D policy issues where the impact of the research and development, directly and indirectly, impacts Māori (New Zealand Government, 2018, 2021; StatsNZ, 2020).

The 2021 AI Readiness Index ranked 160 countries according to how prepared their governments are to use AI in public services. Researchers found that the USA tops the rankings, followed by Singapore in second place, and the UK in third (Oxford Insights, 2023; World Economic Forum, 2022). New Zealand is mimicking the implementation of many of the USA and UK National AI strategies reforms, in that all have endorsed more transparency and trust for their citizens as fundamental. Yet, transparency and trust tend not to be inclusive of Māori transformative practices of change in New Zealand AI strategic reforms (Blackmore, 2019; Eubanks, 2018).

Nordic society's AI policies are based on shared values, a common cultural identity, and democratic political ideologies. However, the Sami, who number between 75,000 and 120,000 people and live in the northern regions of Norway, Sweden, Finland, and Russia, are invisible in official statistics, as there are currently no systems in place for gathering data on the Sami population (Walter et al., 2021). Literature suggests that the development and use of AI based on ethical principles and respect for human rights and democracy is a critical influencer in the advancement of AI in these countries (Andreasson, 2017; Robinson, 2020). But, as shown by Sami people, Nordic AI policies address shared and collective values, however, the actioning of these principles is limited.

Therefore, this section has highlighted various issues related to Te *Whakatōhea-a-Iwi Factors of Whakapono*. In doing so, our whānau posit the first *Whakatōhea-a-Iwi Factors*:

Factor: Whakapono - Integrity

Continuous consideration of the group's kaupapa, i.e., a collective vision and a set of goals and objectives, supports the ability of Māori to be in control.

Moemoeā

A challenge for Māori is to be fluent, conversant, and literate with the foundations of imperial AI organisational ideas and operational procedures. It is not difficult to discern that the insidious foundations of imperial-dominated AI systems can be linked to Greek theory and today's AI (Cavarero & Bucci, 2017; Hauer, 2021; Koons, 2018; Nilsson, 2010; Reiter, 2020; Striker, 2009). Western storytellers were and still are complicit in transferring Western AI ideologies (Barkman et al., 2013; Booker, 1994; Madigan, 2012; Overbye, 2018; Poole et al., 1998; Vinge, 1993). Therefore, fluency, familiarity, and conversance (Grande, 2014; Smith, 2021) in understanding the whakapapa of today's AI systems will help Māori to achieve this through the development of next-generation Māori AI systems.

Our whānau established that we have good reason to be in discussions around AI R&D that directly or indirectly impact Māori. We have identified parallels between Kaupapa Māori Key Principles and Māori governance protocols (Durie, 2021; Joseph & Benton, 2021; Te Aho, 2021). Therefore, our research posits that Kaupapa Māori Key Principles have the potential to, when woven into algorithms, inform next-generation AI systems, promoting cultural well-being for our whānau and their futures.

Data scientists have continued to create AI systems that can do tasks because of the search for AI that resembles humans. For AI systems, philosophers, mathematicians, and logicians have developed organisational theories, suggested methods for making these systems function, and implemented evaluation procedures that can create and change systems. The fundamental epistemology of the twentieth century has supported *Western science* as the dominant narrative. Researchers must consider the analytical and interpretive frameworks of research decisions and actions (Denzin et al., 2008). Consequently, mechanisms need to be put in place to help facilitate Māori AI R&D governance to ensure mātauranga and tikanga Māori solutions are normalised to safeguard Māori against global principles and standards that perpetuate societal biases, inequalities, and global homogenisation. Therefore, our research's second *Whakatōhea-a-Iwi Factors* suggests that:

Factor: Moemoeā - vision

Cultural and structural mechanisms must be put in place for Māori to realise their aspirations for the future.

Āhurutanga

The Whakatōhea-a-Iwi Factors appearing in the Kaupapa Māori Key Principles is understandable, as Kaupapa Māori has grown out of the struggle against the inherent inculturation of Western social ideologies here in Aotearoa (Smith, 1997a). Moreover, Āhurutanga exhibit values and practices which represent comfort and security within correct or meritorious conduct within ancestral lore (Smith, 1997a).

Mead (2016) provides a scholarly foundation for the behaviours and principles that increasing Māori believe are essential for maintaining relationships with other people and the land on which they live. Our whānau provides numerous illustrations, for example, Te Kahautu explains that mātauranga is a concept that permeates many aspects of Āhurutanga, including our language, whakapapa, technology, trading practices, modes of expression, and a wide variety of settings and stories. More importantly, Āhurutanga should be normalised, validated, and legitimised, according to Smith (1997a), who claims that Āhurutanga is, in reality, guidelines for interaction.

Rangimarie and Maui both shared stories of the dialectic tensions between imperial philosophies and te ao Māori perspectives, in which they described the inappropriate labelling systems used in colonial practices. For example, by museums, libraries, and other archive institutions that create, maintain, and alter different knowledge information systems, specifically mātauranga Māori and the achieving of taonga Māori for Te Whakatōhea iwi. Our whānau upholds the opinion that ethical practises not only for achieving our taonga tuku iho but also, in the Māori space of AI R&D, needed to be put in place for future proofing for the next generations. Several of our whānau concurred that taonga tuku iho of ancestral spiritual affirmations were crucial for maintaining our mental health and well-being. Maintaining karakia played a critical role in the operations of Ōpōtiki-mai-tawhiti kapahaka, which aided in

determining the protocols for all their gatherings. The protocols around restorative justice and the support of karakia during this process were shared as a further example of the affirmation of karakia and the practices of Āhurutanga to restore the equilibrium in a group. Yet another example, highlighted how Māori digital platform developers were innately mindful of the tapu nature of the work and composed special karakia they use when coding.

The root of all dialectic tension experienced by Māori stems from the ancient Greek philosophers, including Thales, the pre-socratic philosophers or Milesian thinkers, and Democritus, Socrates, Plato and Aristotle, whose ethical proposals are still evident in today's Western intellectual ideologies (Nilsson, 2010). These ethical philosophies continue to underpin work by researchers during the 1940s, 50s and 60s, while also forwarding the many present-day studies around neural networks. Furthermore, the inaccurate identification and classification of gender and race are still being experienced due specifically to work around computer vision using cameras, videos and deep learning models. The history of facial recognition is one example of this, which has always been shrouded with a dark cloak of covert control (Faugeras, 1993).

Other examples of digital colonisation include the significant investments of the tech giants like Amazon, Facebook, Google, IBM, Microsoft and Tesla drive AI R&D. Moreover, 11 of the top 20 AI-related scientific publications are Chinese research organisations (Roberts et al., 2021; World Intellectual Property Organization, 2019). The tertiary sector sees 17 of the top 20 academic players worldwide in AI patenting being made up of Chinese research organisations. Hence, AI reforms tend to mimic the economic and political desires of the AI superpowers of the USA and China (Schwab, 2017), and Huawei, China's telecommunications giant has established a seemingly irreversible foothold in Africa (Gravett, 2020; Rae, 2020). However, African leaders assert that it is imperative that the building of AI has an ethical focus that is aimed at creating a more inclusive economic and well-being plan for Africa.

On the European front, literature suggests that the development and use of AI based on ethical principles and respect for human rights and democracy is a critical influencer in the advancement of AI in the Nordic countries, the Netherlands, and the UK

(Andreasson, 2017; European Commission, 2019; Gov.UK, 2021; Robinson, 2020). Conversely, although Germany expresses the need for ethical consideration, German ideologies tend to exhibit individualism, which can be seen in the aims of the German National AI strategy. Again, this creates tension between Indigenous worldviews and human-centric dogma.

When looking at the ‘down-under’ countries, Aotearoa’s neighbouring country Australia sees itself as a global leader in developing and adopting trusted, secure and responsible AI (Australian Government, 2021). The Australian AI Action Plan affirms that the highest ethical standards are practised by businesses and governments when designing, developing and implementing AI. However, Nilsson (2010) argues that these ethical standards are not being enacted as they have excluded Australian Aboriginals from any active discourse concerning policy development. Similarly, Aotearoa has mimicked Australia, their neighbouring ally, by mandating the Data Ethics Advisory Group to seek ways to maximise engaging risks and harms when maximising the potentiality of emerging AI technologies using data sets.

AI is a tool that can aid with society and economic, commercial, and general well-being. In light of this, most official AI reforms consider issues pertaining to ethics, such as respect for privacy, transparency, and equality. Additionally, virtually all government AI strategies consider the great relevance of data for AI. Yet, experiences by our whānau concludes that the actioning of these principles are limited, and that mitigation of subjugation is still minimal. Our third *Whakatōhea-a-Iwi Factors*, therefore, postulates that Āhurutanga needs to be normalised by:

Factor: Āhurutanga - Comfort

Affirmation of mātauranga, tikanga and te reo Māori is essential to ensure Māori cultural well-being.

Whanaungatanga

Whanaunga, whanaungatanga, whakawhanuangatanga, and whakapapa, which are derived from the word whānau, are fundamental Māori principles. Consequently,

several Māori researchers emphasise quality relationships as crucial for positive and successful engagements in both informal and formal contexts, including Bishop (1991); (Bishop, 1995); Bishop (2011); Bishop and Berryman (2006); Bishop and Glynn (1999a, 1999b); Mead (2003, 2016); G. H. Smith (1989); Smith (1997a); G. H. Smith (2017b); Tiakiwai and Tiakiwai (2010). The term ‘whanaungatanga’ is now used by our whānau as a metaphor to describe a group acting as though they are related to one another, or working towards a shared goal (Bishop, 2003).

The themes of whakapapa, ahikā, tūpuna, the relationships of tuakana/teina within whenua have transpired from our wānanga. Intergenerational relationships between ageing parents, adults, children, grandchildren and great-grandchildren define us as being distinct from western cultural ideologies (Mead, 2016). Tuakana/teina relationships were a joy to watch when we observed our Whānau Mokopuna assist their Parents and Grandparents in navigating the nuances of emerging technologies. The teaching was reciprocated when the Grandparents explained whakapapa connections, or told stories about their lives on the farm, whereby the expressions of awe and wonderment on the faces of our Whānau Mokopuna were precious.

The repetition of anecdotally referencing our Tūpuna, who have long gone, will ensure they live-on in our hearts, memories, and dreams. For example, Rangimarie reflects on how her tūpuna guides her and her whānau during hard times. Kaye-Maree describes how her tūpuna and their tikanga direct her business policy structures. Moreover, the proverb “ka mua, ka muri” - *walking backwards into the future* in this assertion around what whānau can glean from the past lives and experiences of our tūpuna, is very pertinent.

Urbanisation, diaspora and becoming members of global society have caused alienation from one's whānau at home. Living overseas or getting absorbed in digital realms while still in New Zealand, may have caused a detrimental effect similar to past migrations from rural to urban areas, which saw many become isolated from their whānau at home. Mahuta shares her thoughts about the virtual world not providing a ‘real’ connection with whānau and whenua, as she deems it necessary for whānau to return home and touch the soil to truly connect and engage with who you are. Mahuta

stipulates that the privilege of being whānau needs to be earned and involves returning to the whenua of home.

Currently, with many of our whānau members living away from our tribal homelands, we depend on our ahikā, the whānau living on our turangawaewae. Multiple roles, responsibilities and obligations have fallen on the shoulders of our whānau at home, including kaitiaki of our lands and taonga, the carrying out of marae duties, and the performances of tribal rituals. The term Ahikā translates to *keeping the home fire burning*, which epitomises the responsibilities and obligations befalling our whānau living within our tribal boundaries. From the many of us living away from the Whakatōhea, we are grateful, indebted and genuinely thankful to our whānau Ahikā for their continued unconditional servitude to our whānau, for our hapū and iwi.

The discussion in this section has highlighted how Greek myths and legends regarding the ties between human and non-human families, reflect the views of their state's well-known influence, social class arrogance, and an individual's usage of others (Gramsci, 1971). Moreover, these classical philosophies have become embedded, carrying with them their hegemonic tendencies, which are firmly attached to ideas, concepts, and presumptions about human experience that does not allow any consideration for the subjugated (Nilsson, 2010). The Socratic philosophies of the dominance of one group over another remain deeply rooted in the structural foundations of Western policy. For example, the USA leadership continues to forge relationships with the international business environment to ensure that the interest of their own AI development is consistent with the nation's values, which uphold privacy, civil rights, and civil liberties (OECD AI Policy Observatory, 2023). However, the tech giants are now becoming digital colonisers, such as China's telecom giant Huawei, which has gained what appears to be an unbreakable grip on Africa's communication systems (Gravett, 2020; Rae, 2020). Also, Singapore is a major rising AI country thanks to its R&D in the new communication testbeds for 5G and beyond 5G. The emergence of this AI R&D is aided by developing local talent's potential and recently developed connections with China's top AI businesses.

In Aotearoa, Māori have taken the initiative around the relationship built with technologies, algorithms and learning machines. As the world entered into an AI winter in the mid-1980s (illustrated in Table 3), Māori were proactive in emerging technology and AI R&D (Benton, 1996; Keegan, 2007; Keegan & Sciascia, 2018; Laws, 1998, 2001; Rei & Hamon, 1993; Robust, 2002; Ropiha, 1991), as highlighted in Table 28. However, indiscernible change is being noted with the New Zealand Government's policy design. Individualist propensities are still overshadowing the collectivist statements.

With the thoughts abound from the paragraphs of this section, our fourth *Whakatōhea-a-Iwi Factors*, therefore, recommends that:

Factor: Whanaungatanga - connections

Māori connection to wairua, tūpuna, whanaunga, and whenua through whakapapa remains fundamental to Māori and must be acknowledged.

Koha

Smith (1997a) posits that collaborative and coordinated multi-layered points of intentional Māori interventions can only bring about transformative change practices. Kaupapa Māori theory is integrally linked to the notion of positive change for Māori. Transformative praxis is the foundation of a Kaupapa Māori perspective of transformation, and it is a key principle shared by all the researchers discussed in this thesis. Theorists of Kaupapa Māori continue to urge Māori to create initiatives for change inside distinctly Māori frameworks (Pihama & Penehira, 2005). Pihama (2001) and goes as far as to condemn all forms of tyranny that try to erase our rightful place in Māori society.

Reform frequently provides the opportunity to change and restructure industries or the economy in ways that help achieve long-term objectives, including improved income distribution, expanded access to essentials of life, and sustainable long-term economic growth and employment. To ensure that Māori voices are heard in all governance and policy settings, Vanessa emphasises the importance of placing Māori at the centre of

these reforms. Aunty Ri, Ria, Rangimarie, Kaye-Maree and Hēmi are strong advocates of collective vision as an agent of change. Moreover, our whānau postulated that the community focus enhanced productivity and direction in their work environment. Overall, utilising synergy was a powerful method for getting things done with less effort, time, and resources without sacrificing output quality or quantity.

Humans naturally receive opportunity or must actively seek it or create it themselves. Opportunity is the doorway to success, and it requires skill and the ability to identify, perceive, and pursue it to its logical conclusion. Yet, in order to achieve, many Māori have had to learn to navigate institutional structures that have been born out of Western ideals. Here, whānau recognise whānau's future ambitions and how realising our shared vision will assist whānau in creating change to achieve those aspirations, amplifying achievement and increasing involvement. Kaye-Maree describes how she and her team collaborate with Māori to create pathways through Crown structures.

Whānau wānanga were created to promote knowledge exchange around AI's founding Western principles and identify difficulties facing our whānau as they traversed these imperial-dominated AI systems. We observed substantial socioeconomic and cultural changes among our whānau. For instance, we see increasing racial and ethnic variety among Generation X, those born between 1965 and 1979/80, and Millennials, those aged 22 to 37 in 2018. These generations are also showcasing employment and financial independence. Moreover, what is promising is the increasing number of Generation X and the Millennial generation that are devoted to embracing mātauranga, tikanga and te reo Māori.

Technology advancement in AI R&D is founded upon the advanced development of computer systems capable of performing tasks usually requiring human intelligence. Machine learning has enabled algorithms to perform tasks repeatedly and gradually change and improve outcomes (Katz & Gonzalez, 2016). Western philosophers, mathematicians and logicians have sustained the debate on systemic eurocentric principles fostering imperial-dominated ontologies that underpin AI R&D. The early theorists and scientists, including René Descartes, Thomas Hobbes, Blaise Pascal, Charles Babbage, and Ada Lovelace, were unrelenting in their pursuit of further

defining human mental and physical foundations and the invention of calculating machines (Lovelace, 1842; Rojas-Sola et al., 2021; Russell, 2013; Scott, 2016). Further efforts to increase the scientific rigour of psychology can be seen in the seminal human behavioural works of B. F. Skinner, Noam Chomsky, and Andrew Marr have been fundamental and is comparable to that used by computer scientists to understand the inner workings of the software that carries out computer operations (Katz & Gonzalez, 2016).

With this in mind, ideologies that are primarily European are at odds with te ao Māori. Māori do not see humankind as the focal point of creation. Instead, everything is thought to be interrelated (Ito, 2018; Mead, 2016). Additionally, even though mātauranga Māori and Western scientific knowledge have a parallel existence in the universe, Western scientists are not familiar with the special bond that Māori have with the natural world. All Māori intervention researchers cite the Kaupapa Māori perspective of change as a fundamental Whakatōhea-a-Iwi Factors guiding their interventions. For example, Ferguson (2012) adds that the kaiako must have stronger perceptions to compensate for the lack of visual clues in the e-Education setting. The reason why whatumānawa is located at the peak of e-Aoraki is because of how kaiako perceives different contexts and cues occurring within the learning space. Wylie also emphasises that the Te Hiringa i Te Mahara initiative was an example of the socioeconomic mediation concept, or Kia piki ake i nga raruraru o te kāinga (Smith, 1997a). Furthermore, Hudson's (2020) report contends that "Families will cooperate to make things work, and things are resolved by communal effort" (Hudson, 2020, p. 41). Our fifth *Whakatōhea-a-Iwi Factors* consequently endorses:

Factor: Koha - change

Vivacious and successful experiences for Māori need to be advanced to forward transformative change.

Table 0.1: Te Whakatōhea-a-Iwi Factors

Te Whakatōhea-a-Iwi Factors	
Whakapono	Continuous consideration of the group’s kaupapa, i.e., a collective vision and a set of goals and objectives, supports the ability of Māori to be in control.
Moemoeā	Cultural and structural mechanisms must be put in place for Māori to realise their aspirations for the future.
Āhurutanga	Affirmation of mātauranga, tikanga and te reo Māori is essential to ensure Māori cultural well-being.
Whanaungatanga	Māori connection to wairua, tūpuna, whanaunga, and whenua through whakapapa remains fundamental to Māori and must be acknowledged.
Koha	Vivacious and successful experiences for Māori need to be advanced to forward transformative change.

Note: Adapted from Smith, G. H. (1997)

Our research now looks at the convergence of these Findings into the Nukutere Model, moving away from considering the Mātauranga and Tikanga Māori Elements and Factors and their implications for Māori cultural well-being within the context of AI research and development. The Nukutere Model captures the core of Māori values and perspectives since it is based on the Kaupapa Māori Key Principles and is driven by the six identified Whakatōhea-a-Iwi Factors. These findings are combined into a coherent framework by the Nukutere Model based on significant literature research, wānanga mariko, hui, interviews, and practical research engagements. Six overarching Whakatōhea-a-Iwi Factors have been compiled from the 21 Transformative Elements, representing the essential components of success resulting from this collaborative effort. In AI research and development, these Factors are the cornerstone of the potential for building a culturally sensitive algorithm that promotes Māori cultural

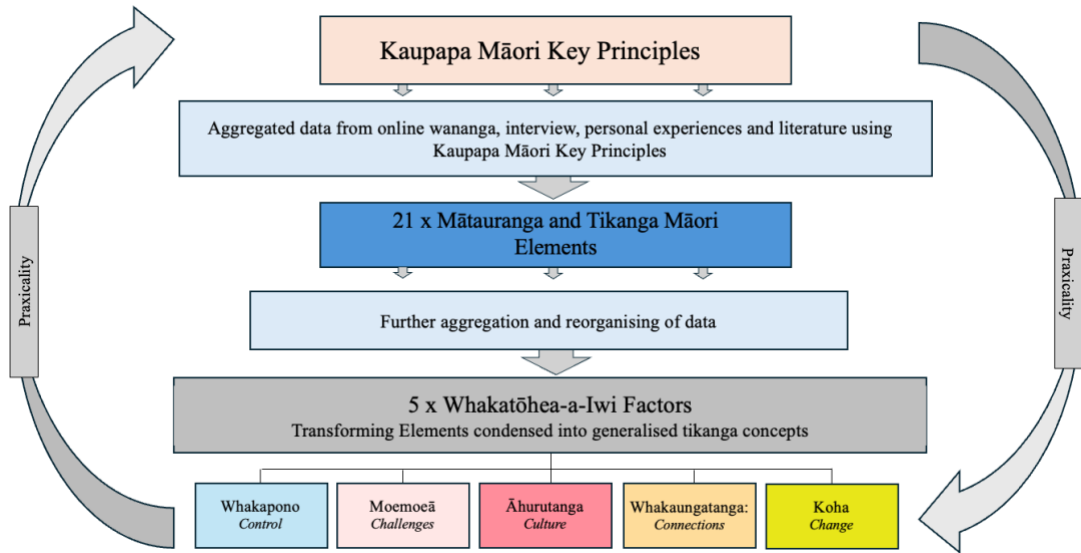
well-being. Thus, to direct and alter the trajectory of AI developments for the benefit of Māori communities, the Nukutere Model encompasses the pinnacle of Māori knowledge, cultural comprehension, and innovative research praxis. The Whakatōhea-a-Iwi Factors align with the model's fundamental components in Figure 4.6, which also serves as a visual depiction of this holistic framework.

4.2.2 Nukutere Model

The Nukutere Model begins by extending **Kaupapa Māori Key Principle** insights and utilising research praxis³² through online wānanga, hui, interviews, observations and literature. These practical research-based activities generated *twenty-one Mātauranga and Tikanga Māori Elements* aggregated as the key ‘success’ elements, which the whānau themselves identified. These twenty-one Mātauranga and Tikanga Māori Elements have been subsequently reorganised into *five Whakatōhea-a-Iwi Factors*. The *Whakatōhea-a-Iwi Factors*, as highlighted in Table 4.2 above, inform a culturally sensitive algorithm to respond positively to Māori cultural well-being.

³² A constant cycle of renewal

Figure 0.1: The Nukutere Model



While the Nukutere Model is the primary contribution, other elements are also significant and will be re-highlighted in the concluding chapter.

Chapter 5 - Rukuruku Hūnā, horahora Pāpākanui.

Conclusions: Questions, contributions, and summary

Whakataukī: Rukuruku Hūnā, horahora Pāpākanui

This Whakatōhea whakataukī refers to the people gathering kiekie by diving in the deep pool called Hūnā, where the taniwha live on the Otara River, where they spread the kiekie out to dry at Pāpākanui, an old pā site of Ngāti Rua

This whakataukī is a metaphor for our Whānau Research and the obstacles (taniwha) that we, as whānau, had to overcome to gather the information required to complete our research. Our findings and our summations, like the kiekie laid to dry at Pāpākanui, are laid out in this thesis for all to see.

Anonymous composition

5.1. Positioning my experiences

I am the Lead Researcher for this whānau intervention. I bring 40 years of teaching and educational administration experience, including international experience in other indigenous jurisdictions. Moreover, I have had 15 years of involvement in providing information communications and technologies professional development programmes within Māori education. Finally, my 2020 master's thesis contributed to new knowledge around the promotion of academic aspirations of Māori scholars in a tertiary online teaching and learning environment. I am a descendant of Tūtāmure of the Whakatōhea iwi. My name is Petera Hudson.

5.2. Our original questions

The first Whānau Research question is central to this thesis:

Question 1:

How can mātauranga and tikanga Māori (Māori epistemologies and ontologies) provide for cultural well-being for whānau and their futures?

The stance in which our whānau takes is articulated in Chapters - Prologue, 1, 3, 4, and 5. The historical and contemporary characteristics and voices portrayed in these chapters encouraged and captured the whānau's hopes of identifying mātauranga and tikanga Māori (*Māori epistemologies and ontologies*). We sought to build on the base proposition that mātauranga Māori, tikanga Māori and te reo Māori could be incorporated within current and future AI systems. Our whānau presents the *Nukutere Model* (see Figure 4.6) as a framework to assist in the identification of mātauranga and tikanga Māori which our whānau believe has the potential to augment cultural well-being for our whānau and their futures if incorporated within current and future AI systems. This whānau question can be recognised in Contributions No, 1, 2 and 3.

Whānau Research Question 2 was developed with our whānau in mind:

Question 2:

How can whakawhanaungatanga enhance whānau connectivity, beyond kanohi ki te kanohi, considering that many of our whānau are living outside our turangawaewae?

Possible solutions to this question were considered in Chapters 2,3,4 and 5. Our whānau's concern was the need to investigate approaches as to how we, as a dispersed whānau, remain connected to our turangawaewae. Whānau Question 2 is vital regarding the ongoing future well-being of our whānau. Many whānau live in different parts of Aotearoa, Australia and Europe. In addition, our whānau have great difficulty keeping in contact with each other, linking to our tribal homelands, gathering face to face and meeting our cultural obligations. Our whānau were highly motivated by the need to investigate approaches as to how we, as a dispersed whānau, remain connected to our tribal territories of Te Whakatōhea (see Contribution No. 2).

The following whānau question was developed to provide an historical context around AI R&D here in Aotearoa and for the rest of the world:

Question 3:

How do mātauranga Māori, te reo Māori and tikanga Māori contribute to the domestic and the global conversation regarding cultural well-being for Indigenous people and their futures?

This question was addressed in all Chapters of our Research. It was required of our whānau to build understandings about colonisation, culture assimilation and Māori language loss. As Smith has noted, colonisation has not gone away. It has more often simply changed shape and is coming at us in new formations. It is, therefore, critical to develop counter-colonising responses in multiple sites, in various forms and numerous resistance initiatives (G.H. Smith, personal communication, 26 February 2023). This question is acknowledged in Contributions No. 3, 4 and 5.

5.3. Contributions to new knowledge

5.3.1. Contribution No. 1: Building an intervention model that can harness AI technologies to support whānau connectivity

Research Whānau Question 1 was significant in the unveiling of a key outcome of this research, the *Nukutere Model*, a framework enabling us to identify mātauranga and tikanga Māori, that when woven into algorithms, has the potential to inform next-generation AI systems which will promote cultural well-being for our whānau and their futures. The development of the *Nukutere Model* has enabled the keeping of our widely spread whānau in contact with each other and with our whenua. More importantly, it provides a means for the transmission of cultural knowledge to our mokopuna and each other. The *Nukutere Model* draws and builds on the insights from Kaupapa Māori theorising (Cram, 2001; Pihama et al., 2004; Smith, 1997a; Smith, 2021).

5.3.2. Contribution No. 2: Enhancement of whakawhanaungatanga

Research Whānau Questions 1 and 2 aided in the facilitation for our research to enhance³³ our whānau ability to ‘socialise’ beyond kanohi ki te kanohi because the *Nukutere Model* augments our whānau, hapū and iwi connectivity. The research wānanga also allowed for the critical conscientisation of the whānau as another important contributing element enabling transformation.

5.3.3 Contribution No. 3: Expanding a Kaupapa Māori Methodological approach

Research Whānau Questions 1 and 3 highlighted that *Kaupapa Māori theoretical frameworks* offered our whānau the freedom to explore the development of a new intervention without the pressures and limitations of the dominant culture (L. T. Smith, 2017). *Ko ahau anō* allowed me to draw on my experiences (Whitinui, 2014). Wānanga provided a traditional platform for sharing, co-creating and transmitting Māori knowledge (Mahuika & Mahuika, 2020; Smith et al., 2019). *Ngā Poutama Whetū* permitted our whānau to explore literature around power relations and prioritises Māori viewpoints (Hapeta et al., 2019) as seen in Figure 3.1.

5.3.4. Contribution No. 4: Adds grounded research literature in a scarce pool of Māori AI R&D

Research Whānau Question 3 led our whānau to articulate that our research has added to existing literature contributing to the AI field where there is:

A lack of culturally informed literature

A shortage of written narratives that illustrate how culture and cultural elements affect actual circumstances and outcomes is referred to as a lack of culturally informed literature. This may be caused by a number of things, such as a lack of knowledge or interest in cultural diversity and how culture affects how people behave, as well as a lack of funding and resources to do research and compile case studies.

³³ Whānau articulated, listen to, felt comfortable, where strengthened

A dearth of Indigenous authors

A dearth of Indigenous authors refers to a situation where there is a shortage of writers who identify as Indigenous or who are members of Indigenous communities. This can be due to a number of factors, including historical trauma and discrimination that has made it more difficult for Indigenous people to access education and publishing opportunities, as well as a lack of investment in Indigenous literature and cultural expression.

A scarcity of culturally based case studies

A scarcity of culturally based case studies refers to a situation where there is a lack of written accounts that provide examples of how culture and cultural factors impact real-world situations and outcomes. This can be due to a variety of factors, including a lack of understanding or interest in cultural diversity and the ways in which culture shapes human behaviour, as well as a shortage of resources and funding to conduct research and document case studies.

5.3.5. Contribution No. 5: Highlights the need to decolonise western AI systems

Research Whānau Question 3 helped discover that ACC, Corrections, Healthcare, the Police and other public institutions and agencies use algorithms in Aotearoa to map behaviours. Emerging technologies that use AI techniques have also been the subject of much criticism. To put this point in perspective, AI may be a new form of colonisation, while simultaneously being a helpful tool for cultural revitalisation. Understandably, this is a complex issue, which highlights how the over-representation of Māori via adverse statistical outcomes suggest algorithms are potentially flawed and biased. In this respect, it would be beneficial for future research to also utilise culturally informed approach, alongside active engagement by Māori to help continue deconstructing some of these tensions.

5.4. Cultural responsibility to whānau

As advocated by Kaupapa Māori theory, as the Lead Researcher, I have the responsibility and obligation to ensure that our whānau receive a copy of our research

findings. I began this process by feeding back through wānanga through an iterative process where I have considered the comments in producing this thesis document.

5.5. Summary statement and future research

To ensure that hegemonic AI systems do not continue marginalising Māori, our research provides an opportunity to interrogate Western-dominated AI systems that underpin commonly used digital technologies. The *Nukutere Model* represents a single building block of knowledge around AI. Also, as the research is idiosyncratic to our tribal homelands of Te Whakatōhea, there is a need for additional case studies to replicate and further this initial work. Furthermore, a cultural examination of the benefits and colonising potential of algorithms that inform next-generation AI systems will also be a valuable contribution.

Moreover, it is important to note that this research was conducted from a Te Uri o Patumoana and Raikete Amoamo perspective. Yet, it would be interesting for future research to adopt a similar approach with another whānau. As we group the research at a whānau level, we start to understand the interests and ideas of a hapū, growing further to iwi perspectives.

This thesis' potential lies in AI's ability to support Māori cultural well-being. The exponential growth in computerised processing power, brought about by the rapid growth of technology, has fundamentally altered how humans interact and socialise. These social considerations ground our belief that our elders, our Kuia and Kaumātua are pivotal in intergenerational knowledge-sharing. Not only does this cultural cross-generational relationship help remind our tamariki and mokopuna where they are from, but it aids in repositioning them as Māori and as tribal members of Whakatōhea. Our whānau, no matter where they live in Aotearoa, in Australia, and other parts of the world, will be connected (virtually or otherwise) to our tribal homelands. These connections enable our whānau to maintain our cultural uniqueness as Whakatōhea.

The spread of our iwi around the globe is an anomaly highlighted by the Whakatōhea settlement process with the Crown³⁴. Many of our iwi members do not reside close to our tribal territory. Given this, our whānau are not homogenous in their thinking, and many of our whānau have assimilated into a Western worldview. Hence, we need ways to affirm ourselves, bring ourselves together, and provide opportunities for forums that are meaningful to us to grow and revitalise ourselves. In short, our whānau believes in the intervention potential of AI. At our last whānau wānanga, we collectively affirmed the *Nukutere Model* as a fundamental model identifying and incorporating the 6 *Transforming Factors*, as shown in Table 34. Here, we collectively agreed that these *Transforming Factors* are essential in rebuilding our cultural selves. Moreover, these *Transforming Factors* have the potential to be woven into algorithms that will inform next-generation AI systems, promoting cultural well-being for our whānau and their futures. Overall, perhaps the most significant outcome is that now our whānau have become convinced of the merit of AI to enable our cultural growth and transformation.

³⁴ Historical disputes with the Crown are settled through the Whakatōhea settlement process.

Postscript - He kāwai e toro ana ki tawhiti

Whakataukī: He kāwai e toro ana ki tawhiti

The shoots of the hue extending in the distance

This whakataukī conveys the idea of seeking to establish relationships and discovering one's own roots. The saying emphasises the value of knowing one's family history and forming relationships with people who may live far away but are nonetheless significant to one's life and cultural identity.

Anonymous composition

This research paves the way for further exploration and application of AI's ability to advance cultural connectedness and well-being for Māori communities and perhaps other indigenous or culturally diverse communities.

Dissemination of findings:

The distribution of the research findings to our whānau is critical, however, the use of appropriate language and communication techniques is essential to ensure that our whānau and others can profit from our research efforts.

Collaborations with other whānau:

As I stated, Te Uri o Patumoana and Raikete Amoamo viewpoints were the main focus of this study. Collaborations with other whānau may be a part of future projects in order to develop a deeper understanding of the goals and perspectives of more whānau and other hapū and iwi.

Replicating the Nukutere Model:

A substantial contribution to the research is the Nukutere Model, which highlights Māori epistemologies and ontologies that may be recognised and incorporated into AI systems. The replication and adaptation of this concept for application in other hapū,

iwi, indigenous communities, or cultural contexts has the potential to be the subject of future projects.

Research in other communities:

The tribal homelands of Te Whakatōhea are the focus of the research, but comparable research issues and approaches may be investigated in other indigenous or cultural societies in future studies. Similar research would contribute to a greater comprehension of the various circumstances in which the potential of AI may assist cultural well-being.

Interdisciplinary collaborations:

Future research might entail interdisciplinary cooperation with authorities in computer science, anthropology, cultural studies, social sciences, ethics, data sovereignty, and technologists due to the complexity of AI and its potential impact on cultural revitalisation. These partnerships might allow for more research into how technology and culture interact.

Postscript summary

Among Māori communities and possibly in other indigenous or culturally diverse groups, the research has paved the way for further investigation and application of AI to improve cultural connectedness and well-being. The necessity of utilising suitable language and communication techniques is shown by the emphasis placed on disseminating findings to the whānau and other communities. The success of the Nukutere Model could be replicated in various contexts, similar research could be investigated in other communities, and interdisciplinary collaborations could be fostered to explore the intersection of technology and culture further. These are just a few examples of potential future projects.

Te rua kūmara o Tapuikākahu: (References)

Whakataukī: Te rua kūmara o Tapuikākahu

Tāpuikākahu was famous for planting kūmara in Te Whakatōhea history. Our references are the kūmara that were stored in the rua (storage pit) or the many archives, libraries, digital and oral sources.

Anonymous composition

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Ōmarumutu: (*Appendices*)

Ōmarumutu

The term Ōmarumutu is in reference to our whānau marae and to the appendices needed to support our research.

*Maru is to clothe or the shelter. Mutu is never-ending.
Ōmarumutu – the marae of never-ending covering or shelter*

Anonymous composition

Appendix 1: Information sheet for Research Whānau

Te Manu Tāiko
Human Research Ethics Committee
Te Pua Wānanga ki te Ao
Faculty of Māori and Indigenous Studies

Private Bag 3105
Hamilton 3240
Phone: 64-7-838 4737
E-mail: fmis@waikato.ac.nz



THE UNIVERSITY OF
WAIKATO
Te Whare Wānanga o Waikato

Mātauranga Māori: Our guide to whakawhanaungatanga, relationship building with emerging technologies that use artificial intelligence (AI) techniques in Māori society.

Research Information Sheet

Tēnā koe,

As our initial discussions revealed I would like to work with you to investigate whether emerging technologies which use artificial intelligence (AI) can make and maintain connections for us living outside our Whakatōhea homelands with those who live on our turangawaewae. The aim of this research project is to develop a framework of best practices so that when building the next generation of AI systems, aspirations will be promoted while Māori engages with the technologies. This research aims to explore engagement with technology practices while in social, educational, political, spiritual or work

contexts to establish the factors that facilitate or hinder optimal conditions that promote cultural aspirations that nurtures the way Māori do things.

As part of the research, we will be conducting online kōrero. I would like to discuss your thoughts and experiences on your use of technology. Kōrero would take about one hour and would be set at time convenient for you. All information you provide in our kōrero is confidential and your name will not be used, unless indicated by yourself. If possible, I would like to record our kōrero in order to develop clear and full transcripts of the discussion. You have the right to among other things to:

- refuse to answer any particular question.
- ask any further questions about the study that occurs to you during your participation.
- withdraw your material and participation at any time.
- receive to change and comment on the summary transcript of your interview.
- be given access to a summary of the findings from the study when it is concluded.

The expected aim of this research to be a Doctoral thesis. A summary of the research findings will be sent out to you.

Thank you very much for your time and help in making this study possible. If you have any queries or wish to know more, please phone me or write to me at:

Petera Hudson
Te Pua Wānanga ki te Ao,
Faculty of Māori and Indigenous Studies,
Te Whare Wānanga o Waikato / The University of Waikato
Private Bag 3105
Hamilton, New Zealand
Email: worldsalsatours@gmail.com
Phone: 0276584663

For any queries regarding ethical concerns please contact my supervisor:

Te Pua Wānanga ki te Ao
Supervisor: Dr Hēmi Whaanga
Email: hemi.whaanga@waikato.ac.nz
Phone: 0211892630

Appendix 2: Ethics approval - Waikato University

Faculty of Maori & Indigenous
Studies
Te Pua Wānanga ki te Ao
The University of Waikato
Private Bag 3105
Hamilton, New Zealand

Dr Haki Tuaupiki
Phone +64 7 858 5017
haki.tuaupiki@waikato.ac.nz



Te Kāhui Manu Tāiko: Human Research Ethics Committee
Faculty of Māori & Indigenous Studies
Te Pua Wānanga ki te Ao

Friday 19 May, 2021

Ethics Approval

Tēnā koe e te manu tāiko e rere atu nā i ngā huarahi o te rangahau.

This letter is to confirm that Petera Hudson has received ethical approval for the study, *The development of a Tikanga Māori Framework which will inform the building of next generation AI systems.*

The ethics application was reviewed by members of Te Kāhui Manu Tāiko and was signed off by the chair of the committee on 19 May, 2021. Good luck as you embark on your research.

Mahia te mahi hei painga mō te iwi – Nā Te Pua Herangi.

Ngā manaakitanga.

Dr Haki Tuaupiki
Convener, Te Kāhui Manu Tāiko
Te Pua Wānanga ki te Ao
Te Whare Wānanga o Waikato
Faculty of Māori & Indigenous Studies
The University of Waikato

Appendix 3: Massey University approval to use Waikato University's ethics processes



Craig Johnson <C.B.Johnson@massey.ac.nz>

to Hemi, Patsy, Human, me, Tracy ▾

Tue, 26 Jul 2022, 15:56



Kia ora Petera,

It is usual for postgraduate students to have ethics approval through Massey ethics committees, but where there is a sensible reason for this not to be the case, other appropriate arrangements can be made subject to written notification to and approval of the Research Ethics Office. Your transfer from Waikato seems like an eminently sensible reason and I am happy to take this email as written notification to our office, so I am happy to approve your use of Waikato ethics processes.

I hope that your studies and exam go well.

Ngā mihi,

Craig

**Prof Craig Johnson BSc (Liv) PhD (Cantab) DSc (Massey) DVA DipECVA
(he/him)**

Professor of Veterinary Neurophysiology and Animal Welfare Science

Director of Research Ethics

Co Director, Animal Welfare Science and Bioethics Centre

School of Veterinary Sciences

Tāwharau Ora

Massey University

Palmerston North

New Zealand

Appendix 4: Information sheet for Research Whānau



Petera Hudson shared a link.
Admin · January 8, 2021 · 🌐

...

Ngā mihinui o te tau hou ra Whānau!!

Sending heaps of love and best wishes to you all as we climb in a new year

I want to share with you more information around our whānau project investigating how technologies, especially those that use artificial intelligence (AI) might make and maintain connections for those of us living away from our tribal homelands and those living on our turangawaewae - our place where one has rights of reside and belong through kinship and whakapapa - genealogy.

In October last year Associate Professor Māui Hudson, Professor Tahu Kukutai and Associate Professor Te Taka Keegan successfully secured funding from the Ministry of Business, Innovation and Employment (MBIE) to lead *Tikanga in Technology: Indigenous approaches to transforming data ecosystems* - a programme that aims to test Māori approaches to collective privacy, benefit and governance in a digital environment with a view to increase the benefits to Māori and reduce data harms.

<https://www.waikato.ac.nz/news-opinion/media/2020/new-research-seeks-to-transform-data-ecosystems-to-benefit-indigenous-peoples>

My research supervisor, Associate Professor Hēmi Whaanga approached me late last year to ask whether I wanted to join their research team and whether our whānau project would consider being part of the *Tikanga in Technology* programme. I didn't hesitate to say yes, I would love to be a contributor to this programme but I wanted to share and ask you whether you wanted our project to be a part of this programme before committing.

There are a number of benefits for us from being a part of the *Tikanga in Technology* programme:

1. We have direct access to resources at Waikato University including knowledge, technology and financial assistance.
2. We will find solutions to our question of whether technologies might make and maintain connections for those of us living away from our tribal homelands and those living on our turangawaewae.
3. Our findings to our question will contribute to the wider good for Māori and Indigenous people around keeping our data safe.

However, we also need to consider:

1. What governance do we have over our Patumoana me Raikete Amoamo data whilst being a part of a national research programme?
2. Connected with the above consideration, how do we protect personal and family privacy?
3. What time commitments are we looking at to complete our whānau project?

You may see other benefits and may have further concerns.

Please feel free to use this space to share your thoughts or contact me directly to discuss further.

I look forward to your considerations

Arohanui

Petera

Appendix 5: Africa - Artificial Intelligence reforms

Country	Areas of priority	
Egypt	The strategy has been planned under the slogan "Artificial Intelligence for Development and Prosperity" and aims to utilise this technology to achieve Egypt's development goals and drive economic growth.	
Kenya	Kenya established a Blockchain & Artificial Intelligence Taskforce to contextualize the application of Artificial Intelligence in areas of the country's financial inclusion, cyber-security, land titling, election and single digital identity processes.	
Nigeria	Nigeria still has a long way to go in Artificial Intelligence and other advanced technologies shaping the global marketplace. The Nigerian government needs to develop an Artificial Intelligent roadmap.	
South Africa	Artificial Intelligence in South Africa is still relatively nascent, with a few upcoming use cases and a lack of government strategy to facilitate the use or discussions of ethical or industry aspects of artificial intelligence.	
Country	Areas of priority	Drivers
Africa Union	<p>Artificial Intelligence ecosystem in Africa*:</p> <ul style="list-style-type: none"> • Education systems must adapt quickly, and new frameworks must be created for workers and citizens to develop the skills they need to thrive. • Broadband coverage must expand rapidly, specifically in rural areas, for all citizens and businesses to reap the benefits. • Ethical implications regarding the fair, safe, and inclusive use of AI applications also must be addressed through collaboration and engagement to ensure AI systems earn trust. • Ensuring a more profound, broader, and more accessible pool of data is available will also be essential to enable researchers, developers, and users to drive AI. <p>*(Brookings Institute Africa Growth Initiative, 2020)</p>	<ul style="list-style-type: none"> • Agriculture will be done more efficiently and effectively, raising yields. • Healthcare will be better tailored, quality, and more accessible, improving outcomes. • Public services will be more efficient and responsive to citizens, enhancing impact. • Financial services will be more secure and expand access and reach more citizens who need them.

Note. Adapted from OECD.AI - Database of National AI Policies, by OECD.AI, 2021.

Appendix 6: Asia: Singapore – Artificial Intelligence reforms

AI Reform	Country	Year	Areas of priority	Drivers
National Artificial Intelligence (AI) Strategy	Singapore	2019	<ul style="list-style-type: none"> • Singapore will be a global hub for developing, test-bedding, deploying, and scaling AI solutions. • Government and businesses will use AI to generate economic gains and improve lives. • Singaporeans will understand AI technologies and the benefits they can bring: our workforce will be equipped with the necessary competencies to participate in the AI economy. 	<ul style="list-style-type: none"> • Triple helix partnerships – Research communities. • Artificial Intelligence talent and education. • Data architecture. • Progressive and trusted environment. • International collaboration.

Note: National Artificial Intelligence (AI) Strategy, by Singapore Government: Smart Nation and Digital Government Office (2019).

Appendix 7: Asia: China – Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers
A Next-Generation Artificial Intelligence Development Plan	China	July 2017	<ol style="list-style-type: none"> 1. The overall technology and application of AI will be in step with globally advanced levels, the AI industry will have become a new important economic growth point, and AI technology applications will have become a new way to improve people’s livelihoods, strongly supporting [China’s] entrance into the ranks of innovative nations and comprehensively achieving the struggle toward the goal of a moderately prosperous society. 2. By 2025, China will achieve breakthroughs in fundamental theories for AI. Some technologies and applications achieve a world-leading level, and AI becomes the main driving force for China’s industrial upgrading and economic transformation, while intelligent social construction has made positive progress. 3. By 2030, China’s AI theories, technologies, and applications should achieve world-leading levels, making China the world’s primary AI innovation centre, achieving visible results in intelligent economy and intelligent society 	<ol style="list-style-type: none"> 1. Build open and coordinated AI science and technology innovation systems. 2. Fostering a high-end, highly efficient smart economy. 3. Construct a safe and convenient intelligent society. 4. Strengthen military-civilian integration in the AI domain. 5. Build a safe and efficient intelligent infrastructure system. 6. Plan a new generation of AI major science and technology projects.

			applications, and laying an important foundation for becoming a leading innovation-style nation and an economic power.	
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Note: Adapted from New Generation Artificial Intelligence Development Plan, by China's State Council (2017).

Appendix 8: Asia: Japan – Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers
Integrated Innovation Strategy 2020	Japan	June 2020	<ul style="list-style-type: none"> • Dignity - A society in which human dignity is respected. • Diversity and Inclusion - A society where people with diverse backgrounds can pursue their well-being. • Sustainability - A sustainable society. 	<p>The creation of ecosystems built by connecting multiplying domains.</p> <p>Strategic Objective 1: To develop a base of human resources and build a mechanism to achieve this objective sustainably.</p> <p>Strategic Objective 2: To become a frontrunner in the application of AI to real-world industry and to achieve strengthened industrial competitiveness.</p> <p>Strategic Objective 3: To realize a "sustainable society that incorporates diversity."</p> <p>Strategic Objective 4: To take a leadership role in building international research, education, and social infrastructure networks in the AI field.</p>

Note: Adapted from Integrated Innovation Strategy 2020, by the Government of Japan (2020).

Appendix 9: Asia: The Republic of South Korea – Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
National Strategy for Artificial Intelligence: Toward AI World Leader Beyond IT	Republic of South Korea	2019	<ul style="list-style-type: none"> • Establishment of a global-learning AI ecosystem. • The country that makes the best use of AI. • The realisation of people-centred AI. 	<ol style="list-style-type: none"> 1. Create an environment where they (Republic of Korean people) can exercise their imagination to the fullest, work together and take on new challenges. The visions and goals that the Republic of Korea envisions. 2. Provide support companies to earn profits. 3. Unrivalled in terms of our use of AI. 4. The Government will become AI-oriented. 	The National Strategy for Artificial Intelligence is an approach paper prepared by the government of the Republic of South Korea.

Note: Adapted from National Strategy for Artificial Intelligence: Toward AI World Leader Beyond IT by the Government of the Republic of Korea (2019).

Appendix 10: Asia: KSA – Artificial Intelligence reforms

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
National Strategy for Data and AI	Kingdom of Saudi Arabia (KSA)	2016	<p>Education Incorporating Data & AI in education to align the education system with labour market requirements besides improving the student's skills.</p> <p>Government Adapting Data & AI in government to create a smarter as well as more effective public sector.</p> <p>Healthcare Fitting Data & AI into healthcare systems in order to enhance access and pre-emptive care along with accommodating growing demand.</p> <p>Energy Fitting Data & AI into energy for augmenting capacity, enhancing efficacy, and developing industries.</p> <p>Mobility Integrating Data & AI in mobility to build a regional hub, creating smart city mobility technology as well, as improving traffic safety in cities.</p>	<p>Ambitions: Position KSA as the global hub where the best of Data & AI is made a reality.</p> <p>Skills: Transform KSA's workforce with a steady local supply of Data & AI-empowered talents +20K data & AI specialists and experts.</p> <p>Policies & Regulations: Enact the most welcoming legislation for Data & AI businesses and talents.</p> <p>Investment: Attract efficient, stable funding for qualified Data & AI investment opportunities.</p> <p>Research & Innovation: Empower top Data & AI institutions to spearhead innovation and impact creation Rank among top 20 countries in scientific contribution.</p> <p>Ecosystem: Stimulate Data & AI adoption with the most collaborative and forward-thinking ecosystem.</p>	2030 Vision of the Kingdom of Saudi Arabia (KSA) (KSA Council of Economic and Development Affairs, 2016).

Note: Adapted from National Strategy for Data and AI by the Saudi Data & AI Authority (2021).

Appendix 11: Asia: UAE – Artificial Intelligence reforms

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
UAE Strategy for Artificial Intelligence (AI)	UAE	Oct 2017	<p>The UAE will begin through its existing strengths:</p> <ol style="list-style-type: none"> 1. Industry Assets & Emerging Sectors. 2. Smart Government. <p>The UAE will also focus on opportunities where it can lead:</p> <ol style="list-style-type: none"> 3. Data Sharing And Governance. 4. New Generation Of Regional Talent. 	<ul style="list-style-type: none"> • Build a reputation as an AI destination. • Increase competitive assets. • Develop fertile ecosystem. • Adopt AI across customer services. • Attract and train talent. • Bring world-leading research capability to work with target industries. • Develop data and supporting infrastructure. • Ensure strong governance and effective regulation. 	<p>UAE National Strategy for Artificial Intelligence 2031 (UAE Government, 2018).</p> <p>and</p> <p>2030 Vision of the Kingdom of Saudi Arabia (KSA).</p>

Note: Adapted from UAE National Strategy for Artificial Intelligence 2031 by the UAE Government (2018)

Appendix 12: Asia: Israel - Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers
Israel’s National Artificial Intelligence (AI) Strategy	Israel	2019	<ul style="list-style-type: none"> • Industry: Create a workforce for the industry. • Academia: Create scientific knowledge that enables technological advancement. • Defence establishment: Create security-related technology. 	<ul style="list-style-type: none"> • National security. • Organization: National infrastructures and human resources: <ul style="list-style-type: none"> ○ Research and development. ○ Budgeting. ○ Safety. ○ Morality. ○ Law. ○ Standardisation. ○ Knowledge sharing international, diplomatic, military intelligence and cooperative aspects.

				<ul style="list-style-type: none"> ○ Human resources education and training. • Investment.
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Note: Adapted from Artificial Intelligence and National Security in Israel, by Antebi (2021)

Appendix 13: EU: Austria - Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
Artificial intelligence mission Austria 2030 policy/report URL Link: https://knowledge4policy.ec.europa.eu/ai-watch/country/austria_en	Austria	June 2019	Trustworthiness of AI. Artificial Intelligence foundations, objectives and joint action of the European Union. Regulatory framework (ethics, legal) <ul style="list-style-type: none"> • safety and security of AI • defining standards, • Artificial Intelligence infrastructure • data use and sharing, • conditions for R&D • transfer and uptake of AI. Cooperation between education, research and business societal dialogue and creating awareness and AI in the public sector.	AI to address societal challenges Climate and environment. COVID-19 pandemic.	EU National Strategies.

Note: Adapted from AI Watch - EU AI Strategy Report, by the European Commission (2021a)

Appendix 14: EU: Belgium - Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
<p>URL Link: https://knowledge4policy.ec.europa.eu/ai-watch/country/belgium_en</p>	Belgium	Start date 2022	<p>Supporting high-quality talent by:</p> <p>Ensuring social and economic benefits by encouraging:</p> <ul style="list-style-type: none"> * Continuous skills development in AI, * Building a robust and prosperous AI economy, and * Optimising public services through AI. <p>Building of an ethical, resilient and secure society through AI.</p>	<p>Human capital Successful deployment of an AI ecosystem is the access to human capital in AI.</p> <p>From the lab to the market To spur research and innovations in AI.</p> <p>Networking to encourage networking, raise international attractiveness and increase awareness of AI.</p> <p>Regulation To ensure a reliable, safe and trustworthy AI development by establishing a legal and regulatory framework that encourages innovation while respecting citizens' fundamental rights and freedoms.</p> <p>Infrastructure Recognises the importance of facilitating access to data and making it available for citizens, businesses, public authorities and researchers.</p> <p>AI to address societal challenges Climate and environment</p> <p>COVID-19 pandemic.</p>	EU National Strategies.

Note: Adapted from AI Watch - EU AI Strategy Report, by the European Commission (2021a)

Appendix 15: EU: Bulgaria - Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
<p>National AI strategy</p> <p>URL Link: https://knowledge4policy.ec.europa.eu/ai-watch/country/bulgaria_en</p>	Bulgaria	Dec 2020	<p>Nurturing a solid knowledge and skills base in AI.</p> <p>Developing a strong research capacity for scientific excellence.</p> <p>Supporting innovations to foster the implementation of AI in practice.</p> <p>Building a reliable infrastructure for AI development.</p> <p>Ensuring sustainable conditions for financing AI developments: Raising awareness and building trust in society.</p> <p>Creating a regulatory framework for the development and use of reliable AI in accordance with international regulatory and ethical standards.</p>	<p>Human capital Education reforms are needed across all education levels and place greater emphasis on vocational training and lifelong learning to enable people to acquire and improve their digital and AI-related skills.</p> <p>From the lab to the market To spur research excellence are presented in the recently updated National research strategy 2017-2030, the National roadmap for scientific infrastructure and the funding schemes of the National scientific programmes.</p> <p>Networking Emphasises the need to strengthen research and innovation capacities and the uptake of AI technologies by means of active collaborations between research institutions and industry at the national and international level.</p> <p>Regulation Commits establish a regulatory basis for developing and using trustworthy AI in line with</p>	EU National Strategies.

				<p>international regulatory and ethical standards.</p> <p>Infrastructure To invest in infrastructure for delivering high-performance computing, secure data collection, storage and processing.</p> <p>AI to address societal challenges Climate and environment.</p> <p>COVID-19 pandemic.</p>	
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Note: Adapted from AI Watch - EU AI Strategy Report, by the European Commission (2021a)

Appendix 16: EU: Croatia - Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
<p>National plan for the development of artificial intelligence</p> <p>URL Link: https://knowledge4policy.ec.europa.eu/ai-watch/country/croatia_en</p>	Croatia	2020	Policy measures and actions for the period 2021 to 2025.	<p>Artificial Intelligence to address societal challenges Climate and environment.</p> <p>COVID-19 pandemic.</p>	EU National Strategies.

Note: Adapted from AI Watch - EU AI Strategy Report, by the European Commission (2021a)

Appendix 17: EU: Cyprus - Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
<p>National Artificial Intelligence Strategy</p> <p>URL Link: https://knowledge4policy.ec.europa.eu/ai-watch/country/cyprus_en</p>	Cyprus	Jan 2020	<p>Cultivating talent, skills and lifelong learning.</p> <p>Increasing the competitiveness of businesses through support initiatives towards research and innovation and maximising opportunities for networking and partnerships.</p> <p>Improving the quality of public services through the use of digital and AI-related applications.</p> <p>Creating national data areas.</p> <p>Developing ethical and reliable AI.</p>	<p>Human capital Improvements to the education in AI.</p> <p>From the lab to the market Fostering research and innovation.</p> <p>Networking Encourage partnerships with leading international organisations to increase the level of research and innovation in AI.</p> <p>Regulation Develop a legislative framework.</p> <p>Infrastructure Artificial Intelligence to address societal challenges create a data ecosystem with guidelines and regulations about data interoperability and data exchange agreements.</p> <p>Climate and environment.</p> <p>COVID-19 pandemic.</p>	EU National Strategies.

Note: Adapted from AI Watch - EU AI Strategy Report, by the European Commission (2021a)

Appendix 18: EU: Czech Republic - Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
<p>National Artificial Intelligence Strategy</p> <p>Innovation strategy 2019–2030</p> <p>Digital Czech Republic strategy</p> <p>URL Link: https://knowledge4policy.ec.europa.eu/ai-watch/country/czech-republic_en</p>	Czech Republic	May 2019	<p>A responsible and trusted AI ecosystem.</p> <p>The digitalisation of enterprises, in particular, SMEs.</p> <p>Equitable opportunities and benefits in AI to boost the economic development of society.</p>	<p>Human capital Reform the primary, secondary and higher education towards AI learning.</p> <p>From the lab to the market Support basic and applied research in the field of AI.</p> <p>Networking Foster both national and international partnerships.</p> <p>Regulation Effective regulation to protect human rights, and to clarify responsibilities, intellectual property rights and liabilities.</p> <p>Infrastructure A well-functioning data infrastructure is a key prerequisite of AI developments.</p> <p>Artificial Intelligence to address societal challenges Climate and environment.</p> <p>COVID-19 pandemic.</p>	

Note: Adapted from AI Watch - EU AI Strategy Report, by the European Commission (2021a)

Appendix 19: EU: Estonia - Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
<p>Estonia’s national AI strategy</p> <p>URL Link: https://knowledge4policy.ec.europa.eu/ai-watch/country/estonia_en</p>	Estonia	July 2019	<p>Providing direct support to research in AI and increasing the relevant skills and competencies to do so.</p> <p>Developing a legal environment to facilitate the uptake of AI.</p>	<p>Human capital Reforms to the formal education and training systems in order to increase skills and competencies in AI.</p> <p>From the lab to the market Increase the capacity of AI research.</p> <p>Networking Improve networking and collaboration opportunities.</p> <p>Regulation Amendments to the legislation to facilitate the development and uptake of AI.</p> <p>Infrastructure salient attention to data infrastructure policies.</p> <p>Artificial Intelligence to address societal challenges Climate and environment.</p> <p>COVID-19 pandemic.</p>	EU National Strategies.

Note: Adapted from AI Watch - EU AI Strategy Report, by the European Commission (2021a)

Appendix 20: EU: France - Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
<p>AI for Humanity</p> <p>URL Link: https://knowledge4policy.ec.europa.eu/ai-watch/country/france_en</p>	France	March 2018	<p>Improve the AI education and training ecosystem to develop, retain and attract world-class AI talent.</p> <p>Establish an open data policy for the implementation of AI applications and pooling assets together.</p> <p>Develop an ethical framework for transparent and fair use of AI applications.</p>	<p>Human capital The AI strategy will continue to provide financial incentives to higher education and research institutions to increase initial training at all levels, intermediate and expert, dual programmes and the retraining or upgrading of talent.</p> <p>From the lab to market Support applied research and innovation.</p> <p>Networking Foster networks and collaborations in AI.</p> <p>Regulation Ethical matters to ensure fair and transparent use of AI technologies and algorithms are central to the French AI strategy.</p> <p>Infrastructure Data policy initiatives.</p> <p>Artificial Intelligence to address societal challenges Climate and environment.</p> <p>COVID-19 pandemic.</p>	EU National Strategies.

Note: Adapted from AI Watch - EU AI Strategy Report, by the European Commission (2021a)

Appendix 21: EU: Germany - Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
<p>National AI strategy</p> <p>URL Link: https://knowledge4policy.ec.europa.eu/ai-watch/country/germany_en</p>	Germany	Nov 2018	<p>Increasing and consolidating Germany's future competitiveness by making Germany and Europe a leading centre in AI.</p> <p>Guaranteeing a responsible development and deployment of AI which serves the good of society.</p> <p>Integrating AI in society in ethical, legal, cultural and institutional terms in the context of a broad societal dialogue and active political measures.</p>	<p>Human capital Policy reforms and initiatives for formal training and education, with a special focus on the formation of educators, trainers and the general public in order to guarantee a high-quality level of education in AI.</p> <p>From the lab to market Funding schemes and support initiatives to foster research in the field of AI.</p> <p>Networking Foster networks and collaborations across the business community, academia and public research centres.</p> <p>Regulation Repeated examination of regulatory issues relating to AI.</p> <p>Infrastructure Expand the current data infrastructure in order to create optimal conditions for the development of cutting-edge AI applications.</p> <p>Artificial Intelligence to address societal challenges Climate and environment.</p>	EU National Strategies.

				COVID-19 pandemic.	
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Note: Adapted from AI Watch - EU AI Strategy Report, by the European Commission (2021a)

Appendix 22: EU: Greece - Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
National AI strategy URL Link: https://knowledge4policy.ec.europa.eu/ai-watch/country/greece_en	Greece	Planning	Determining the conditions for the development of AI, including the skills and trust framework, the data policy as well as the ethical principles for its safe development and use. Describing national priorities and areas for maximizing the benefits of AI to meet societal challenges and economic growth. Analysing the necessary actions related to the above priorities and proposing horizontal interventions and at least one pilot application per policy area.	Artificial Intelligence to address societal challenges Climate and environment. COVID-19 pandemic.	EU National Strategies .

Note: Adapted from AI Watch - EU AI Strategy Report, by the European Commission (2021a)

Appendix 23: EU: Hungary - Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
<p>National AI strategy</p> <p>URL Link: https://knowledge4policy.ec.europa.eu/ai-watch/country/hungary_en</p>	Hungary	Sept 2020	<p>Strengthen the foundation pillars of the Hungarian AI ecosystem: data economy, research development and innovation (R&D&I), AI uptake, education and competence development, infrastructure deployment, and regulatory and ethical framework.</p> <p>Focus on specific sectors and technology fields with the highest acceleration potential for Hungary: manufacturing, healthcare, agriculture, public administration, transportation, logistics & energy.</p> <p>Initiate transformative programmes with long term ambitious goals that offer direct benefits to citizens: autonomous systems and self-driving vehicles, health-consciousness in a digital world, climate-driven agriculture, data-wallet and personalised services, AI-supported</p>	<p>Human capital To raise citizen's awareness of AI and to leverage human competencies in using and developing AI technologies.</p> <p>From the lab to market To foster scientific research in the field of AI.</p> <p>Networking Establishing a broad-based and dynamic research ecosystem driven by collaborative efforts between national and international AI developers and researchers.</p> <p>Regulation To ensure a responsible, reliable and human-centred utilisation of AI technologies.</p> <p>Infrastructure To foster the development and adoption of AI are data processing and data analysis.</p> <p>Artificial Intelligence to address societal challenges Climate and environment.</p> <p>COVID-19 pandemic.</p>	EU National Strategies.

			development of personal competencies, automated administration procedures in Hungarian, and energy networks focused on renewable sources of energy.		
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Note: Adapted from AI Watch - EU AI Strategy Report, by the European Commission (2021a)

Appendix 24: EU: Ireland - Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
National AI strategy “AI - Here for Good” URL Link: https://knowledge4policy.ec.europa.eu/ai-watch/country/ireland_en	Ireland	2021	Societal opportunities and challenges of AI. Enterprise development and deployment of AI: RD&I. Human capital considerations: data: digital and connectivity infrastructure: public sector use of AI. Ethics, governance, standards and regulatory framework.	Artificial Intelligence to address societal challenges Climate and environment. COVID-19 pandemic.	EU National Strategies.

Note: Adapted from AI Watch - EU AI Strategy Report, by the European Commission (2021a)

Appendix 25: EU: Italy - Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
<p>National AI strategy</p> <p>URL Link: https://knowledge4policy.ec.europa.eu/ai-watch/country/italy_en</p>	Italy	Oct 2020	<p>Improving AI education at all levels and providing lifelong learning and reskilling opportunities to the labour force.</p> <p>Fostering AI research and innovation to enhance the entrepreneurial competitiveness.</p> <p>Establishing an ethical regulatory framework for a sustainable and trustworthy AI.</p> <p>Supporting (international) networks and partnerships: Developing a data infrastructure for AI applications.</p> <p>Improving public services through wider adoption and use of AI systems.</p>	<p>Human capital Initiatives to strengthen AI education at all levels.</p> <p>From the lab to market To increase the competitiveness of the AI industry.</p> <p>Networking Encourages the wide range of national centres of excellence to set up an R&D network close to the industrial communities.</p> <p>Regulation The ethical regulatory framework for AI has to ensure transparency, accountability, and reliability to stimulate citizens' trust and engagement in a thriving AI ecosystem.</p> <p>Infrastructure To define a data policy that promotes collection, exchange and re-use of data while respecting privacy rights and ensuring interoperability based on standards.</p> <p>Artificial Intelligence to address societal challenges</p>	EU National Strategies.

				Climate and environment. COVID-19 pandemic.	
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Note: Adapted from AI Watch - EU AI Strategy Report, by the European Commission (2021a)

Appendix 26: EU: Latvia - Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
<p>National AI strategy on Developing artificial intelligence solutions</p> <p>URL Link: https://knowledge4policy.ec.europa.eu/ai-watch/country/latvia_en</p>	Latvia	Feb 2020	<p>Raising the awareness of and competencies in AI across society through education reforms.</p> <p>Promoting the adoption and development of AI in the public and private sector.</p> <p>Engaging actively in national and international cooperation.</p> <p>Developing a solid legal and ethical framework for AI.</p> <p>Unleashing the benefits of a well-developed data ecosystem.</p> <p>Investing in a digital and telecommunication infrastructure to support AI developments.</p>	<p>Human capital Improving skills and competencies in AI-related fields is essential to accelerate AI deployment, use and development.</p> <p>From the lab to market The Latvian strategy highlights that several universities and research centres are currently conducting several research projects in AI.</p> <p>Networking To foster innovations in AI, research and development should not be conducted in isolation but rather in collaboration by bringing together competencies from national and international organisations.</p> <p>Regulation The development of a normative framework to define what is ethically and legally sound in AI.</p>	EU National Strategies.

				<p>Infrastructure The adopted guiding principles for e-government and data governance in the public administration.</p> <p>Artificial Intelligence to address societal challenges</p> <p>Climate and environment.</p> <p>COVID-19 pandemic.</p>	
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Note: Adapted from AI Watch - EU AI Strategy Report, by the European Commission (2021a)

Appendix 27: EU: Lithuania - Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
<p>Lithuanian artificial intelligence strategy: a vision for the future</p> <p>URL Link: https://knowledge4policy.ec.europa.eu/ai-watch/country/lithuania_en</p>	Lithuania	March 2019	<p>Improving the skills and education in AI for all citizens.</p> <p>Strengthening the national research and innovation ecosystem in the field of AI.</p> <p>Increasing the deployment, development and use of AI in all economic activities, including both the private and public sector.</p> <p>Promoting national and international collaborations in AI and enhancing network opportunities.</p>	<p>Human capital Advocates the development of skills and competencies in AI at all education levels, emphasising the need to start teaching AI foundations at an early age.</p> <p>From the lab to market The growth of research and development in the field of AI.</p> <p>Networking AI ecosystem is further strengthened with policies towards networking and opportunities for partnerships across all relevant stakeholders.</p>	EU National Strategies.

			<p>Developing an ethical and legal framework for sustainable and transparent development of AI applications.</p> <p>Establishing a responsible and efficient data ecosystem for AI.</p>	<p>Regulation To create a solid foundation for trustworthy developments of AI, the Lithuanian strategy sets out recommendations for creating an ethical and legal regulatory framework.</p> <p>Infrastructure Create a stable and AI-friendly data environment with a focus on the public sector.</p> <p>Artificial Intelligence to address societal challenges</p> <p>Climate and environment.</p> <p>COVID-19 pandemic.</p>	
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Note: Adapted from AI Watch - EU AI Strategy Report, by the European Commission (2021a)

Appendix 28: EU: Luxembourg - Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
<p>Artificial intelligence: a strategic vision for Luxembourg</p> <p>URL Link: https://knowledge4policy.ec.europa.eu/ai-watch/country/luxembourg_en</p>	Luxembourg	May 2019	<p>Enhancing the skills and competencies in the field of AI and providing opportunities for lifelong learning.</p> <p>Supporting research and development of AI, transforming Luxembourg into a living lab for applied AI.</p> <p>Increasing public and private investments in AI</p>	<p>Human capital Reforming the secondary and higher education systems and vocational training programmes to include AI-related courses in their curricula.</p> <p>From the lab to market The creation of marketable products and services in AI, the Government of Luxembourg has</p>	EU National Strategies.

		<p>and related technologies.</p> <p>Fostering the adoption and use of AI in the public sector: Strengthening opportunities for national and international networks and collaborations with strategic partners in AI.</p> <p>Developing an ethical and regulatory framework, with particular attention to privacy regulation and security to ensure transparent and trustworthy AI development.</p> <p>Unleashing the potential of the data economy as a cornerstone of AI development.</p>	<p>the ambition to transform the country into a living lab for applied AI.</p> <p>Networking Increasing national and international partnerships in AI.</p> <p>Regulation To removes barriers to AI development.</p> <p>Infrastructure Well-developed data and telecommunication infrastructure.</p> <p>Artificial Intelligence to address societal challenges</p> <p>Climate and environment.</p> <p>COVID-19 pandemic.</p>	
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Note: Adapted from AI Watch - EU AI Strategy Report, by the European Commission (2021a)

Appendix 29: EU: Malta - Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
<p>Malta's national AI strategy</p> <p>URL Link: https://knowledge4policy.europa.eu/ai-watch/country/malta_en</p>	<p>Malta</p>	<p>Oct 2019</p>	<p>The creation of a solid AI ecosystem based on investments, start-up support and innovation.</p> <p>Support for increased adoption of AI in the public sector.</p> <p>Support measures for the adoption of AI in the private sector.</p>	<p>Human capital Introduce fundamental changes to the educational system.</p> <p>From the lab to market Increased research activities, dedicated investment instruments, start-ups development and innovation support in the public and private sector.</p> <p>Networking The development of a detailed framework for collaboration between industry, educational and research institutes.</p> <p>Regulation Developing a legal and ethical framework is a salient step towards a successful adoption and subsequent widespread deployment and use of AI across the economy.</p> <p>Infrastructure Development and adoption can only be achieved in a well-developed and cutting-edge data and ICT infrastructure.</p> <p>Artificial Intelligence to address societal challenges</p>	<p>EU National Strategies.</p>

				Climate and environment. COVID-19 pandemic.	
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Note: Adapted from AI Watch - EU AI Strategy Report, by the European Commission (2021a)

Appendix 30: EU: Poland - Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
<p>Policy for the development of artificial intelligence in Poland from 2020</p> <p>URL Link: https://knowledge4policy.ec.europa.eu/ai-watch/country/portugal_en</p>	Poland	Dec 2020	<p>Reforming the educational system and providing lifelong learning opportunities in AI-related fields.</p> <p>Encouraging growth and innovation of AI companies through dedicated support in AI research, including the provision of sufficient financial resources.</p> <p>Increasing national and international partnerships in AI.</p> <p>Creating a data ecosystem with trustworthy and high-quality data and increased data exchange mechanisms.</p> <p>Reinforcing the digital infrastructure, regulatory framework and test environments to foster the development of AI innovations.</p>	<p>Human capital Acquiring the necessary competencies and skills to develop AI applications is essential to preparing for the transformations and challenges that AI will bring along.</p> <p>From the lab to market To foster basic and applied research in AI, the Polish Government will set up a Virtual Research Institute for Artificial Intelligence (VIR) in collaboration with businesses, academia and non-governmental organisations.</p> <p>Networking To foster the Polish industry's competitiveness and strengthen the research competencies of the scientific community, the Polish strategy proposes various policy initiatives to encourage a culture of collaboration in AI developments.</p>	EU National Strategies.

				<p>Regulation create a trustworthy and sustainable environment for the development of AI.</p> <p>Infrastructure create a trustworthy and sustainable environment for the development of AI.</p> <p>Artificial Intelligence to address societal challenges</p> <p>Climate and environment.</p> <p>COVID-19 pandemic.</p>	
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Note: Adapted from AI Watch - EU AI Strategy Report, by the European Commission (2021a)

Appendix 31: EU: Portugal - Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
<p>AI Portugal 2030</p> <p>URL Link: https://knowledge4policy.ec.europa.eu/ai-watch/country/portugal_en</p>	Portugal	June 2019	<p>Sets out challenges and opportunities of the growing AI ecosystem.</p> <p>To foster the use of AI in public and private sectors during the coming years.</p> <p>Actions on inclusion, education, qualification, specialisation and research as people are the main engine of a successful AI deployment.</p>	<p>Human capital Human development, particularly the enablement and reinforcement of the population vis-à-vis challenges and priorities set by the AI technologies.</p> <p>From the lab to market Supporting AI products and services from the lab to the market will stimulate knowledge-intensive research and the entrepreneurial ecosystem on AI.</p> <p>Networking The establishment of partnerships between public and private institutions and advocates that joint undertakings should include European and international collaborations.</p> <p>Regulation Legal, regulatory and ethical frameworks are essential to developing standards in AI for transparency, accountability, liability and ownership.</p> <p>Infrastructure Support the AI infrastructure.</p>	EU National Strategies.

				<p>Artificial Intelligence to address societal challenges</p> <p>Climate and environment.</p> <p>COVID-19 pandemic.</p>	
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Note: Adapted from AI Watch - EU AI Strategy Report, by the European Commission (2021a)

Appendix 32: EU: Romania - Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
<p>National AI strategy</p> <p>URL Link: https://knowledge4policy.ec.europa.eu/ai-watch/country/romania_en</p>	Romania	Released for public consultation at the end of 2019.	<p>To ensure the adoption of safe AI applications in every day life.</p> <p>To promote fundamental research leading to genuine AI applications and developments while preserving human rights and social values.</p>		EU National Strategies

Note: Adapted from AI Watch - EU AI Strategy Report, by the European Commission (2021a)

Appendix 33: EU: Slovakia - Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
<p>Action plan for the digital transformation of Slovakia for 2019–2022</p> <p>URL Link: https://knowledge4policy.ec.europa.eu/ai-watch/country/slovakia_en</p>	Slovakia	July 2019	<p>Supporting the digital transformation of schools and education to promote skills for the digital era.</p> <p>Strengthening the digital basis of the data economy.</p> <p>Improving the capacity of public administrations to use data for the benefit of citizens:</p> <p>Supporting the AI ecosystem.</p>	<p>Human capital To simulate an AI education in line with current and forthcoming needs of both public and private sectors.</p> <p>From the lab to market Support policies to increase the research potential in AI of both public and private sectors:</p> <p>Networking Increase networking opportunities and partnership.</p> <p>Regulation Building trustworthy AI systems requires proper ethical guidelines to define integrity, explainability, and reproducibility in AI.</p> <p>Infrastructure To become a dynamic data economy since data is the fuel for the successful development of AI.</p> <p>Artificial Intelligence to address societal challenges</p> <p>Climate and environment.</p> <p>COVID-19 pandemic.</p>	

Note: Adapted from AI Watch - EU AI Strategy Report, by the European Commission (2021a)

Appendix 34: EU: Slovenia - Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
<p>In August 2020, a National draft programme promoting the development and use of AI in the Republic of Slovenia by 2025 was released</p> <p>URL Link: https://knowledge4policy.ec.europa.eu/ai-watch/country/slovenia_en</p>	Slovenia		<p>Creating a supportive ecosystem for research, innovation and AI deployment.</p> <p>Strengthening technological and industrial capacities in the field of AI.</p> <p>Implementing reference AI solutions in the industry, public sector, public and state administration and society.</p> <p>Enhancing international cooperation.</p> <p>Ensuring an appropriate ethical and legal framework to increase public trust in AI.</p> <p>Launching a National AI Observatory.</p> <p>Establishing a cutting-edge data and computing infrastructure for AI.</p>	<p>Human capital To reinforce human resources in AI.</p> <p>From the lab to market Promotes research excellence and increases AI's scientific and innovation capacity in both the public and private sectors.</p> <p>Networking To foster networks and collaborations across the business community, public sector, academia and public research centres.</p> <p>Regulation Defining principles for a human-centred, trustworthy, fair, transparent and sustainable development of this emerging technology.</p> <p>Infrastructure To foster the development of an appropriate data and telecommunication infrastructure to collect, share and analyse big data that feed into AI algorithms.</p> <p>Artificial Intelligence to address societal challenges</p> <p>Climate and environment.</p>	EU National Strategies.

				COVID-19 pandemic.	
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Note: Adapted from AI Watch - EU AI Strategy Report, by the European Commission (2021a)

Appendix 35: EU: Spain - Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
<p>National AI strategy</p> <p>URL Link: https://knowledge4policy.ec.europa.eu/ai-watch/country/spain_en</p>	Spain	Dec 2020	<p>Promoting the development of human capital in AI through the development of a large base of skilled employment, the provision of training and education opportunities, the stimulation of Spanish talent and the attraction of global talent towards Spain.</p> <p>Developing solid scientific excellence in the field of AI to promote Spain as a leading country in AI.</p> <p>Placing Spain as a leader in the development of tools, technologies and applications for the projection and use of the Spanish language in AI.</p> <p>Boosting the deployment and use of AI technologies in both the public and private sector, including also cross-cutting sector activities</p>	<p>Human capital Human capital is an essential cornerstone and driver for the successful deployment and development of AI in Spain.</p> <p>From the lab to market The development of AI goes along with solid scientific research in AI and the subsequent efforts to transform science into marketable products and services.</p> <p>Networking An efficient knowledge sharing across stakeholders is crucial for the development of AI.</p> <p>Regulation The proliferation of AI across the economy and society needs a well-developed ethical and regulatory framework that protects individual and collective rights and safeguards inclusion and social welfare.</p>	EU National Strategies.

			<p>and grand challenges.</p> <p>Guaranteeing an ethical framework that outlines individual and collective rights and builds an environment of trust in AI.</p> <p>Ensuring inclusiveness in the AI-driven economy by reducing gender gaps and digital divides while supporting ecological transition and territorial cohesion.</p>	<p>Infrastructure Incorporates dedicated policies to develop data platforms.</p> <p>Artificial Intelligence to address societal challenges</p> <p>Climate and environment.</p> <p>COVID-19 pandemic.</p>	
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Note: Adapted from AI Watch - EU AI Strategy Report, by the European Commission (2021a)

Appendix 36: EU: Switzerland - Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
<p>National AI strategy</p> <p>URL Link: https://knowledge4policy.ec.europa.eu/ai-watch/country/switzerland_en</p>	Switzerland	Dec 2019	<p>Improving AI-related skills and competencies at all education levels and creating a lifelong learning and reskilling opportunities for the labour force.</p> <p>Fostering AI research and innovation to enhance the competitiveness of the entrepreneurial ecosystem.</p> <p>Enhancing public services through wider adoption and use of AI applications: Supporting</p>	<p>Human capital To enhance human capacity in AI emphasises the need to develop courses to acquire the necessary skills for the deployment of AI in the primary, secondary and tertiary education systems.</p> <p>From the lab to market Support scientific research in AI and enhance innovation in AI.</p> <p>Networking recommended promoting better networking and cooperation</p>	EU National Strategies.

			<p>(international) networks and partnerships, and ensuring the exchange of information and knowledge between all economic and institutional players.</p> <p>Establishing a regulatory and ethical framework to ensure a sustainable and trustworthy AI: Developing a data infrastructure to fuel AI developments.</p> <p>Reinforcing the telecommunication infrastructure, in particular with respect to cybersecurity.</p>	<p>between AI-relevant actors.</p> <p>Regulation The regulation concerns legislation and recommendations to foster AI innovations, create a standard of AI adoption and application, and care for the principle of ethics and inclusion.</p> <p>Infrastructure The implementation of a suitable infrastructure is among its challenges.</p> <p>Artificial Intelligence to address societal challenges</p> <p>Climate and environment.</p> <p>COVID-19 pandemic.</p>	
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Note: Adapted from AI Watch - EU AI Strategy Report, by the European Commission (2021a)

Appendix 37: Nordic: Denmark – Artificial Intelligence reforms

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
<p>National AI strategy</p> <p>Strategy for Denmark’s Digital Growth</p> <p>URL Link: https://knowledge4policy.ec.europa.eu/ai-watch/country/denmark_en</p>	Denmark	March 2019	<p>Develop a common ethical and human-centred basis for AI.</p> <p>Prioritise and support research in AI.</p> <p>Encourage the growth of Danish businesses by developing and using AI.</p> <p>Ensure that the public sector uses AI to offer world-class services for the benefit of citizens and society.</p>	<p>The strategy has three goals:</p> <p>(1) make Danish businesses the best at using digital technologies,</p> <p>(2) have the best conditions in place for the digital transformation of business, and</p> <p>(3) ensure every Dane is equipped with the necessary digital skills to compete.</p>	EU National Strategies.

Note: Adapted from AI Watch – Denmark AI Strategy Reports, by the European Commission (2021b)

Appendix 38: Nordic: Finland – Artificial Intelligence reforms

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
<p>Finland's age of artificial intelligence</p> <p>URL Link: https://knowledge4policy.ec.europa.eu/ai-watch/country/finland_en</p>	Finland	Oct 2017	<p>Increase the competitiveness of business and industry.</p> <p>Provide high-quality public services and improve the efficiency of the public sector.</p> <p>Ensure a well-functioning society and wellbeing of its citizens.</p>	<p>Human capital Skills directed to the utilisation and development of AI and robotics are mainly present in technological and mathematical fields, which are often too broadly defined to support society in these times of change.</p> <p>From the lab to market Support AI developments from the lab to the market.</p> <p>Networking Seamless collaborations and networking between various players.</p> <p>Regulation To promote good management and the effective utilisation of information.</p> <p>Infrastructure Several data infrastructure initiatives are deployed at a large scale: others are proposed in a restricted environment and serve as regulatory sandboxes.</p> <p>Artificial Intelligence to address societal challenges Climate and environment.</p> <p>COVID-19 pandemic.</p>	EU National Strategies.

Note: Adapted from AI Watch – Finland AI Strategy Reports, by the European Commission (2021b)

Appendix 39: Nordic: Norway – Artificial Intelligence reforms

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
<p>National AI strategy</p> <p>URL Link: https://knowledge4policy.ec.europa.eu/ai-watch/country/norway_en</p>	Norway	Jan 2020	<p>Expanding the offer of education programmes and workplace training in the field of AI in order to create a solid basis of digital skills and capabilities.</p> <p>Strengthening the Norwegian research in AI: Enhancing the innovation capacity in AI in both the private and public sector.</p> <p>Outlining ethical principles for AI in order to allow fair, reliable and trustworthy AI-related developments.</p> <p>Establishing digitalisation-friendly regulations to define the legislative framework in which AI developments take place.</p> <p>Constructing a strong data infrastructure ensuring open data and data sharing across sectors and business areas. Dedicated opportunities for language data resources are established through The Norwegian language bank at the National Library.</p> <p>Deploying a telecommunication infrastructure that provides high-capacity connectivity and computing power and that ensures security in AI-based systems.</p>	<p>Human capital The AI strategy strongly emphasised the need of increased digital competence at all levels of education and those already employed.</p> <p>From the lab to market Promotion of scientific research is essential to achieve groundbreaking innovations in AI.</p> <p>Networking To increase the networking and collaboration opportunities.</p> <p>Regulation The national AI strategy aims to encourage the development and use of AI based on ethical principles and respect for human rights and democracy.</p> <p>Infrastructure The development of a strong data ecosystem to improve the collection of quality data, to facilitate data sharing and promote open data policies.</p> <p>Artificial Intelligence to address societal challenges Climate and environment. COVID-19 pandemic.</p>	EU National Strategies.

Note: Adapted from AI Watch –Norway AI Strategy Reports, by the European Commission (2021b)

Appendix 40: Nordic: Sweden – Artificial Intelligence reforms

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
<p>National approach for artificial intelligence</p> <p>URL Link: https://knowledge4policy.europa.eu/ai-watch/country/sweden_en</p>	<p>Sweden</p>	<p>May 2018</p>	<ul style="list-style-type: none"> * Education and training. * Research. * Innovation and use. * Framework and infrastructure. 	<p>Human capital Addresses the need of formal education and training as well as lifelong learning in AI.</p> <p>From the lab to market To transform innovative ideas into marketable products and services.</p> <p>Networking Setting up policies to: Foster strong collaborations and partnerships among business, the public sector and research in AI, Develop collaboration and partnerships on the use of AI applications with other countries.</p> <p>Regulation To foster AI regulation, the Government has identified the need to: Develop rules, standards, norms and ethical principles for an ethical and sustainable AI & its use, Push for Swedish and international standards and regulations that promote a risk-free use of AI.</p> <p>Infrastructure The Swedish strategy emphasizes the need of digital infrastructure to harness AI's opportunities, including both a high-quality data infrastructure and a</p>	<p>EU National Strategies.</p>

				<p>well-developed digital and telecommunication infrastructure in computer power, connectivity, and network capacity.</p> <p>Artificial Intelligence to address societal challenges Climate and environment. COVID-19 pandemic.</p>	
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Note: Adapted from AI Watch –Sweden AI Strategy Reports, by the European Commission (2021b)

Appendix 41: German – Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
<p>National AI strategy</p> <p>URL Link: https://knowledge4policy.ec.europa.eu/ai-watch/country/germany_en</p>	<p>Germany</p>	<p>Nov 2018</p>	<p>Increasing and consolidating Germany’s future competitiveness by making Germany and Europe a leading centre in AI.</p> <p>Guaranteeing a responsible development and deployment of AI which serves the good of society.</p> <p>Integrating AI in society in ethical, legal, cultural and institutional terms in the context of a broad societal dialogue and active political measures.</p>	<p>Human capital policy reforms and initiatives for formal training and education, with a special focus on the formation of educators, trainers and the general public in order to guarantee a high-quality level of education in AI.</p> <p>From the lab to market Funding schemes and support initiatives to foster research in the field of AI.</p> <p>Networking foster networks and collaborations across the business community, academia and public research centres.</p> <p>Regulation repeated examination of regulatory issues relating to AI.</p> <p>Infrastructure expand the current data infrastructure in order to create optimal conditions for the development of cutting-edge AI applications.</p> <p>Artificial Intelligence to address societal challenges</p>	<p>EU National Strategies.</p>

				Climate and environment. COVID-19 pandemic.	
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Note: Adapted from AI Watch - German AI Strategy Report, by the European Commission (2021b)

Appendix 42: Netherlands – Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
<p>Strategic Action Plan for Artificial Intelligence (AI)</p> <p>URL Link: https://knowledge4policy.ec.europa.eu/ai-watch/country/netherlands_en</p>	Netherlands	Oct 2019	<p>Capitalising on societal and economic opportunities: policies encouraging the adoption, use and development of AI in the private and public sector and promoting the use of AI to tackle societal challenges.</p> <p>Creating the right conditions: policies supporting education and skills development in AI, fostering research and innovation in AI, facilitating access to qualitative data and improving the digital infrastructure.</p> <p>Strengthening the foundations: including policy actions related to ethical issues, such as trust, human rights, consumer protection, and safety of citizens.</p>	<p>Human capital increased digital literacy in primary and secondary education and providing more opportunities to develop skills and competencies in data science in higher education.</p> <p>From the lab to market supporting a new research programme on AI.</p> <p>Networking values collaborations and public-partnerships (PPPs) in AI.</p> <p>Regulation advocates a trustworthy and responsible use of AI with respect for human rights and consumer protection and based on a well-developed legal framework.</p> <p>Infrastructure to foster the data infrastructure and to provide foundations for data use and sharing.</p> <p>Artificial Intelligence to</p>	EU National Strategies.

				address societal challenges Climate and environment. COVID-19 pandemic.	
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Note: Adapted from AI Watch - Netherlands AI Strategy Report, by the European Commission (2021b)

Appendix 43: The UK – Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers	Genesis
<p>New Artificial Intelligence (AI) Strategy</p> <p>URL Link: https://knowledge4policy.ec.europa.eu/ai-watch/united-kingdom-ai-strategy-report_en</p>	UK	Jan 2021	<p>Growth of the economy through the widespread use of AI technologies.</p> <p>Ethical, safe and trustworthy development of responsible AI.</p> <p>Resilience in the face of change through an emphasis on skills, talent and R&D.</p> <p>Ideas - the world’s most innovative economy</p> <p>People - good jobs and greater earning power for all: Infrastructure - a major upgrade to the UK’s infrastructure</p> <p>Business environment - the best place to start and grow a business</p> <p>Places - prosperous communities across the UK.</p>	<p>Human capital formal education and training towards increasing AI-related skills and competencies of future generations in the UK.</p> <p>From the lab to the market To foster research in the short run, UK’s government recently increased the rate of R&D expenditure credit to 12 per cent.</p> <p>Networking policy actions for networking and partnerships in AI.</p> <p>Regulation To build trust for the usage, adoption and development of AI across society.</p> <p>Infrastructure Policy initiatives for the development of a reliable and qualitative data infrastructure.</p>	<p>In April 2018, the government of the UK published their national AI strategy entitled AI Sector Deal (Gov.UK, 2021). This strategy was updated after one year in May 2019.</p> <p>A dedicated web portal developed by the Ministerial Department for Business, Energy & Industrial Strategy and the Ministerial Department of Digital, Culture, Media & Sport presents an update on the progress.</p> <p>These ministries have developed an Office for Artificial Intelligence to coordinate the implementation efforts set out in the AI Sector Deal.</p>

Note: Adapted from AI Watch - United Kingdom AI Strategy Report, by the European Commission (2021b)

Appendix 44: Russia – Artificial Intelligence reform

AI Reform	Country	Year	Areas of priority	Drivers
<p>National Strategy for Development of Artificial Intelligence</p> <p>URL Link: https://www.ifri.org/sites/default/files/atoms/files/nocetti_russia_artificial_intelligence_2020.pdf</p>	<p>Russia</p>	<p>2019</p>	<p>The Economy via:</p> <ol style="list-style-type: none"> 1. The economy, via industry. 2. The social sphere, including healthcare, education and public services. <p>Defence</p> <ul style="list-style-type: none"> • A significant omission from the: <p>The defence sector is always working on modernising the country’s armed forces and developing sensitive AI applications in command-and-control systems, military robotics and drones.</p>	<p>Recognition of definition of AI as</p> <ul style="list-style-type: none"> • A collection of technological solutions that allow one to simulate human cognitive processes and to get results when accomplishing concrete tasks that are at least comparable with those of the human intellect. • Importance of AI as a prerequisite for Russia’s entry into the group of economic world leaders and the country’s technological independence and competitiveness. • Expression of high confidence in Russia’s ability to overcome the existing gap and catch up with the more technologically developed countries.

Note: Adapted from The Outsider: Russia in the Race for Artificial Intelligence Report by the Nocetti (2020).

Appendix 45: Latin American: Argentina – Artificial Intelligence reforms

AI Reform	Country	Year	Areas of priority	Drivers
<p>Argentina’s Artificial Intelligence Strategy</p> <p>URL Link: https://www.oxfordinsights.com/insights/2021/1/8/oxford-insights-ai-strategy-series-argentina-and-uruguay</p>	Argentina	2019	<p>Promote AI in the private sector.</p> <p>Minimize ethical risks.</p> <p>Develop talent, amongst other objectives.</p>	<p>Maximise the potential of AI to contribute to economic growth.</p> <p>Support AI developments that are inclusive and seek to improve people’s quality of life.</p> <p>Minimise the risk associated with AI in terms of data protection and privacy.</p> <p>Invest in developing AI talent and in R&D, which will benefit both the public and private sectors.</p> <p>Improve collaboration around AI between government, research bodies, scientists, and international and domestic businesses.</p>

Note: Adapted from Oxford Insights’ AI Strategy Series: Argentina and Uruguay, by Kendall (2021)

Appendix 46: Latin American: Uruguay – Artificial Intelligence reforms

AI Reform	Country	Year	Areas of priority	Drivers
<p>Uruguay’s Artificial Intelligence Strategy</p> <p>URL Link: https://www.oxfordinsights.com/insights/2021/1/8/oxford-insights-ai-strategy-series-argentina-and-uruguay</p>	Uruguay	2019	Promoting the use of AI within public administration.	<p>Map out the AI ecosystem in the Uruguayan public and private sectors and academia, identifying areas of expertise and action plans.</p> <p>Define an AI Governance model in Public Administration and generate the capabilities for its implementation.</p> <p>Create spaces for learning around AI in public and private spheres.</p> <p>Create technical guides for the good use of AI in Public Administration.</p> <p>Promote algorithm transparency.</p> <p>Create AI action plans for specific sectors.</p>

Note: Adapted from Oxford Insights’ AI Strategy Series: Argentina and Uruguay, by Kendall (2021)

Appendix 47: Latin American: Chile - Artificial Intelligence reforms

Country	Year	Areas of priority	Drivers
Chile URL Link: https://oecd.ai/dashboards/policy-initiatives/http:%2F%2Faipo.oecd.org%2F2021-data-policyInitiatives-24840	2019	<ul style="list-style-type: none"> • To empower citizens in the development and application of AI tools and encourage their participation in the debate on their legal, ethical, social and economic consequences. • To develop AIs enabling factors encompass human capital development, technological infrastructure and data availability. • To foster the use and development of AI, which encompasses research, development, innovation, and entrepreneurship based on AI systems. It also fosters adoption both in the private and the public sector. • To discuss and reach consensus about ethics, standards, cybersecurity and regulation between the private and public sectors for a human-centred development and use of AI. This includes privacy, transparency, responsibility, environmental issues, gender gap, automation impacts, among others. 	<p>The Chilean Artificial Intelligence Policy 2021-2030 covers three pillars:</p> <ol style="list-style-type: none"> 1. enabling factors, 2. development and adoption of AI 3. ethics, regulatory aspects and socio-economic impacts.

Note: Adapted from OECD.AI: Chile: Artificial Intelligence National Policy by the OECD.AI (2023b).

Appendix 48: Latin American: Brazil - Artificial Intelligence reforms

Country	Year	Areas of priority	Drivers
Brazil URL Link: https://oecd.ai/dashboards/policy-initiatives/http:%2F%2Faipo.oecd.org%2F2021-data-policyInitiatives-27103	2021	<ul style="list-style-type: none"> • Develop ethical principles that guide the responsible use of AI. • Remove barriers to innovation. • Improve collaboration between government, the private sector and researchers. • Develop AI skills: promote investment in technologies: and • Advance Brazilian tech overseas. 	<p>Brazil has adopted the OECD’s five principles for responsible AI:</p> <ul style="list-style-type: none"> • Inclusive growth, sustainable development and wellbeing. • Human-centred values and equity. • Transparency and responsible disclosure. • Robustness, security and safety. • Accountability.

Note: Adapted from OECD.AI: Brazil’s National AI Strategy by the OECD.AI (2023d).

Appendix 49: Latin American: Mexico - Artificial Intelligence reforms

Country	Year	Areas of priority	Drivers
Mexico URL Link: https://stip.oecd.org/stip/policy-initiatives/2019%2Fdata%2FpolicyInitiatives%2F26703	2018	<p>Mexico's AI Strategy 2018 included five key actions:</p> <ul style="list-style-type: none"> • To develop an inclusive governance framework. • To identify the uses and needs of AI in the industry. • To open the medium and long term recommendations of the Policy Report for public consultation. • To support Mexico’s AI leadership in international forums. • To promote continuity through changing administration. 	<ol style="list-style-type: none"> 1. Data, Digital Infrastructure and Cybersecurity. 2. Ethics. 3. Research and Development. 4. Governance, Government and Public Services . 5. Skills, Capacities and Education 6. Mexicans Abroad.

Note: Adapted from OECD.AI: Mexico’s National AI Strategy by the OECD.AI (2023f)

Appendix 50: Canada - Artificial Intelligence reforms

AI Reform	Country	Year	Areas of priority	Drivers
<p>Pan-Canadian Artificial Intelligence Strategy</p> <p>URL Link: https://www.oecd.ai/dashboards/policy-initiatives/https://www.oecd.ai/dashboards/policy-initiatives/https://www.oecd.ai/dashboards/policy-initiatives/https://www.oecd.ai/dashboards/policy-initiatives/https://www.oecd.ai/dashboards/policy-initiatives/</p>	Canada	2017	<ul style="list-style-type: none"> To increase the number of outstanding artificial intelligence researchers and skilled graduates in Canada. To establish interconnected nodes of scientific excellence in Canada's three major centres for artificial intelligence in Edmonton, Montreal and Toronto-Waterloo. To develop global thought leadership on the economic, ethical, policy and legal implications of advances in artificial intelligence. To support a national research community on artificial intelligence. To foster cooperation between AI research centres and industry. 	<ul style="list-style-type: none"> Inclusive growth, sustainable development and well-being Human-centred values and fairness Investing in AI R&D Building human capacity and preparing for labour market transition

Note: Adapted from OECD.AI: Pan-Canadian Artificial Intelligence Strategy. Canadian Institute for Advanced Research (CIFAR:), by the OECD.AI (2021)

Appendix 51: USA - Artificial Intelligence reforms

AI Reform	Country	Year	Areas of priority
National Artificial Intelligence (AI) Strategy URL Link: https://www.oecd.ai/dashboards/policy-initiatives/http%2F%2Faipo.oecd.org%2F2021-data-policyInitiatives-24281	USA	2018	<ul style="list-style-type: none"> • Make long-term investments in AI research. • Develop effective methods for human-AI collaboration. • Understand and address the ethical, legal, and societal implications of AI. • Ensure the safety and security of AI systems. • Develop shared public datasets and environments for AI training and testing. • Measure and evaluate AI technologies through standards and benchmarks. Better understand the national AI R&D workforce needs. Expand public-private partnerships to accelerate advances in AI.

Note: Adapted from OECD.AI: USA: National AI R&D Strategic Plan, by the OECD.AI (2023e)

Appendix 52: Australia - Artificial Intelligence reforms

AI Reform	Country	Year	Areas of priority	Drivers
<p>National AI Plan</p> <p>URL Link: https://www.industry.gov.au/data-and-publications/australias-artificial-intelligence-action-plan</p>	<p>Australia</p>	<p>2021</p>	<p>The AI Action Plan will be implemented under four focus areas.</p> <ol style="list-style-type: none"> 1. Developing and adopting AI to transform Australian businesses – support to help businesses develop and adopt AI technologies to create jobs and increase their productivity and competitiveness. 2. Creating an environment to grow and attract the world’s best AI talent – support to ensure our businesses have access to world-class talent and expertise. 3. Using cutting edge AI technologies to solve Australia’s national challenges – support to harness Australia’s world-leading AI research capabilities to solve national challenges and ensure all Australians have an opportunity to 	<p>Vision: To establish Australia as a global leader in developing and adopting trusted, secure and responsible AI.</p> <p>The Digital Economy Strategy aims to deliver on the Australian Government’s ambition for Australia to be a leading digital economy and society by 2030. Building capability in emerging technologies within the digital economy, such as AI will:</p> <ul style="list-style-type: none"> • drive productivity and prosperity, • create jobs, • enable us to solve the real-world problems of today, • grow the businesses and sectors of tomorrow.

			benefit from AI. 4. Making Australia a global leader in responsible and inclusive AI – support to ensure AI is inclusive and technologies are built to reflect Australian values.	
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Note: Adapted from Government of Australia: National AI Plan, by the OECD.AI (2023c)

Appendix 53: Aotearoa/New Zealand - Artificial Intelligence reforms

AI Reform	Country	Year	Areas of priority	Genesis
<p>National Artificial Intelligence (AI) Strategy</p> <p>URL Link: https://aiforum.org.nz/wp-content/uploads/2018/07/AI-Report-2018_web-version.pdf</p>	<p>Aotearoa / New Zealand</p>	<p>Jan 2021</p>	<p>Theme 1: Forging a coordinated New Zealand AI strategy.</p> <p>Theme 2: Creating Awareness and Understanding of AI.</p> <p>Theme 3: Assisting AI Adoption.</p> <p>Theme 4: Increasing Trusted Data Accessibility.</p> <p>Theme 5: Growing the AI Talent Pool.</p> <p>Theme 6: Adapting to AI effects on Law, Ethics and Society.</p>	<p>AI Forum of New Zealand.</p> <p>The Data Ethics Advisory Group.</p> <p>The Algorithm Charter.</p>

Note: Adapted from the Algorithm Charter for Aotearoa New Zealand by the OECD.AI (2023a)

Karakia Whakamutunga³⁵ (*Closing Prayer*)

Kia tau te Rangimārie

O te rangi e tū iho nei

O Papatūānuku e takoto nei

O te Taiao e awahi nei

Ki runga i a tatou

Tihei mauri ora

May the peace of the sky above

Of the Earth below

And of the all-embracing Universe

Rest upon us all

Behold it is life

³⁵ End, last, concluding, final, finale