# ĀMIOMIO: TOWARD A FRAMEWORK FOR SUSTAINABLE WELLBEING—A NEW ZEALAND PERSPECTIVE

An update [version 2]

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## INTRODUCTION

*How do we sustainably increase the wellbeing of the people of New Zealand?* is the question of a research programme called Āmiomio, a term which means "to turn round and round" in the Māori language (Moorfield, 2024), but is taken here to mean 'circularity and convergence.' Through the lens of Āmiomio, the belief is that the answer is to be found thorough an ongoing debate about its meaning, practice, and effect from the intellectual traditions of all knowledge. This report summarises our collective search for a framework for sustainably increasing wellbeing in Aotearoa, New Zealand using Māori knowledge and contemporary economic ideas and principles.

In keeping with the transdisciplinary nature of Āmiomio, which comprises three teams working on *framework development*, *materials and design*, and *law and policy*, we employ three kinds of data to develop a framework: (1) existing literature; (2) dialogic; and (3) deliberative. Describing the way in which knowleges are combined is a delicate task because of the potential for sensitivities about misplaced assumptions (stereotyping), cross-cultural miscues (racism), power imbalances (inequalities), and theoretical inconsistencies (empiricism versus spiritualism) (Morgan & Manuel, 2020). Fortunately, none of these problems were observed among the authors who were members of Research Aim 1.1, tasked with developing a conceptual framework for the entire research programme. Instead, we learned from each other and enjoyed the process, the initial fruits of which appear in this report. Members within the group began to appreciate a view of nature that was new to them, the significance of the Treaty of Waitangi to Māori and the Crown, and subsequent injustices, and the ethics of kaitiakitanga (stewardship) (Kawharu, 2000), which had been a foundation of a Māori world view for sustainable living over several centuries (Hēnare, 2015). Scholars in the group became more familiar with economic theory and its way of explaining human behaviour. The mutual respect and understanding that arose from the ongoing dialogue enabled new thinking to arise. An example of this is the credence

(in our dialogic haven at least) given to the idea of tangata whenua as a more responsible and effective custodian of common pool and heritage assets than the state (Ostrom, 2012), which goes well beyond the notion of co-governance (Magallanes, 2021) to a place where Indigenous governance and ethics may be preferable (Joseph, 2014).

Two other elements deserved caution: (1) essentialism—when one section of a group perceives another as an inferior representation of the group, which can arise in *Māori for Māori* research, but is generally repelled by the heterogeneity of Māori identity (Greaves et al., 2015; Houkamau et al., 2019); and (2) responsiveness—when one section of the group fails to behave culturally appropriately and effectively toward another, which can arise when Māori work in non-Māori dominant organisations or spaces, requiring an active concern for cultural safety and efficacy (Mika & Dana, 2021; Mika et al., 2018).

When faced with the question "How do we balance the needs of current and future generations?" mainstream analysis e.g., by NZ Treasury, looks for leads in the foundational work of Pearse et al, (2003), the Brundtland Report (1987) and World Bank (2011). Such approaches assume that to increase wellbeing all we need is more capital (the sum of human, financial & physical, social and natural). If some particular capital stock declines, for example, a non-renewable natural resource, wellbeing can still increase if some other type of capital, say human, increases to allow the sum to grow. However, in adding up the value of capital, as in many other economic models, the special characteristics of 'nature', e.g., that some natural capital, such as air, land and water, is essential for continued existence, are ignored.

Our belief is that a fundamentally different approach from mainstream analysis is needed. in that sustainable wellbeing requires recognising the importance of maintaining holistic balance in all relationships for collective wellbeing.

The report proceeds in six sections. First, we discuss the Treaty of Waitangi, which is central to New Zealand's history and debate about wellbeing. The next three sections review three distinct methods we employed to develop a framework for sustainable wellbeing in Aotearoa: (1) review of existing literature; (2) co-design; and (3) wānanga, which is a Māori way of arriving at consensus. Section five proposes a framework for Āmiomio. Finally, we conclude with comments on the implications for policy, practice, education and research.

## NEW ZEALAND PERSPECTIVE

This section discusses te Tiriti o Waitangi, the Treaty of Waitangi as foundational for discussion on wellbeing and New Zealand wellbeing frameworks, including Treasury's Living Standards Framework and He Ara Waiora, among others.

### Treaty of Waitangi

As the founding document of New Zealand, the Treaty of Waitangi encourages partnership-based approaches to influence policy, practice, and research, drawing on the knowledge and institutions of Māori and the Crown in this process. Āmiomio was conceived and implemented as a research programme with this partnership-based approach in mind. Despite being written rather hastily in 1840, what is known and understood about the Treaty is always changing, offering new interpretations about its relevance and impact. While there is only one Treaty of Waitangi, there are two texts, one written in the English language comprising 568 words and one written in te reo Māori (the Māori language) consisting of 480 words. We follow the Waitangi Tribunal's conventions on the Treaty (Coxhead et al., 2014) because, under the Treaty of Waitangi Act 1975, the tribunal is responsible for deciding the meaning and effect of the Treaty when inquiring into Māori treaty claims taking into account what the parties intended and the circumstances of the Treaty signing (Waitangi Tribunal, 2016).

*Treaty provisions*

The Treaty contains a preamble, three articles, and an epilogue (Waitangi Tribunal, 2016). Freedom of religious belief, including the practice of Māori spiritual beliefs, was also agreed by Hobson, but was not written into the Treaty text. While article one of the English text provides that the tribes of Nu Tireni (New Zealand) ceded 'sovereignty' to Queen Victoria, in article one of the Māori text, Māori gave the British Monarch kāwanatanga—a transliteration for governance. In article two of the English text, the Queen guaranteed Māori 'undisturbed possession' of their

lands, forests, and fisheries, so long as it was their wish to retain them. Under article two, Māori could only sell their lands to the Crown. In the Māori text of article two, 'rangatiratanga' was used to acknowledge the status of the tribes and to protect the authority of the chiefs over their lands and other taonga (treasured things). In article three of the English text, the British Crown promised Māori all the rights and privileges of 'British subjects,' while in the Māori text, 'nga tikanga katoa rite tahi' was granted, translated to mean the same rights and duties as citizens of England (Kawharu, 1989).

*Treaty making*

While the languages used acknowledge two sovereign nations—Māori and the British Crown—who forged the Treaty, differences in the words used in the English and Māori texts and their meanings have haunted Māori and Crown relations since its signing on 6 February 1840 at Waitangi in the Bay of Islands. Key characters involved in the Treaty event were William Hobson, lieutenant-governor, acting under instructions that colonial secretary Lord Normanby had issued him, which James Stephen of the Colonial Office had prepared. In negotiating a treaty to secure British sovereignty, Hobson's instructions were to act with "sincerity, justice and good faith," not to allow Māori to unintentionally harm themselves, and only acquire land from Māori that they did need for themselves (State Services Commission, 2005a, p. 2). James Busby, British Resident, reviewed and revised the draft Treaty text that Hobson and his assistant James Freeman had prepared. Henry Williams and his son Edward translated the Treaty into Māori. Around 40 Māori chiefs signed the Treaty of Waitangi on 6 February 1840, and a further 500 chiefs signed nine surviving copies of the Treaty at 50 meetings around New Zealand between April and September (State Services Commission, 2005b). On 1 May 1840 William Hobson proclaimed Crown sovereignty over New Zealand via the Treaty and discovery in the case of the South Island. With this, New Zealand came under the jurisdiction of New South Wales, but in 1841 became a British colony. The British government preferred annexation and encouraged Māori to amalgamate with

settlers rather than protection through Indigenous reservations, which had not worked elsewhere—in effect, assimilation followed (State Services Commission, 2005c).

*Treaty effects*

Settlers were dismissive of the Treaty as a useful instrument for "pacifying savages," with the Crown prioritising establishing order and making land available for settlement (State Services Commission, 2005c, p. 5). Crown purchases of Māori land under its right of pre-emption in article two of the Treaty resulted in the sale of much of the South Island, leaving tribes without adequate land for their needs. The formation of a settler government was made possible through the Constitution Act 1852, where Māori were largely excluded from the parliamentary process because ownership or leasing of freehold land worth more than £50 or leased for £10 or more a year was required to vote or stand for election. While section 71 of the Constitution Act allowed for 'native districts' in which Māori could be self-governing, this provision was not implemented. In 1858, Potatau Te Wherowhero became the first Māori king, a movement established as a way to promote tribal unity, reassert Māori authority over Māori affairs, and to protect Māori lands from further alienation (Derby, 2012). In July 1860, the New Zealand Wars began following Māori resistance to land sales in Taranaki, which spread to other areas, ending in 1872 (Belich, 1998). The land wars eventually resulted in confiscating four million acres of Māori land under the New Zealand Settlements Act 1863 (State Services Commission, 2005c). Under the Native Lands Act 1862, settlors could now purchase land directly from Māori, ending Crown pre-emption. The Native Land Court, however, operated in a way that severely disadvantaged Māori, with high costs to attend hearings and the conversion of land from communal to individual title facilitating further land loss (State Services Commission, 2005c). Aggressive Crown purchasing of Māori land continued from 1870 to 1914, including the taking of Māori land under the Public Works Act 1864 without compensation. The Native Rights Act 1865 recognised Māori as subjects of the Crown, consistent with article three of the treaty. In 1867, four Māori seats in parliament were

established, whose members' proposals for Treaty policy were easily voted down (State Services Commission, 2005c).

*Treaty principles*

In 1877, in the Wi Parata v Bishop of Wellington case, which concerned the validity of a Crown grant over Ngāti Toa land in Porirua agreed as a site for a school that was never built, Justice James Prendagast states that "it [the Treaty] must be regarded as a simple nullity" because no "body politic existed capable of making cession of sovereignty" (Morris, 2004, p. 125). The effect of the judgement on Māori was severe because it was relied upon by successive governments and courts to set aside the Treaty and, along with it, Māori customary law until a 1987 Court of Appeal judgement (Hayward, 2012). In this case, the New Zealand Council asked the Court of Appeal if the transfer of Crown assets to state-owned enterprises breached the principles of the Treaty of Waitangi. The court found that such transfers would be unlawful without a system to consider their compliance with the principles of the Treaty of Waitangi as required by section 9 of the State-Owned Enterprise Act 1986 (Hayward, 2012). In the case, the court had to determine what the principles of the Treaty were, deciding that they included:

- the duty to act reasonably, honourably, and in good faith because the treaty represented a partnership between Māori and the Crown;
- a Crown obligation to actively protect Māori interests to the furtherest practical extent;
- the duty on the Crown to make informed decisions regarding the Treaty;
- an expectation that the Crown resolve past grievances;
- the Crown's right to govern without unreasonable restriction.

Since its formation under the Treaty of Waitangi 1975, the Waitangi Tribunal has developed Treaty principles, which are recorded in its reports on inquiries into Māori Treaty claims (Hancock

& Grover, 2001). While influential, the tribunal's findings are not binding on the Crown and have no legal effect unless recognised by a Court. Treaty principles recognised by the tribunal include: the *principle of partnership between Māori and the Crown* which is based on "the essential bargain" in which Māori ceded sovereignty in exchange for the protection of rangatiratanga (Hancock & Grover, 2001, pp. 80-81); *the principle of reciprocity*, which recognises the equal status of Māori and the Crown as Treaty partners, where rights were not absolute but subject to each other's needs; *the principle of mutual benefit* where *balance and compromise* are expected between the Treaty partners, acting reasonably, honourably, and in good faith; *the principle of active protection*, which goes beyond recognising property rights to *preserving and enabling the exercise of tribal authority, cultural practices, and taonga* (all things Māori value and consider important to their way of life) as an ongoing duty; *the principle of redress for Treaty breaches*, which is fair and reasonable, and necessary to restore the Crown's honour and Māori resources (Hancock & Grover, 2001). *The duty to make informed decisions* is demonstrated by consulting Māori on matters affecting their rangatiratanga and other Treaty rights (Hancock & Grover, 2001). While the duty to consult is not absolute, honouring this principle is indicated by consulting early, with an open mind, giving Māori adequate time and resources to participate, including local hapū and iwi, and making sure Māori voices are heard (Hancock & Grover, 2001). The Treaty is referred to in 62 pieces of legislation, giving the courts legal authority to inquire into its application.

*Treaty settlements and legal personhood*

The recognition and codification of natural features as legal persons has arisen in the process of Treaty settlements in Aotearoa, New Zealand (Wheen & Hayward, 2012) as a way of restoring Indigenous relationships with and customary authority over ancestral lands and waters as spiritual and physical beings deserving of the maximum protection available within prevailing institutional arrangements (Cribb et al., 2024; Mika & Scheyvens, 2023; Morris & Ruru, 2010). Te Urewera, the forest homelands of the Tūhoe people (Mika, 2021b), is recognised via section 11(1)

of the Te Urewera Act 2014 as "a legal entity, and has all the rights, powers, duties, and liabilities of a legal person," (p. 14) except insofar as Te Urewera Board must exercise the rights, powers and duties of Te Urewera. Te Kawa o te Urewera (Te Kawa) sets out a plan for the management of the people for the benefit of Te Urewera as a living system in accordance with Te Urewera Act 2014 (Te Urewera Board, 2017). Te Kawa describes "the interrelationship between people and Te Urewera for a just life" because people are born of nature and come with responsibilities for "her" care. Te Urewera principle of balance, the axiom that "nothing in nature is wasted, everything happens for a reason" applies to the natural functioning of Papatūānuku (earth) as a process of "recycling and regeneration" (Te Urewera Board, 2017, p. 22). The effect of the Te Urewera Act, according to Te Kawa, is to liberate the identity and personality of Te Urewera from a distorted view of her natural features under a framework of property rights that improperly gave credence to human ownership over land rather than responsibilities to land as one would have to a mother (Te Urewera Board, 2017).

Te Awa Tupua, otherwise known as the Whanganui River, is recognised as a legal person via section 14(1) of Te Awa Tupua (Whanganui River Claims Settlement) Act 2017, whose rights, powers, and duties must be performed by Te Pou Tupua on its behalf. While scholarly attention has tended to focus on the novelty of legislating rights of nature (Mika & Scheyvens, 2021), Cribb et al. (2024) focus on the implementation of the Whanganui model and its potential for "river relationality and reciprocity in collaborative river governance" (p. 2). In this, they identify three main insights: (1) the need for scholarship to move beyond the legal fiction of personhood to the "enabling jurisdiction for *kawa"* as value-based Indigenous law; (2) the potential for decision-making to transition away from Western ideas of "sustainability towards *kawa*-based notions of relationality and abundance" (Cribb et al., 2024, p. 2); and (3) the importance of the legal governance arrangements, including devolving decision-making to hapū. The legal personhood is a "work-around to the complicated issue of ownership" (Cribb et al., 2024, p. 3). The Act establishes Te Pā Auroa nā Te Awa Tupua as a river governance network of entities guided by

Tupua te Kawa functioning as Indigenous law, which acknowledges the river as a holistic, living being whose health directly influences human health (Cribb et al., 2024). Cribb et al. (2024) find that the literature tends to focus on personhood and overlook the Māori world view, which "position people as a part of nature within a reciprocal exchange, and see no obvious tension in using a river as a resource as well as having an obligation to care for it" (Cribb et al., 2024, p. 6). Relational legal pluralism (Crown law and Māori law) is enlivened by inclusion of kawa (protocols) in the settlement legislation (Whanganui Iwi & The Crown, 2014a, 2014b). There is acceptance that the iwi retain the mana, or jurisdiction, to define what kawa means, which is operationalised via Te Kōpuka (a strategy group for the river) in accordance with tikanga (custom). Yet, Te Kōpuka takes an inclusive approach, inviting Māori and non-Māori with interests to commit to principles which acknowledge the wellbeing of the river as paramount (Cribb et al., 2024).

## New Zealand wellbeing frameworks

### *Living Standards Framework*

New Zealand's approach to wellbeing has its recent origins in NZ Treasury's Living Standards Framework (LSF) (Treasury, 2018a, 2018b, 2018c), expanded to include elements of a Māori wellbeing framework called He Ara Waiora (McMeeking et al., 2018, 2019; O'Connell et al., 2018). These concepts were used as the basis for a statutory report on the state of wellbeing in Aotearoa (Treasury, 2022). The LSF has evolved, now comprising three levels: (1) wealth constituted in stocks of four types of capital (natural, social, financial-physical, human) available to support sustainable wellbeing; (2) the role of institutions and governance; and (3) indicators of individual and collective wellbeing—along with four analytical features—distribution, resilience, productivity, and sustainability (Treasury, 2022). Using Statistics New Zealand data, Treasury finds, among other things, that New Zealanders are "healthier, better educated, have higher incomes and are less affected by crime… [while younger] people fare less well" (McLiesh, cited in Treasury, 2022, p. 2).

*He Ara Waiora*

He Ara Waiora uniquely positions spirituality, the living earth, and the human element at its core, enveloped by perennial Māori values, to give effect to waiora (wellbeing) (Treasury, 2022). He Ara Waiora emphasises that the wellbeing of te ira tangata (the human element) and te taiao (the environmental element) is *inter*dependent. Using He Ara Waiora as a framework for analysis, Treasury shows that Māori cultural participation is widely beneficial to Māori identity and sense of belonging, and the Māori economy is growing, but material hardship, distress, and discrimination are growing challenges (Treasury, 2022). The Treasury (2022) state that it is unsure whether wellbeing in Aotearoa, New Zealand is sustainable. Depletion of natural capital is already assessed as an unsustainable basis for future wellbeing because of natural limits and climate change effects, necessitating change (Treasury, 2022). Three major risks affect sustainable wellbeing in Aotearoa, New Zealand: climate change and biodiversity declines, geopolitical volatility to a rules-based trading system, and youth health and educational achievement (Treasury, 2022). A limitation of He Ara Waiora is that it lacks a dynamic principle that shows how waiora might be activated and function in practice. We argue that the Indigenous notion of reciprocity between human, spiritual, and ecological systems is the missing element of the model (Reid et al., 2021).

*Māori wellbeing frameworks*

Durie (2016) focuses on mauri ora as a framework for Indigenous flourishing in human and environmental terms identifying several pathways for this. In a similar vein, Ellis (2021) acknowledges the work of Hēnare (2011, 2014, 2015, 2021) and his vision for a flourishing Māori and tribal economies of wellbeing predicated upon culturally responsive methods for distributing Māori economic wealth, a relationship of reciprocity and respect between human, ecological, economic, and spiritual realms, guided by core Māori concepts and ethical practice as constitutive of a good life.

Ellis (2021) uses the term whai rawa to denote “diverse modes of Māori economies… as contextually specific networks of regional economies, both rural and urban, with national and international connections… [inclusive of] independent Māori enterprise, small whānau businesses, units within hapū or iwi structures, tribal incorporations and larger pan-tribal entities” (p. 14). Productivity, profitability, resilience, and expansion of Māori enterprise exist with a “context-specific, socio-historical, culturally constituted framework” essential for Māori self-determination and overcoming impediments to Māori wellbeing, including entrenched poverty and inequality (Ellis, 2021, pp. 14-15).

Within a framework of Māori economies of wellbeing with whānau (extended family) the primary but not the only unit of analysis, Spiller et al. (xxxx) set out to identify pathways to well living for Māori four domains—pātaka (storehouse, code for economy), pakari (strength, code for resilience in work), pou (post, code for leadership), pakihi (business, code for whānau enterprise), integrated through pae ārahi (linchpin) and pou tikanga (language and culture expert) (Rout et al., 2022). While not defining a Māori economy of wellbeing, Rout et al. (2022) identify its likely constituents, consisting of a theory of whānau, the whakapapa and kaupapa of Māori organisations, the institutions of mātauranga, kaupapa and tikanga, wealth as cosmic forces of mana, mauri, tapu, hau, and wairua, and human and environmental needs and values. They do, however, identify principles from the traditional whānau-hapū economy as a guide for a future Māori economy of wellbeing (Rout et al., 2022). These consist of tauutuutu (reciprocity), which encourages distributed economic growth within environmental limits; collective leadership and consensus decision making; nested and nuanced user rights; multigenerational integration and communal parenting; balance and harmony; and collective existence synchronised with nature (Rout et al., 2022).

Assimilation, deculturation, and economic deprivation as a consequence of colonisation are argued to be causes of persistently lower states of wellbeing for Māori (Houkamau & Sibley,

2011), which gives rise to the argument that increased access to and participation in te ao Māori (the Māori world) should increase Māori wellbeing (Durie, 1995, 2006). Cultural efficacy is the extent to which Māori perceive they have access to resources to participate in Māori cultural contexts (Houkamau & Sibley, 2011). In a study of subjective Māori wellbeing, Houkamau and Sibley (2011) found that increasing a person's sense of personal wellbeing decreased their sense of the state of the nation. While the study provided support for policies that promote access to te ao Māori, causality in terms of what works in this regard required further work. A further study found that "bilingualism seems to strengthen the relationship between ethnic identity and wellbeing for Māori" (Matika et al., 2021, p. 396).

A te ao Māori view of wellbeing, according to Mika (2021a), is one which is "multidimensional (spiritual, physical, psychological and social), dependent on leaders and groups who collectively engender… mauri ora [wellbeing] and hauora [health], and is enhanced through fulfilling cultural roles and whakapapa-based affiliation" (p. 8). Essential principles in this view of wellbeing are variations in Māori identity (Greaves et al., 2015), engagement in Māori society (Durie, 2003) affiliation through whakapapa (genealogy) (Tūhono Trust, 2020), and leadership values and qualities (Spiller et al., 2020). A Māori view of environmental wellbeing does not preclude the formation of an economy to sustain people in their kaitiaki responsibilities to land, water, and air and use rights that enable people to live on and by the water as hunga tiaki (collective guardians) (Mika, 2021a).

*Other New Zealand wellbeing frameworks*

While economics is primarily concerned with the wellbeing of people, according to Dalziel et al. (2018), adverse human and environmental consequences of economic growth has necessitated consideration of new approaches. (Dalziel et al., 2018) wellbeing framework proposes that economic growth must occur within ecological limits for it to be sustainable,

account for human choices at multiple scales about investments in multiple types of capital needed to expand human capabilities.

## LITERATURE REVIEW

This section summarises the literature reviewed: Indigenous and Māori world views; collective wellbeing; entrepreneurship; spiritual capital; and New Zealand wellbeing frameworks.

### Indigenous world views

World view is how a person or people see the world and act on what they see. World views come from what is taught about values and beliefs, which become accepted assumptions and manifest in consistent behaviour and norms, are passed from one generation to another, and define for people what is good and true (Hilton, 2021). Indigenous world views, as Hilton (2021) notes, are expressions of human values to which groups adhere which, according to Little Bear (1998), function as ethical determinants, organising principles, and an intellectual infrastructure for identity and culture that derive from and exist in relationship to land. Indigenous world views enable value to be conveyed and are grounded in holism, that is, implied knowledge of connections to all physical and spiritual elements, constitutive of the whole which have sustained Indigenous peoples through time (Hilton, 2021).

According to Hilton (2021), Indigenous economies, founded upon Indigenous world views, which see humans within not above creation, provide a basis for wellbeing. For instance, Hilton (2021) suggests that because everything has a spirit and everything is connected to everything else, from the cosmos to humans, then the object, function, value of business and economy are measured in terms of relationships and their condition. Principles of Indigenous economy in these terms then include the capacity to give, where generosity serves as the benchmark for success, risk is managed through responsibilities to care for others across time, which is non-linear, rights to property intimate responsibility, not ownership, where wealth is in the relationships, which are spiritually-based, circular and abundant because resources are all your

relations, and most importantly, from a sustainability perspective, “what you do to the environment, you do to yourself” (Hilton, 2021, p. 19).

Indigenous philosophies position humans as part of nature who are guided by ethical principles of respect for the sacredness of all things because the “unity of existence” revealed through intergenerational experience means taking care of nature is the same as taking care of ourselves (Crowshoe & Lertzman, 2020, p. 16). Because all people share in the Earth’s wellbeing, both non-Indigenous and Indigenous peoples have a common ethical imperative for its sustainability. Collaboration on sustainable wellbeing requires acceptance that all people share the physical realm of the land. Ginmapiipitsin is a Blackfoot word that means “sanctified kindness” which is the principle that “we all need each other to survive”, animals and insects need each other, they each need air (Crowshoe & Lertzman, 2020, p. 21). Smudging is a cultural ceremony involving the burning of plant material, allowing smoke to convey internalised thoughts and feelings to the Creator as an expression of respect for the principle of sanctified kindness and associated protocols (Crowshoe & Lertzman, 2020). An Indigenous view of sustainability has four themes, according to Crowshoe and Lertzman (2020): (1) sanctified kindness for all in Ginmapiipitsin; (2) ethics that extend from the environment as life and life-giving; (3) identity that originates from the notion that people are the land; and (4), self-determination and cultural meanings of sustainability. A culturally safe space for dialogue on divergent world views—one in which people own the land and another in which people belong to the land—is a difficult but necessary prospect because our mutual survival depends on such collaboration (Crowshoe & Lertzman, 2020).

### Māori world view

According to Harcourt et al. (2021), in the Māori world view, “people are seen as a part of, and genealogically connected to, the natural world, and interconnectedness and holism are fundamental concepts” (p. 116). Previous frameworks for assessing land use matched biological

conditions to economic gains, but a focus on holism has given rise to wellbeing-based, multidimensional, and multistakeholder approaches (Harcourt et al., 2022). Holism in Western-oriented framework tends to focus on balancing environmental, economic, and social considerations, whereas, for Māori, holism requires the "inclusion of Māori knowledge, aspirations, and values and their practical, everyday application to decision-making." For instance, a kaupapa Māori-based framework evaluates land use options against core Māori values, including kaitiakitanga (sustainability), manaakitanga (reciprocity), whakatipu rawa (responsible use), the mauri (life essence) of water, land, flora and fauna, and food sources, drawing on mātauranga Māori (Māori knowledge) with local knowledge-holders (Harcourt et al., 2022).

A core principle of the Māori world view is "that all things, animate and inanimate, are related—all trace their descendency from Ranginui [sky father] and Papatūānuku [earth mother], creating an interconnectivity, an interdependence, and an intertemporality between all things for all time" (Mika, 2021a, pp. 12-13). The relationship with nature is governed by respect for the natural world as kin, both physical and spiritual in nature, according to Māori values intended to maintain balance and wellbeing (Mika, 2021a). The connection between environmental and human wellbeing, from a Māori perspective, is evident in several theoretical frameworks, including the socio-spiritual-ecological framework of a Māori environmental economy (Rout et al., 2021), whakatipu rawa as a framework for kaupapa Māori entrepreneurial activity (Awatere et al., 2017) integrating wellbeing, equity, and balanced growth, and post-settlement governance entities' function as effecting "multigenerational and multidimensional wellbeing" (Mika, 2021a, p. 16).

**Collective wellbeing**

In reconciling science with metaphysics, Harman (1980) argues that the ontological assumption of separability leads to a nonsensical abstraction in which humans are able to pursue their own ends upon the earth without consequence or reverence. Harman (1980) further

illustrates the discontinuity in that scientific explanation of coincidence between separate entities as somehow physically connected is not borne out by evidence that no such connection seems to exist in some instances; for example, the connection between "the act of prayer and the occurrence of the prayed-for" (pp. 113-114). What Harman (1980) proposes is complementary ontological assumptions of "*oneness, wholeness, interconnectedness of everything"* [emphasis in original] and an epistemological assumption that "we contact reality…through ourselves being part of the oneness" based on the disciplined subjectivities of intuition and consciousness and an acceptance of universal wisdom of nature as higher intelligence (Harman, 1980, p. 114). In other words, a proposal for "wholeness science" based on an "*ontological assumption of oneness, wholeness, interconnectedness of everything*… [and an] *epistemological choice to include 'all the evidence'*" [emphasis in original] leading to consensus about values and resolving paradoxes through an acceptance of unity in all things (Harman, 1980, p. 115).

**Entrepreneurship**

Harman (1987) discerned that the world is undergoing a period of transformation at the level of basic assumptions about humans and the cosmos akin to the advent of empirical science and was convinced that the role of business in this was essential in this "respiritualisation of society" (p. 7). The ecological and human consequences of industrialisation wrought by science combined with challenges to prevailing assumptions of economic rationalism (positivism, objectivism, and reductionism) are making way for a new paradigm where "'everything is connected to everything' in a single unity… [with] a deep spiritual [centre]" (Harman, 1987, p. 6). The realisation that unyielding faith in techno-economic systems and structures is "not compatible with a viable future" may be reaching the necessary critical mass for transition to a new paradigm that is best served by an entrepreneurial rather than a destructive response (Harman, 1987). Some of the noticeable tendencies toward a different set of assumptions

include enterprise providing fulfilling work and obtaining assent for its activity from all affected stakeholders, alternative economies and modes of exchange, cooperation over competition, and values that foster earth care, which propel humanity toward a way that is good for people and planet (Harman, 1987). As the "most powerful institution on the planet," business has to assume responsibility not just for itself but "for the whole" (Harman, 1987, p. 14).

Colbourne and Anderson (2020) share texts that explicate the interdependencies among indigeneity, sustainability, and wellbeing in Indigenous enterprise and promote "reciprocity between the human, natural and spiritual realms" (p. 1).

## Spiritual capital

Spiritual capital is related to questions of spirituality and religiousness, which are often conflated, so it is useful to delineate the two. In a study of self-rated religiousness and spirituality Zinnbauer et al. (1997) found that, on the one hand, religiousness was associated with authoritarianism and performative church commitments. Whereas spirituality was almost a rejection of these elements of organised religion in favour of the belief system on which religiousness is founded. A small group of 'spiritualists' perceived religiousness as "a means to extrinsic ends such as feeling superior to others and avoiding personal responsibility" (Zinnbauer et al., 1997, p. 561). An extreme example of the harm from this kind of sentiment is the Doctrine of Discovery, a Pope-made declaration in the 15th-century known as the 'papal bulls' that legitimised "the colonial-era seizure of Native lands and form the basis of some property laws today" (Gillies, 2023, p. 1). Notwithstanding the overlaps, contrasting religiousness and spirituality on the basis of their objective-subjective consciousness, institutionalised-individualised activity, and intrinsic-extrinsic values orientation, is possible.

Iannaccone and Klick (2003) deride spiritual capital as a catchphrase, indistinguishable from religious capital and otherwise a subset other more well-established forms such as human

capital, social capital, and cultural capital. When Americans say they are spiritual, Iannaccone and Klick (2003) argue that are simply saying they are less inclined to participate in religious activity or favour non-Western or New Age faiths, which can still be counted as religiousness. Zinnbauer et al. (1997) suggest that religiousness and spirituality began to separate with the rise of secularism associated with the mistrust of religious institutions. Spirituality has come to mean an individual's relationship with and experience of a supranatural order that provides meaningfulness, whereas religiousness concerns theological institutions, structures, and rituals (Zinnbauer et al., 1997).

Spiritual capital, according to Zohar and Marshall (2004), offers business enlightened innate forms of wealth that consist of fundamental purposes, aspirations, motivations and values, which people and enterprises can use to enact sustainable approaches to organisational, economic and community life. Zohar and Marshall (2004) include spiritual intelligence in their view of spiritual capital. This form of intelligence is about self-awareness, which shapes human orientation and potential. Spiritual capital is not limited to religious capital but does explain what is sacred.

While few empirical analyses exist, Tjahjadi et al. (2023) found that spiritual capital affected how well Indonesian firms performed on environmental management. Tjahjadi et al. (2023) define spiritual capital "as an intangible resource utilized by a company as a moral intelligence in conducting activities" (p. 84). Thus, to Tjahjadi et al. (2023), spiritual capital is a valuable intangible asset firms can deploy to enliven the moral functioning where values-based vision, compassion, and long-term thinking become evident (Tjahjadi et al., 2023), consistent with Zohar and Marshall (2004). The inferred effect of spiritual capital on managers is productive value judgements, trust, confidence, and commitment, which are potential sources of competitive advantage because such qualities are non-substitutable and inimitable.

Spirituality is rarely addressed in the science and economics of circularity, sustainability, and wellbeing because it concerns unseen elements that defy principles of verifiability. Spirituality implies acceptance of an omnipotence beyond humanity, an inexplicable causation of being that can only be assuaged by faith. The power of the human for sense-making has, however, gifted societies religion to help answer innate questions of who we are, where we come from, what is our purpose, how we should be, and what are causes and effects? While monotheism, polytheism, and syncretism create contestability in the explanations of being, their religiosity provide a comforting cultural framework of beliefs, premises, values, rituals, and rules for social order. Human agency happily functions within the materiality of religious structures, adding credence to favourable action as spiritually-aligned and discouraging unfavourable action as outside the ambit of the prevailing religiosity. Spirituality concerns the intangibility of self, others, and the omnipotent, whereas religiosity concerns the tangibility of these entities as though spirituality possesses materiality. Faith as the nexus between spirituality and religiosity owes its impetus to earth, sky, people and the universe and their interrelationships. Existence and purpose are ultimately explained by spirituality.

Wairuatanga or spirituality remains a potent ontological framing for Māori in securing their wellbeing. This is evident in arguments for the inclusion wairuatanga in conceptualisations of health (Durie, 1985; Wilson et al., 2021) and in business (Dell et al., 2022; Spiller et al., 2011). Wilson et al. (2021) define wairua as "a person's spirit or soul that exists before the birth of a person and beyond their death… [that] acts as a guide… and can be either protected or damaged" (p. 3544). According to Durie (1985), taha wairua is the spiritual dimension without an awareness of which people are prone to illness or other calamity. In his view, spirituality includes religious practices and a belief in God, but also implies "spiritual communion with the environment," separation from which would lead elders to diagnoses of poor health (Durie, 1985, p. 483).

## METHODS

Three distinct methods were applied to the research in this paper: (1) co-design consistent with premise of Āmiomio as a research programme that seeks to integrate Māori and European ideas on circularity, sustainability, and wellbeing; (2) wānanga with researchers and stakeholders about the meaning of wellbeing and how Āmiomio research is contributing to this; and (3) a stylised theoretical model of sustainable wellbeing that uniquely incorporates nature.

### Co-design

The first method we employed to develop a framework for sustainable wellbeing for New Zealand is co-design, which consisted of sharing and interrogating ideas from the perspectives of a Māori world view and contemporary economic ideas and principles.

Wellbeing is subjective. What people consider to be wellbeing depends on their values and preferences. Economics, as a social science, analyses the choices that people, businesses, governments, and nations make to allocate resources. A fundamental principle in economics is that people make choices to maximise their wellbeing (or 'lifetime utility'). People make choices about how to spend their time, work, consumption, saving. When making these choices they consider trade-offs. For example, working overtime increases income to buy more goods and services but reduces time that can be spent with family and friends. Buying a new car leaves less money for a trip.

Macroeconomic models are stylised models of a country's economy to describe the behaviour and interactions of economic agents, households, firms, government, the central bank and the rest of the world. They have a long-run 'steady state' when the economy is in balance. The steady state or balance is determined by people's preferences and values, production

technology, public policies, and interactions between economic agents. Infinite horizon macroeconomic models include past, current and future generations and implicitly assume intergenerational sustainability.

Our debates led to two main conclusions. First, infinite horizon macroeconomic models are a useful starting point but insufficient for developing a framework for sustainable wellbeing. They are insufficient because they do not recognise the interdependence between all life on Papatūānuku (earth), humans (past, current and future generations) and nature. Maintaining holistic balance in all relationships, including with nature, is essential for collective wellbeing of current and future generations. Second, current institutions, legal foundations and decision making processes are inadequate to protect nature. Nature is being destroyed because not everyone practices tauutuutu (reciprocity and balance) and recognises their responsibilities towards nature. Defining and enforcing obligations that arise from using natural capital is difficult; see annex 1 for detail.

**Wānanga**

Wānanga is a Māori way of arriving at consensus, advanced in this instance, through researchers sharing their collective wisdom on what each is doing to serve an agreed vision of a circular economy for the wellbeing of New Zealand. The implication is that each researcher is guided by their interpretation of the consensus and its application in their research as well as a framework for articulating Āmiomio Aotearoa principles.

At an all-of-team hui in November 2023, around 30 researchers gathered in Hamilton to reflect on their combined research activity on Āmiomio. Āmiomio is an amalgam of three distinctive lens on the notions of circular economy and its effectuation of sustainable wellbeing, with economics, materials, and law and policy operating as the three perspectives. Māori knowledge is integrated into all three areas, but particularly into the economics domain, where discourse

has heightened mutual awareness among researchers about Māori knowledge, its economic logic, and its capacity to enhance standard macroeconomic models toward sustainable wellbeing. At the all-of-team hui, two of members of the economics team facilitated a wānanga (deliberation) on four questions:

1) How do other researchers in Āmiomio understand sustainable wellbeing?
2) How do they think their research contributes to sustainable wellbeing?
3) What contribution do they expect to make from this work?
4) What action could be taken by the researchers and others to give effect to such impacts?

*Meanings of wellbeing*

Groups conceptualised wellbeing variously as: self-actualisation, ownership of one's life path; equity and justice; meaningful employment; adaptability and resilience; inclusion of social, economic, spiritual, and environmental dimensions; subjective life satisfaction and happiness; access to essentials of water, food, shelter, security and connection; people and nature; hopefulness for future generations and thriving communities. Āmiomio research comprised sustainable energy, design, construction, and building materials and processes; circularity and waste in legal, regulatory and policy terms; extending producer responsibilities; and climate change effects on wellbeing of people and the land, among others. On the question about the intent of such research answers included policy making, developing theories of change, improving living standards, aesthetics, better, low-cost and comfortable living, and the capacity for adaptability, and fulfilment of wellbeing; better consumer decisions; regulating and managing the waste hierarchy; expanding an affective ethic of care. Given effect to such ambitions in the view of the researchers present was to be advanced through collaboration, consultation, communication, prototyping, regulation, standards, sharing knowledge with co-investigators, stakeholders, communities, policy makers, firms, and others.

*Implications for theory and practice*

In decoding the wānanga several insights emerge. First, wellbeing is a multidimensional and intertemporal phenomenon, having material and nonmaterial elements, whose effects extend from satisfaction of existential needs to the subjectivities of human fulfilment, thriving just not for self but others, with others seen in the broader view of people and nature together, encompassing a spiritual dimension. Second, the research is eclectic, with the circularity problem to be resolved through changes in theory, policy, perception, materials, and behaviour, with a strong hint of redistributive equity, human needs theory, top-down state intervention and bottom-up consumer-inspired change in producer responsibilities and environmental effects. Third, the ideology of transdisciplinarity is intuitively appealing for attempts at solving complex problems, but its implementation can be fraught with researchers easily reverting to the comfort of the intellectual homes that their disciplines have created for them in times of contestation and uneven progress. An example of this is the unresolved debate in Āmiomio about whether eliminating waste unquestionably and in all respects contributes to sustainable wellbeing. There are at least two reposts to this argument. First, that waste reduction does not intuitively lead to sustainable wellbeing for all because some parts of society may be worse off as a consequence of changes in policy or practice through loss of enterprise or employment, couched as economic transitions. Second, what constitutes waste between Māori and non-Māori perspectives can differ. For example, flood sediment might be seen as waste, but also seen as carrying nutrients.

## ĀMIOMIO: TOWARDS A FRAMEWORK FOR SUSTAINABLE WELLBEING

Building on the findings of the literature review, insights from the wānanga and our sharing of knowledge on Māori world view and contemporary economic ideas and principles, we propose a framework for sustainable wellbeing for New Zealand. The framework comprises a macroeconomic model that includes nature and guiding principles.

### A stylised macroeconomic model with nature

Recognising the interdependence between all life on Papatūānuku (earth), humans (past, current and future generations) and nature, and the importance of maintaining holistic balance, we created a stylised macroeconomic model that includes nature.

A useful analogy of our stylised model is fruit and trees. In this analogy, wellbeing is the fruit from trees and the time we spend not growing fruit and caring for nature to provide the fruit. The sources of wellbeing are existential natural capital essential for continued existence (e.g., trees, water, sunshine, fertile soil, air, bees), and our knowledge, practices, community collaboration and tools to grow fruit. Maintaining wellbeing over time requires that the sources of wellbeing to grow fruit, i.e., nature, trees, our knowledge, practices, community collaboration and tools, are maintained. Wellbeing declines when we do not practice tauutuutu (reciprocity and balance), e.g., cut down trees and do not replant, and when we do not pass on to future generations our knowledge, practices, community collaboration and tools to grow fruit.

For wellbeing to be sustainable requires, first, that we protect and regenerate natural capital that is existential for continued existence (e.g., trees, water, fertile soil, air), and second, that we pass on the knowledge, practices, community collaboration and tools to future generations to grow fruit. Sustainable wellbeing increases when nature regenerates and grows and we improve our knowledge, practices, collaboration and tools over time so that:

- we can produce the same amount of fruit working less (growing fruit and caring for nature), or produce more fruit working the same amount of time
- while maintaining the mauri (life force) of nature.

Annex 2 contains a detailed description of our stylised macroeconomic model with nature. We show that sustainable wellbeing is determined by what is passed on to us by past generations for our benefit and what we pass on to future generations for their use, i.e., capital. Capital is broadly defined and includes all things of value and considered important to life.

- Human capital includes mātauranga (science/knowledge), skills, education, health of people.
- Social capital are the required agreements in a reciprocal relationship. The foundation of social capital is the right to be and have influence, dignity and responsibility. Social capital is built and maintained by a system of values and practices that supports and is enforced by institutions, legal foundations and decision making processes.
- Reproducible capital consists of roads, buildings, machinery and equipment.
- Natural capital comprises the limited resources of Papatūānuku (earth) including basic resources (e.g., land, air, temperature, water, wind, sunlight), other renewable resources and ecosystems (e.g., plants, animals, timber, fish) and non-renewable energy and material resources (e.g., minerals, fossil fuels). Some natural capital (e.g., natural and cultural taonga (treasures), water, fertile soil, air) is existential for continued existence.

Including nature leads to an environmental sustainability condition that is missing in standard economic models used by economists and policymakers. For wellbeing to be sustainable requires two conditions to be met. The first sustainability condition is that we uphold the mana (power) and mauri (life force) of Papatūānuku (earth) and protect and regenerate natural capital

that is existential for continued existence. The second condition is that the capital passed on to future generations is not declining.

## Principles

Kaitiakitanga (guardianship) of nature should be entrusted not to government but to those who value nature the most because of a time inconsistency problem. The time inconsistency problem arises because governments are tempted to break earlier promises when circumstances change (Hovi, Sprinz and Underdal, 2009). Optimal choices at one point in time may not be optimal choices at future points in time (Kydland and Prescott, 1977). Governments have an incentive to renege on environmental protection promises because they would bear the full costs but not the full benefits of environmental protection. Appointing a guardian who places greater relative weight on nature than society (the government) can help overcome the time inconsistency problem. This solution to the time inconsistency problem was initially proposed by Rogoff (1985) for monetary policy.

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## ANNEX 1

### Defining and enforcing obligations towards nature

Nature is being destroyed because not everyone practices tauutuutu (reciprocity and balance) and recognises their responsibilities towards nature and because defining and enforcing obligations that arise from the use of natural capital is difficult. Defining obligations is difficult (and costly) because of (i) externalities, (ii) public good and common access characteristics of natural capital and (iii) hidden information (Hanley, Shogren and White, 2019).

Externalities arise whenever a person or firm does not bear all the costs or receives all the benefits of their actions. As a result, social costs and benefits exceed private costs and benefits. Externalities can arise from production or consumption. An example of a negative production externality is the emission from livestock farming. A positive production externality is the development of a new technology that has wide application in other industries. An example of a negative consumption externality is driving a car. Conversely, a person walking or taking public transport is a positive consumption externality. Negative (positive) production (consumption) externalities lead to over (under) production (consumption) from what is socially optimal.

A price mechanism (e.g., carbon pricing) can help correct the imbalances (i.e., over production and over consumption) caused by negative externalities because people and firms respond to incentives and prices generally are an important incentive. A price mechanism that values the scarcity of natural capital would achieve environmental protection at a lower cost than regulation. Regulation stipulates how to protect the environment or how much pollution can be emitted whereas prices help allocate resources to their highest valued use. Prices allow evaluating trade-offs, e.g., install pollution treatment, purchase carbon offset credits, invest in cleaner technology, stop the polluting activity.

A price mechanism would also enhance wellbeing more than subsidies. Prices for polluting products, e.g., fuel, should include the social costs to current and future generations of environmental damage. Higher prices would change people's behaviours depending on their values and preferences. A higher price of fuel may lead some people to buy electric cars, take public transport, cycle, walk, drive less, etc. and firms to develop new technologies. Targeted support, e.g., cash transfers, can be provided to those in need to cope with higher prices.

Public goods are goods that are non-rival in consumption and non-excludable. Non-rivalry means that a person's consumption does not reduce the good's availability to anyone else (Samuelson, 1954). With non-excludability no one can be prevented from enjoying the benefits or costs of a good. Examples of public goods include biodiversity and climate protection, air and water quality and open spaces. Public goods are undersupplied because they create a positive externality, i.e., they have a private cost but a common benefit. Another reason why public goods are supplied at a less than socially optimal level is because of a free rider problem. People enjoy the benefits of public goods but do not pay for them.

Common access resources are natural resources that are non-excludable, like public goods, i.e., no one can easily be excluded from using them, but they are rivalrous, i.e., one person's use diminishes the benefits of the resources to others in society. Examples of common access resources include oceans, lakes, rivers, land, wildlife. Common access resources lead to a 'tragedy of the commons' (Hardin, 1968). People and firms make choices that lead to the worst possible outcomes for themselves and society. All have access and a right to a resource and ignore its scarcity leading to over-use and possibly destruction. "(T)he fish in the sea are valueless to the fisher (…), because there is no assurance that they will be there (…) tomorrow if they are left behind today" (Gordon 1954, p. 135).

The tragedy of the commons has been formalised by game theory models, often a prisoner's dilemma game; see Faysse (2005) for a literature review. In the prisoner's dilemma game, when

communication and binding agreements are not possible, players do not cooperate, even if it is in their best interests to do so. However, as Ostrom (1990) shows tragedy of the commons is not a necessary outcome. Management of common access resources by groups using them can prevent their degradation and depletion but it requires cooperation and enforcement. An example of sustainable management and conservation of a common access resource by cooperation is the Parties to the Nauru Agreement (PNA), which controls the world's largest tuna purse seine fishery. PNA members include Federated States of Micronesia, Kiribati, Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands and Tuvalu plus Tokelau.

The hidden information problem arises because people's and firms' actions to protect nature cannot be easily observed and monitored. For example, firms have an incentive to shirk on unobservable (costly) pollution controls and/or to sell products as sustainable when they are not, if sustainable products achieve a premium price and sustainability is difficult to verify. Regulatory strategies, such as credible certification programs, can help overcome hidden information problems.

## ANNEX 2

### Overview of the stylised model

**Wellbeing**. A fundamental principle in economics is that of utility maximisation. People value consumption and leisure and each period choose a bundle of consumption goods and services and leisure to maximise lifetime utility (wellbeing). Following Arrow et al. (2012) intergenerational wellbeing, W, is given by the discounted flow of lifetime utilities of current and future generation households[1]

$$\max W = E_t \sum_{j=0}^{\infty} \beta^j U(C_{t+j}, (1 - L_{t+j})$$

where $U(.)$ is the aggregate utility of current and future generation households, $\beta \in (0,1)$ is the utility discount factor and $C_t$ is an index of consumption goods and services in period t. Time endowment is normalised to one, labour supply is given by $L_t$ and $(1 - L_t)$ is leisure. $E_t$ is the conditional expectations operator with respect to information available at time t.

The way people maximise lifetime utility (wellbeing) is by ensuring a balance between consuming and saving during the different phases of their life. Generally, people prefer stable levels of consumption to large variations, i.e., people prefer similar levels of consumption today, tomorrow and the day after to a pattern that more closely matches their lifetime income of no or low income when young and when retired and high earnings during working years.[2]

[1] Constant population is assumed.

[2] People's desire for consumption smoothing typically leads to three stages of saving during their lifetime. The first stage is a period of dis-saving or borrowing in early adulthood. The second stage is a period of repaying debt and asset accumulation when income is high and the third stage again is a period of dis-saving and a decline in assets during retirement when earnings are low.

Saving is the part of disposable income that is not spent on consumption. Disposable income that is not used for consumption, i.e., saving, is used to acquire financial assets, e.g., cash, stocks, bonds, mutual funds, bank deposits, and/or non-financial assets, e.g., real estate, machinery and equipment. Financial assets, except cash, are claims to ownership of non-financial assets (capital), which firms use to produce output.[3] When saving is negative, i.e., consumption exceeds disposable income, dis-saving is financed by disposing of assets and/or incurring debt (borrowing).

**Capital**. Aggregate capital, $K_t$, includes all forms of capital: Human capital, $K_t^H$, social capital, $K_t^S$, reproducible capital, $K_t^R$, and natural capital, $K_t^N$. Human, social and reproducible capital are created by economic agents, e.g., households, firms, communities, organisations, government, while natural capital is created by nature.

Human capital captures the knowledge, skills, education, health of people, while social capital are the required agreements in a reciprocal relationship. Reproducible capital consists of roads, buildings, machinery and equipment. Natural capital comprises cultural capital, renewable resources and ecosystems and non-renewable energy and material resources. In our stylised theoretical model all non-renewable energy and material resources used in production are imported and all other natural capital is existential capital essential for continued existence.

Prices play a key role in allocating scarce resources to maximise wellbeing because prices signal/measure the value people or society attach to scarce resources. The different forms of capital, i.e., human capital, $K_t^H$, social capital, $K_t^S$, reproducible capital, $K_t^R$, and existential natural capital, $K_t^N$, are valued at estimated or intrinsic prices. Prices must be estimated because the value of the different forms of capital are unknown. For example, the value of a machine

[3] The value of cash arises from its legal tender function, i.e., creditors are obliged to accept it for payment of debt.

depends on its remaining useful life and its residual value which cannot be precisely predicted. Also, some forms of capital, like social cohesion, bilingualism, a country's legal system, regulation, wildlife conservation, are not traded in the market and intrinsic values/costs must be inferred.

Valuing the different forms of capital at intrinsic prices allows adding them up and the aggregate capital stock is given by

$$P_t^K K_t = P_t^H K_t^H + P_t^S K_t^S + P_t^R K_t^R + P_t^N K_t^N$$

where $P_t^K$, $P_t^H$, $P_t^S$, $P_t^R$ and $P_t^N$ are the respective intrinsic prices of the aggregate capital stock, human, social, reproducible and existential natural capital.

The useful life of reproducible capital, i.e., roads, buildings, machinery and equipment, declines over time because of wear and tear. In our stylised theoretical model reproducible capital is assumed to depreciate at a constant rate $\delta^R$ although the depreciation rate may not be constant. For example, useful life may decline with increased occurrence and/or severance of natural disasters, while investment in climate resilient capital and greater durability of products would increase useful life. For simplicity, human and social capital are assumed not to depreciate.

**Production of output**. To produce output firms hire labour which they combine with capital and other production inputs. The production function shows how much output $Y_t$ can be produced with a certain set of production inputs. The economy wide, aggregate production function $F_Y(.)$ is given by

$$Y_t = F_Y\left(K_{t-1}^H L_t^Y, K_{t-1}^S, K_{t-1}^R, R_t, IM_t, Z_t\right)$$

where $K_{t-1}^H L_t^Y$ is human capital weighted labour hired to produce output, $K_{t-1}^S$ is social capital,

$K^{R}_{t-1}$ is reproducible capital, $R_t$ is resource use of existential natural capital, $K^{N}_{t-1}$, and $IM_t$ denotes imports from the rest of the world of non-renewable natural resources used in production. $Z_t$ denotes total factor productivity.

Total factor productivity measures the efficiency with which inputs are combined to produce output. It is impacted by technological progress and innovation. Increases in total factor productivity shift the production frontier, which is the maximum quantity of output that can be obtained from a given set of production inputs and available technology. The production frontier can also be shifted by increases in production inputs.

Natural resources used in the production of output include imported non-renewable energy and material resources, $IM_t$, and existential natural capital, $R_t$. The use of existential natural capital in the production of output, $R_t$, depletes the environment. Environmental degradation (e.g., build-up of greenhouse gases, water pollution, destruction of ecosystems, habitat intrusion, wildlife extinction) occurs when depletion of natural capital exceeds the regeneration and assimilative capacity of nature to absorb and transform harmful materials into harmless substances.

Firms sell the output they produce to households, the government and the rest of the world.

**Sustainability**

Sustainability is defined as non-declining total capital; see Hanley, Dupuy and McLaughlin (2015) for a review of the literature. In our theoretical framework, sustainability is determined by an environmental resources constraint and an intergenerational budget constraint. The intergenerational budget constraint is obtained by summing firms', households' and the government's intertemporal budget constraints. It is the constraint that the present value of current and future cash outflows (consumption) cannot exceed the present value of currently

available funds (initial net assets and current income) and future cash inflows (future income). Net assets comprise human, social and reproducible capital and financial assets.

**Firms' intertemporal budget constraint**. Firms hire labour, $L_t^Y$, rent reproducible capital, $K_{t-1}^R$, and use existential natural resources, $R_t$, and imported non-renewable commodity inputs, $IM_t$, to produce output, $Y_t$. Resource use of existential natural capital gives rise to abatement costs, $A_t^N$. Firms choose the optimal value of production inputs to maximise the present discounted value of dividends, $\Omega_t$, and their intertemporal budget constraint is given by

$$E_t \sum_{j=0}^{\infty} \beta^j \Omega_{t+j} = A_0^f + E_t \sum_{j=0}^{\infty} \beta^j \{P_{t+j} Y_{t+j} - W_{t+j} L_{t+j}^Y - R_{t+j}^R P_{t+j}^R K_{t-1+j}^R - P_{t+j}^N R_{t+j} - A_{t+j}^N - F_{t+j} IM_{t+j}\}$$

where $P_t$ is the aggregate price level, which is an index of the prices of the consumption goods and services produced, $W_t$ is the return to paid work, $R_t^R$ is the rental rate of reproducible capital, and $F_t$ is the nominal exchange rate. For simplicity, firms are assumed not to accumulate or decumulate net assets or issue new equity. At the end of each period, they pay all dividends to households and initial net assets, $A_0^f$, are assumed to be zero.

**Households' intertemporal budget constraint**. Households own all reproducible capital, which they produce using output purchased from firms. Households derive income from four sources. First, they earn income, $W_t L_t^Y$, from supplying labour, $L_t^Y$, to firms to produce output, where $W_t$ is households' return to paid work. Second, they earn income from renting their accumulated reproducible capital holdings, $K_{t-1}^R$, at rate $R_t^R$ to firms. Third, they receive dividends, $\Omega_t$, from firms. Fourth, households receive interest, $I_t$ and $I_t^*$, from holding government bonds, $B_{t-1}^G$, and net foreign assets, $B_{t-1}^*$. Households pay taxes on their labour, rental, interest and dividend income and consumption. The tax rate imposed by the government is given by $\tau$. For simplicity capital gains are not taxed.

Households' flow budget constraint in period t is given by

$$(1-\tau)W_t L_t^Y + (1-\delta^R + (1-\tau)R_t^R)P_t^R K_{t-1}^R + (1-\tau)\Omega_t + (1+(1-\tau)I_t)B_{t-1}^G + (1-\tau)I_t^*)F_t B_{t-1}^* - (1+\tau)P_t C_t - P_t^R K_t^R - B_t^G - F_t B_t^* = 0$$

The flow constraint can be interpreted as follows. Each period, households receive income from supplying labour. They also earn a rate of return on their financial assets (i.e., government bonds and foreign assets) and accumulated reproducible capital. Households then sell all their financial assets and reproducible capital net of depreciation to obtain consumption goods and services, reproducible capital and new financial assets. The budget constraint is binding and households' expenditure is equal to their income.

Households' lifetime budget constraint is given by

$$A_0^h + E_t \sum_{j=0}^{\infty} \beta^j \{(1-\tau)\left[W_{t+j}L_{t+j}^Y + R_{t+j}^R P_{t+j}^R K_{t-1+j}^R + \Omega_{t+j} + I_{t+j}B_{t-1+j}^G + I_{t+j}^* F_{t+j} B_{t-1+j}^*\right] - (1+\tau)P_{t+j}C_{t+j}\} = 0$$

where $A_0^h$ denotes households' initial net assets consisting of reproducible capital, government bonds and net foreign assets

$$A_0^h = P_0^R K_0^R + B_0^G + F_0 B_0^*$$

The lifetime budget constraint states that the present value of current and future cash outflows (consumption) cannot exceed the present value of currently available funds (initial net assets and current income) and future cash inflows (future income).

When consumption spending on goods and services is less than income earned, households are saving and accumulating net assets. Households are dis-saving and decumulating net assets when consumption exceeds income earned. How much is saved/dis-saved is a function of

households' preferences and choices regarding consumption, leisure and investment decisions.[4] Consumption and leisure choices and investment decisions are not sustainable in the long run, leading to lower future wellbeing, if lifetime savings are insufficient to maintain initial net assets.

**Government intertemporal budget constraint**. The government purchases goods and services from firms which it uses for consumption, $G_t$, and to invest in human and social capital. It obtains revenue from three sources. The first source is taxes. Second, the government receives the income earned by nature from firms' use of natural capital. Third, it imposes abatement charges for environmental damage caused by the production of output. The government also borrows by issuing bonds. For simplicity, all government borrowing is assumed to be from domestic households. All debt issued matures at the end of the period and interest payments are made at the end of the period.

The government's flow and intertemporal budget constraints in period t are given by

$$\tau[W_t L_t^Y + R_t^R P_t^R K_{t-1}^R + \Omega_t + I_t B_{t-1}^G + I_t^* F_t B_{t-1}^* + P_t C_t] + P_t^N R_t + A_t^N + B_t^G - P_t G_t - (1 + I_t) B_{t-1}^G - (K_t^H - K_{t-1}^H) - \left(K_t^S - K_{t-1}^S\right) = 0$$

and

$$A_0^g + E_t \sum_{j=0}^{\infty} \gamma^j \{\tau [W_{t+j} L_{t+j}^Y + R_{t+j}^R P_{t+j}^R K_{t-1+j}^R + \Omega_{t+j} + I_{t+j} B_{t-1+j}^G + I_{t+j}^* F_{t+j} B_{t-1+j}^* + P_{t+j} C_{t+j}] + P_{t+j}^N R_{t+j} + A_{t+j}^N - P_{t+j} G_{t+j} - I_{t+j} B_{t-1+j}^G\} = 0$$

where $A_0^g$ denotes the government's initial net assets and $\gamma$ is its discount factor. The government's initial net assets comprise human and social capital less government debt

[4] In the short run, it is also influenced by the state of the economy.

$$A_0^g = P_0^H K_0^H + P_0^S K_0^S - B_0^G$$

The government is saving and adding to net assets (currently available funds) when revenue (cash inflow) exceeds government consumption (cash outflow). It is dis-saving and decumulating net assets when government consumption exceeds revenue. The government's choices with respect to revenue generation and public expenditure are not sustainable in the long run if discounted future saving is insufficient to maintain initial net assets.

**Environmental resources constraint**. Natural capital declines with resource use, $R_t$, by firms and increases with environmental self-renewal by nature, environmental protection by government that reduces resource use and regeneration efforts by households. Nature's environmental self-renewal rate is given by $\delta^N$. For simplicity, the growth rate of natural capital due to environmental self-renewal is assumed to be constant although it may decline, e.g., because of climate change, or increase because of technological progress. Environmental regeneration, $F_N(.)$, is a function of labour input $L_t^N$, human capital $K_{t-1}^H$, and social capital $K_{t-1}^S$. Labour input to regenerate natural capital is provided by households. Households allocate time to produce output, $L_t^Y$, and to reduce the loss of natural capital that results from the production of output, $L_t^N$. Their total labour supply is thus given by $L_t = L_t^Y + L_t^N$. Environmental regeneration to reduce existential natural capital loss lowers abatement costs $A_t^N$, which are levied by government for environmental degradation.

The value of the natural capital stock in period t, $P_t^N K_t^N$, is given by

$$P_t^N K_t^N = (1 + \delta^N) P_t^N K_{t-1}^N - P_t^N R_t + F_N\left(K_{t-1}^H L_t^N, K_{t-1}^S, A_t^N\right)$$

where $(1 + \delta^N) P_t^N K_{t-1}^N$ is the growth of natural capital due to environmental self-renewal, $P_t^N R_t$ denotes resource use and nature's income earned from firms' use of natural capital and

$F_N\left(K_{t-1}^H L_t^N, K_{t-1}^S, A_t^N\right)$ is environment regeneration. Nature's income derived from firms' natural resource use is transferred to the government at the end of each period.

The environmental sustainability condition is given by the intertemporal natural capital constraint

$$P_0^N K_0^N = -\frac{1}{\delta^N} E_t \sum_{j=0}^{\infty} \beta^j P_{t+j}^N R_{t+j} + F_N\left(K_{t-1+j}^H L_{t+j}^N, K_{t-1+j}^S, A_{t+j}^N\right)$$

Natural capital is increasing when environmental protection by government and regeneration efforts by households more than offset resource use by firms net of nature's environmental self-renewal. When nature does not renew itself, human environment regeneration and government protection are needed to maintain existential natural capital.

**Intergenerational sustainability conditions**. Assuming the same discount factor for the government and households, the intergenerational sustainability conditions are given by the intertemporal natural capital constraint and the sum of firms', households' and the government's intertemporal budget constraints

$$P_0^R K_0^R + P_0^H K_0^H + P_0^S K_0^S + F_0 B_0^* + E_t \sum_{j=0}^{\infty} \beta^j \left\{P_{t+j} Y_{t+j} - F_{t+j} IM_{t+j} + I_{t+j}^* F_{t+j} B_{t-1+j}^* - P_{t+j} C_{t+j} - P_{t+j} G_{t+j}\right\} = 0$$

The intertemporal budget constraint shows that intergenerational wellbeing is maintained if discounted future saving is sufficient to maintain initial net assets, which include human, social and reproducible capital and net foreign assets. Saving is the part of disposable income that is not spent on consumption. Disposable income is the sum of the value added of the output produced by firms, $P_t Y - F_t IM_t$, and the income earned from net foreign assets, $I_t^* F_t B_{t-1}^*$. Consumption comprises household and government consumption, $P_t C_t$ and $P_t G_t$.

The first intergenerational sustainability condition that existential natural capital is maintained for current and future generations, captures the concept of ‘strong sustainability’. The second sustainability condition that the intergenerational budget constraint must hold, indicates ‘weak sustainability’. The sustainability conditions imply that a reduction in the value of an asset can be offset by an increase in the value of another asset or assets, but existential natural capital cannot be replaced by other forms of capital.

## ANNEX 3

### Legal personhood of nature

Stone (1972) in "Should trees have standing?" proposes to "give legal rights to forests, oceans, rivers and other so-called "natural objects" in the environment—indeed, to the natural environment as a whole" (p. 456). Several decades after the publication of the groundbreaking article, legal systems have started to give legal rights to "nonhuman natural entities" (Gutmann, 2021, p. 36); see International Rivers (2020) for a survey of rights of nature in domestic and international law.

To create legal rights and corresponding legal duties requires that the "parties to (a) legal relation are constituted as legal persons" (Naffine, 2008, p. 885). A legal entity or legal person is an entity established by law with similar rights and responsibilities as a natural person although certain rights only apply to natural persons, e.g., the right to vote in elections. Both natural and legal persons can own property, enter into contracts, commence legal proceedings. A contract is a legally binding agreement between two or more parties that specifies certain legally enforceable rights and obligations.

Contract theory in economics originates from Coase's seminal 1937 paper "The nature of the firm" in which he postulates that resources are allocated by a price mechanism, i.e., markets, or by organisations, e.g., firms. Firms emerge to "supersede" the price mechanism when the cost of organising transactions within a firm is lower than carrying out exchange transactions through the price mechanism. Within a firm resource allocation is determined not necessarily by a price mechanism but by the entrepreneur who has a "right of control or interference". Coase (1937) also notes that firms would unlikely "emerge without the existence of uncertainty" (p. 392) and the incentive to shift transactions from markets to organisations increases "the longer the period

of the contract is for the supply of the commodity or service" due "to the difficulty of forecasting" (Coase, 1937, p. 391).

Tănăsescu (2021), who discusses legal personhood of Te Urewera notes that "(o)ne of the closest precedents in common law to the legal form of Te Urewera is, perhaps strikingly, the corporation" (p. 76). The Companies Act 1993 contains the law and rules for setting up, managing and closing a company, a legal person, in New Zealand. It affirms "the value of the company as a means of achieving economic and social benefits through the aggregation of capital for productive purposes, the spreading of economic risk, and the taking of business risks" (p. 24). The guardians of a company are its directors who "must act (…) in the best interests of the company" (Companies Act 1993, paragraph 131 (1)). The requirement to act in the best interests of the 'company' recognises that a firm is an intertemporal entity that consists of a "system of relationships" (Coase, 1937, p. 393).

Nature is being destroyed because not everyone recognises their responsibilities and because defining and enforcing obligations that arise from our use of nature's capital is difficult. Ostrom (1990) shows that common access resource problems and degradation and depletion of natural capital can be prevented with cooperation and enforcement. When cooperation and enforcement are uncertain or not feasible, legal personhood of natural entities could help overcome common access problems because it provides a means for dispute resolution. A necessary condition to help overcome common access problems is that legal person natural entities have financial independence to ensure a credible threat of litigation to enforce rights and obligations.