Barriers, Enablers & Approaches

Transition to a more **circular economy** in Aotearoa New Zealand

March 2024

THE CONNECTIVE

ARUP

PROJECT:MOONSHOT

What is in this slide deck?

Research objectives

Drivers for a more circular economy

A systems approach to research

Integration of te ao Māori & Māori aspirations

Research findings

Whole economy

Manufacturing

Food

Built environment

What is in this slide deck?

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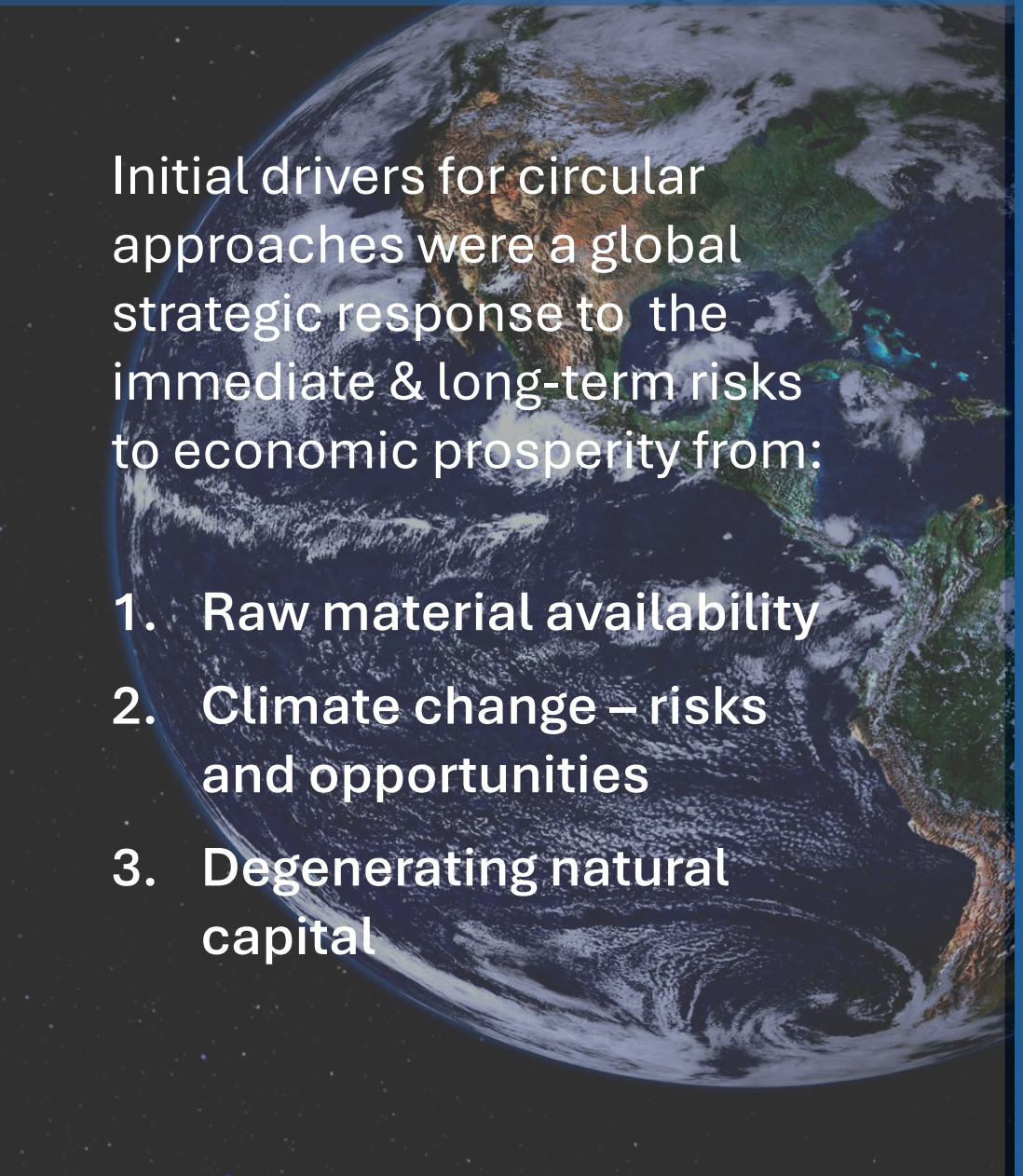
Research Objectives

Identify the critical barriers and enablers to implementing a more circular economy in Aotearoa New Zealand by 2050, and how these could be addressed

1. Using a system context, identify the most critical barriers and enablers to implementing a more circular economy in Aotearoa New Zealand by 2050, reflecting in particular the implications of New Zealand's unique economic geography on circular activities, as well as other aspects of our ecological, cultural, and social context.
2. Approaches that could address these, by providing tangible and practical examples of potential actions or interventions (not recommendations), that government or other actors could use to accelerate, or in other ways strengthen, the shift to a circular economy in Aotearoa New Zealand.
3. Māori perspectives should be considered throughout, for example the relevance of te ao Māori worldviews, any barriers, or enablers particular to Māori, and opportunities for Māori business/industry to meet aspirations.
4. Delivery of an engagement process/workshop, with involvement across the manufacturing industry and in collaboration with the Advanced Manufacturing ITP, to develop insights and actionable approaches about how New Zealand manufacturing can become a leading circular net-zero sector and contribute more widely to circular economy goals.

The research focused on four areas: the whole economy; manufacturing sectors; food sector; and the built environment

Drivers for a more circular economy



Initial drivers for circular approaches were a global strategic response to the immediate & long-term risks to economic prosperity from:

1. Raw material availability
2. Climate change – risks and opportunities
3. Degenerating natural capital

Subsequent drivers for circular approaches are:

4. **Amplifying resilience:** Countries globally are taking precautions to safeguard against geopolitical risks and volatile trade by focusing on self-sufficiency and resilience
5. **Significant productivity gains:** Circular transitions are associated with significant gains in productivity. For example, in Europe it's estimated that circularity will improve productivity at 3% annually, translating into GDP gains up 7% relative to BAU.
6. **Increasing competitiveness and higher-value jobs:** Increasing competitiveness is driven by consumer and regulatory demand for circular and low impact products – which are increasingly commanding premium prices in global markets.

New Zealand drivers for a more circular economy

1. Climate change
2. Dwindling fossil fuel reserves
3. Degenerating natural capital
4. Amplify resilience
5. Significant productivity gains
6. Competitiveness and jobs

Sticks to Paris Agreement commitments & remain on par with peers to protect global image

Our energy mix is 60% dependent on fossil fuels, rendering our economy vulnerable to shocks

We’re crossing multiple planetary boundaries – acting now will protect our natural capital on which ongoing prosperity depends

In addition to oil, we’re import dependent in other sectors such as construction and agriculture

Circular economy is a huge opportunity to get over NZ’s slow productivity challenges

To remain competitive globally , ‘green’ vs cutting costs will be the new advantage

Research Approach: Six project phases

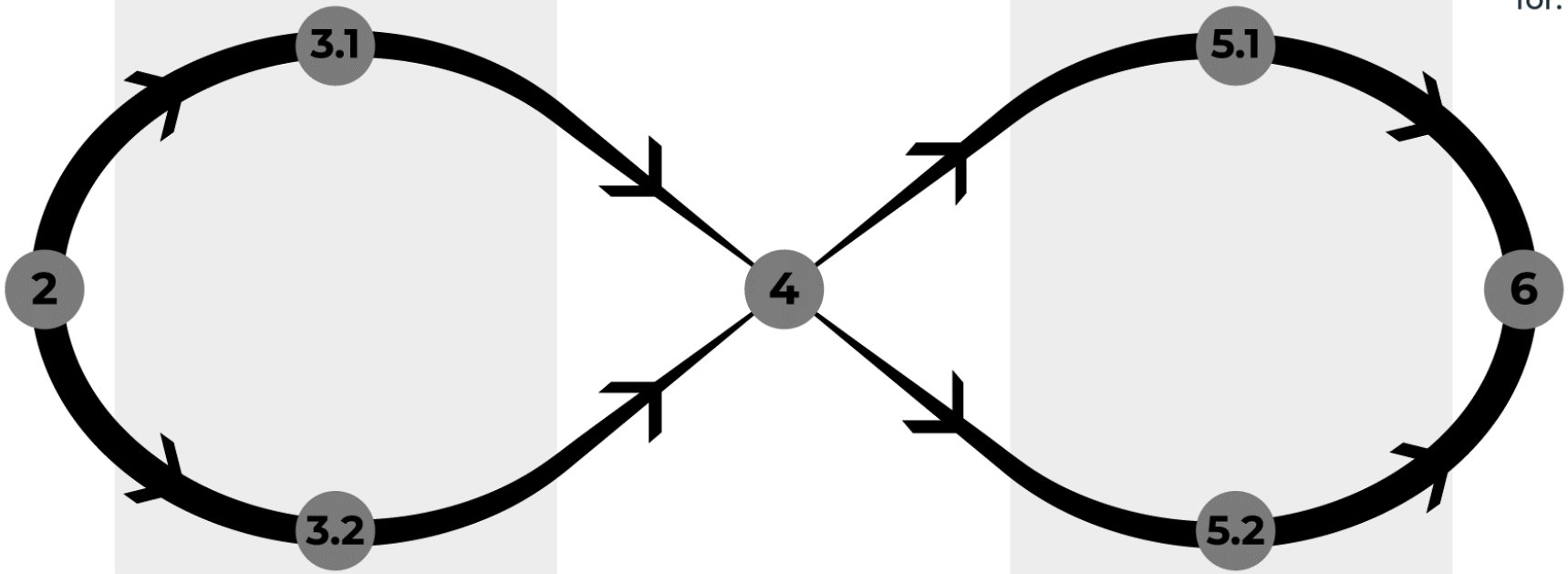
Phase 1
Systems approach & Integration of Mātauranga Māori

Phase 2
Initial mapping of current system

Identify barriers & enablers

Phase 3
Potential future system and circular alternatives

Understand future states



Identify CE alternatives

Phase 4
Workshops and engagement

Govt & industry

Phase 5
Opportunities for NZ and approaches to implement

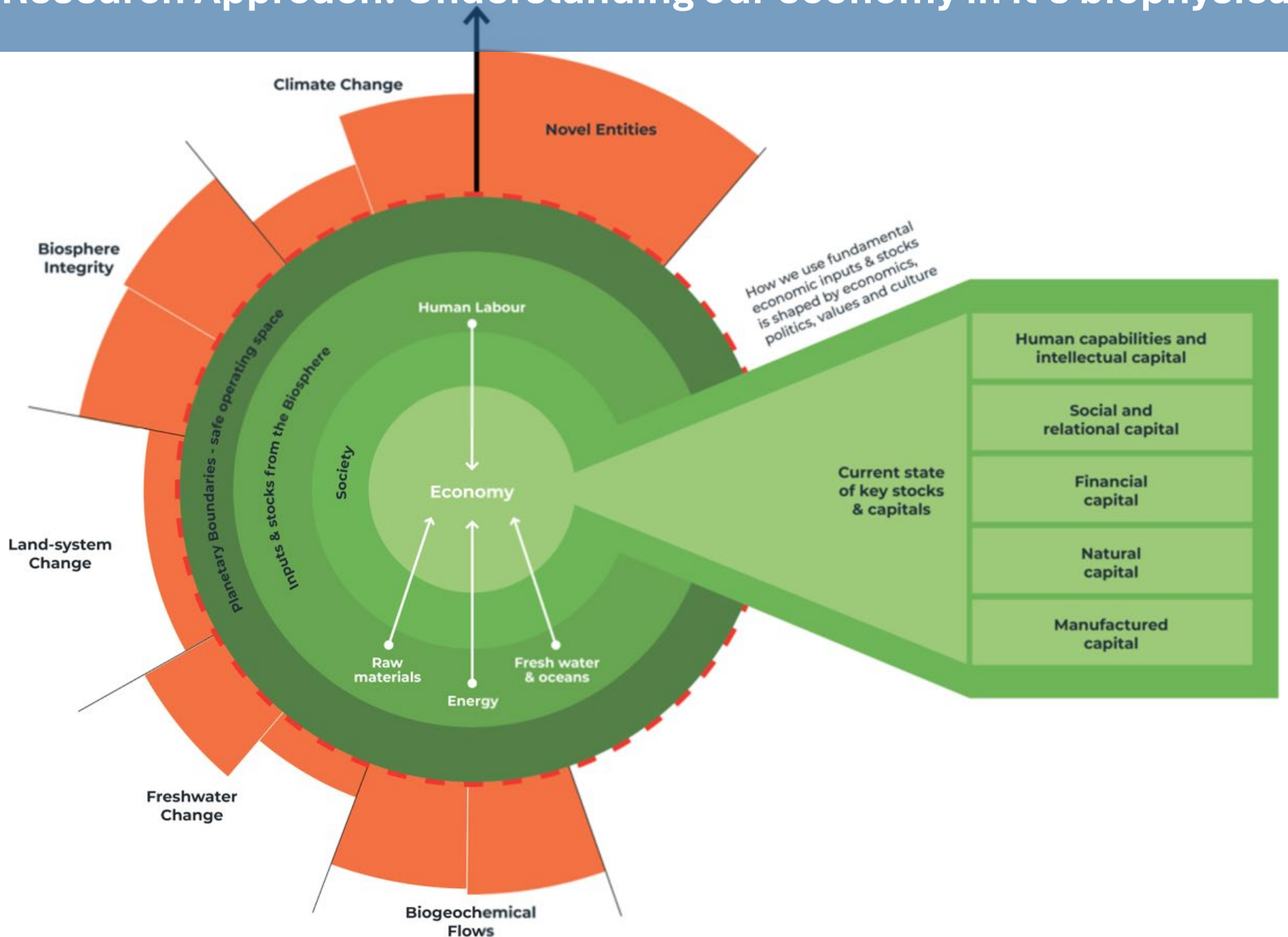
Highest opportunities

Approaches to more circularity

Phase 6
Conclusions and final deliverables

- Opportunity Areas
- Barriers & Enablers
- NZ & International Examples for:
  - Whole economy
  - Manufacturing
  - Food
  - Built environment

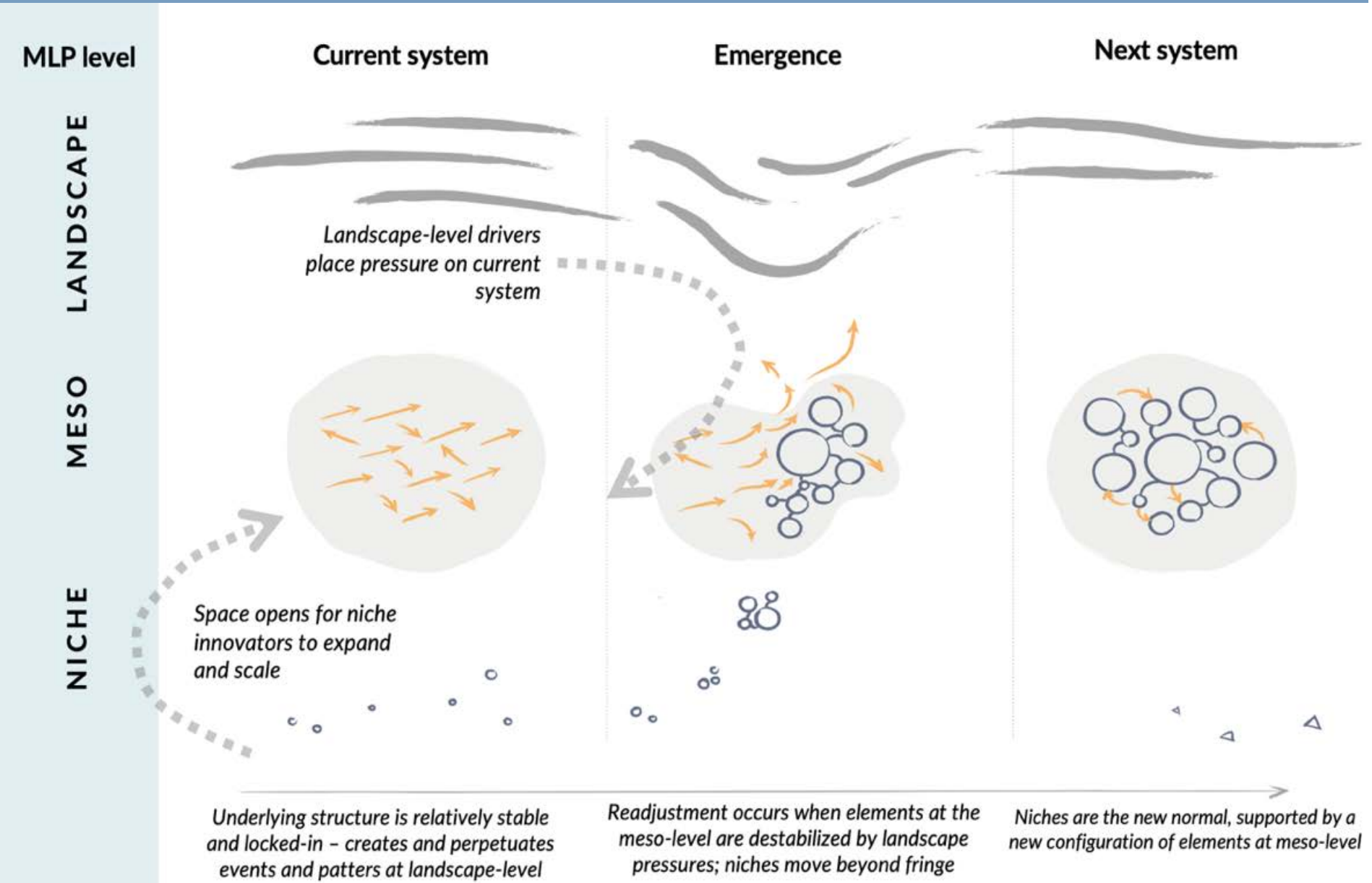
Research Approach: Understanding our economy in it's biophysical and social context



New Zealand's economy in biophysical and social context provides an illustration of the **critical components for decision-makers to consider to safeguard long-term our economic prosperity:**

1. Fundamental economic inputs and stocks
2. Political and economic ideals, underlying values and culture
3. Five capitals
4. Planetary boundaries

Systems Approach: Multi-level perspective (MLP) framework



MLP is an analytical framework used by policy makers to understand the complexities of socio-economic systems, and to identify points of intervention to drive transitions:

- **Landscape** - the 'seen' landscape of events and trends;
- **Meso -** the underlying system that acts to 'lock-in' conventional practices and norms;
- **Niche** - innovations and emerging practices that 'open up' possibilities for different way.

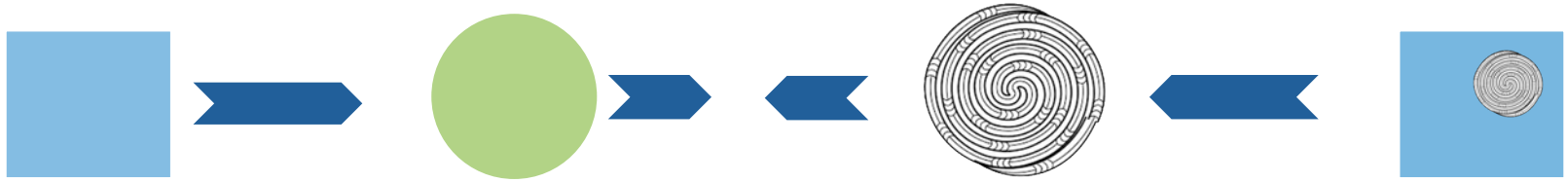
Key barriers and enablers to circularity were identified against all three levels of MLP – this process informed where systemic opportunities for circularity lie in New Zealand's economy.

The Māori Economy & a more Circular Economy

The Māori Economy, Māori enterprise, and Māori industry are already circular-spiral in nature

- The Māori economy aims for Wellbeing - Oranga of People-Place-Nature
- The Māori Economy can underpin and act as a catalyst to anchor and help transform Aotearoa New Zealand's economy to become more circular
- A key element of the Māori Economy is Māori Enterprise, which can be viewed in an integrated way, Iwi/ Hapū Enterprise (tribal enterprise), Whānau Enterprise (Māori SMEs) and Kaupapa Enterprise (Inter-tribal/ Sector/Industry based Enterprises)
- We are seeing a shift to hapu centred enterprise rather than just iwi - more localised, anchored to place and informed by hapu specific Mātauranga
- Actions to create greater circularity and develop our bioeconomy will also need to uphold Te Tiriti o Waitangi, apply te ao Māori and Mātauranga Māori principles, and protect Māori interests.
- A concern that Mātauranga Māori is becoming more academic/ homogenised and favoured by the Crown as opposed to whakapapa centred collective Mātauranga that sits with hapu and whānau

Application of te ao Māori and Mātauranga Māori: Moving from Square-linear systems to Circular-spiral system

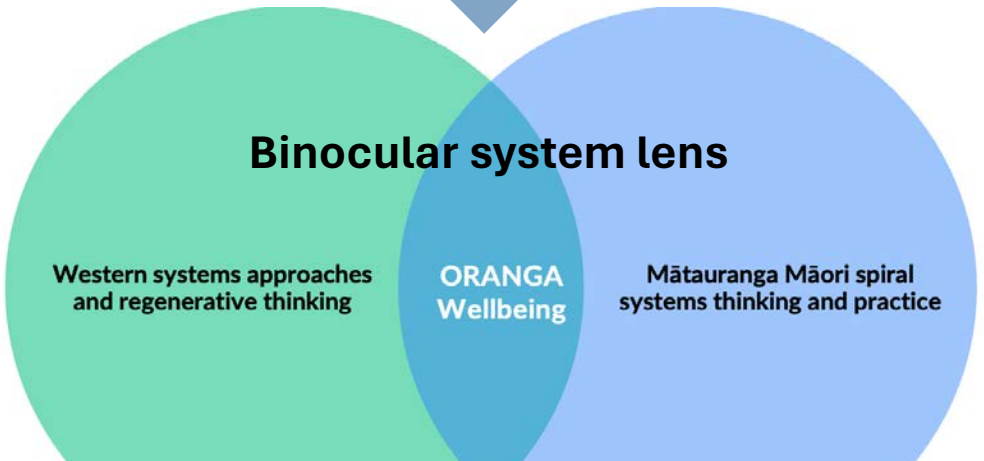


Current Western Square-Linear Systems Thinking
Linear
Extractive
Patriarchal
Individual rights and interests

Western Regenerative Circular Thinking
Regenerating the partnership between humanity and nature
"Commons"

Te Ao Māori Circular-Spiral Systems Thinking
Spiral' Intergenerational Whakapapa, Shared obligations and responsibilities

Impacts of: Squarisation Colonisation, Westernisation and Urbanisation
Rights and interests; Treaty rights; Legal rights; Human rights; Indigenous rights; Customary rights; Cultural rights



The Māori Economy and Māori Enterprise are circular-spiral in nature.

The Māori Economy is inextricably linked to Oranga/Wellbeing.

Mana and respect can be given to Western system approaches and to a Te ao Māori circular-spiral systems lens.

The Dual-Systems **Binocular lens** shows that each lens can be applied interdependently. The 'third space' draws on the strengths of both – leading to a place of collective oranga, or wellbeing

A more Circular Economy: Enablers and Barriers of Most Relevance to Māori

- Māori land utilisation will become more important given it is predominantly located within the foothills, as opposed to coastal areas impacted by physical climate-related risks e.g., sea level rise and storm surges
- Shifts to covered food production. This disruption will come at a cost
- Big shift to Food and Fibre (increasing productivity/economies of scale) presently only large economic sector driving change in NZ context
- Building economic resilience must be a priority at a time where major longstanding geo-political instability forecasted
- Free Trade Agreements that have been signed with the EU reference the Treaty and Māori trade and cooperation. These are important and world leading, creating a level playing field for all of NZ, for which all exporters will benefit.
- Ahu Whenua Trusts need to concentrate their energy on regional and local government - more relevant to their diversification interests and resolving legislative barriers - rather than central government.
- Māori need to increase investment in R&D rather than relying on government grants and be willing to risk investments in new ideas from the next generation.
- Climate migrants will impact on our rangatiratanga
- Converting pasture into protein is a huge global opportunity - we have a competitive advantage
- A significant shift within the Whānau Ora area, with an increasing focus on the development of whānau – social/ business enterprise as part of wellbeing pathways with whānau

Whole Economy: Barriers, Enablers and Key roles for Government

Barriers to more circularity

- Low support for local manufacturing
- Information/data gaps and incomplete feedback loops
- Challenges to integrated approaches
- Lack of long-term planning
- Poor linkages with global expertise
- Low investment in innovation
- Limited consideration of biophysical realities
- Complex and interconnected global trading environment
- Pricing alone will not solve complex challenges
- Economy-wide financialisation
- High private and public debt
- Perception that climate risks are a distant future problem
- Challenge for SME's to access circular transition capital and capabilities

Enablers to more circularity

- Significant, underutilised primary sector
- Industry understand that 'circular' is the new comparative advantage globally
- Existing pockets of place-based initiatives
- Filling data gaps to support intelligent decision making
- Setting broad long-term goals to align cross-sector efforts
- Māori economy is strong in priority areas for circular practice
- Mātauranga Māori and systems approaches to guide decision-making
- Trend to localism, place-based and regional approaches to build resilience
- Industrial policy and mission-orientated approaches can enable productivity

Key Roles for Government

Immediate/Short term (1-2 yrs)

1. Smart Public Procurement and long-term supply contracts
2. Continue focus on filling data gaps and incomplete feedback loops
3. Collaboration with industry at their request to identify shared challenges
4. Public circular demonstration projects

Longer term (2+ yrs)

1. Employ horizon scanning and systems thinking to improve decision-making in contexts of complexity
2. Identify critical inputs (raw materials and components) required for transition
3. Invest in system-wide enabling infrastructure
4. Taskforce to explore more radical policies and beyond growth models

Whole Economy Systems Map

The stronger the system connection, the higher the leverage point to support a more circular economy

Macro level drivers

- Productivity, growth gains & lower costs linked to circular transitions
- Access to Critical Raw Materials to enable circularity and productivity growth
- International regulations: EU stds, finance industry TCFD & TNFD
- Increasing uncertainty & complexity
- International reputation: retain green image & remain on-par with peers
- Risks to natural capital of continuing with BAU

Whole Economy: Barriers and enablers to more circularity

GOVT
- Upholding Te Tiriti o Waitangi ●●●
- Commitments for climate action ●●●
- Narrow internal KPIs ●●
- Short-term electoral cycles ●●
- Applied holistic evaluation and measurement ●●
- Reliance on price mechanisms to fix market failures ●●
- Free-market policies ●●●
- Low support for local manufacturing ●●●
- Bold policy and Market-shaping experiments ●●
- Budget constraints to deliver on ambitions ●●
- Challenges with integrated approaches ●●●

Financial
- Debt burden ●●●
- Financialisation inhibits productivity ●●●
- High-cost of capital ●
- Conservative investment & liquidity requirements ●
- Shape diverse impact investment ecosystem ●●●
- Unrestricted FDI ●
- NZGIF ●
- Large pools of private capital ●

Human Capabilities
- Reduced headspace – innovation & transition thinking ●●●
- Low R&D & low innovation ●●
- Financialisation of education ●●●
- Reduced ability to navigate complexity ●
- Low demand for local circular products ●
- Gaps in data and understanding ●●●
- Regenerative land use practices ●
- Mātauranga & Western systems thinking ●●●
- Aversion to doing things differently ●●●
- Capabilities in industrial and mission-oriented policy ●●●

Social
- Too little focus on long term common good ●●
- Low relational responsibility of business ●●
- Poor linkages between decision-makers, Science data and evaluation ●●
- Māori-led initiatives and innovation ●●
- Pockets of place-based resilience ●●●
- Distrust in govt. growing ●
- Poor global links to circular expertise ●●
- Low confidence in long-term circular goals ●●

Physical infrastructure & tech
- Tech as an amplifier of BAU ●●
- Lack of system-wide enabling infrastructure ●●
- Centralised energy grid ●
- Current transport network is not fit for purpose ●●
- International shipping infrastructure: not resilient ●
- Tech as enabler ●
- Technology to capture holistic data ●●

Industry & Business
- Māori economy practices that embody the concepts of whakapapa, kaitiakitanga and manaakitanga ●●●
- Prioritise efficiency & certain outcomes ●●●
- Stakeholder vs shareholder value, narrow KPIs ●●●
- Slow progress on low carbon transition ●●
- Significant percentage GDP linked to financialised activities ●●
- Lock-in to low value primary sector services ●●●
- Momentum for Industry transformation ●●●
- Circular business models ●●●
- Conflict with BAU business models ●
- Clean tech sector ●●
- Import dependency and vulnerabilities rising cost of input ●

World View
- Economic ideology ●●●
- Culture of busyness and distraction ●●●
- Go it alone ●●
- Reductionist and technocratic thinking ●●●
- Consumer based culture ●●
- Discomfort with uncertainty ●●
- Economic pluralism ●●●
- Te ao Māori & systems thinking ●●●
- Trend to localism ●●
- Climate apathy ●●●
- Culture shift in younger generations ●●

Natural
- Tension between regen land use and increasing biomaterial inputs ●
- Utilise significant primary-sector for long-term value ●●●
- Regenerative inputs ●
- Export-orientation ●●
- Reduced control over biomaterials ●●
- Climate impacts to biomaterials ●
- Pushing planetary boundaries ●
- Rising cost of imports ●●
- Measurement and data to understand natural capital ●●●
- Māori leadership ●●●
- Better utilisation of Māori land ●●

KEY

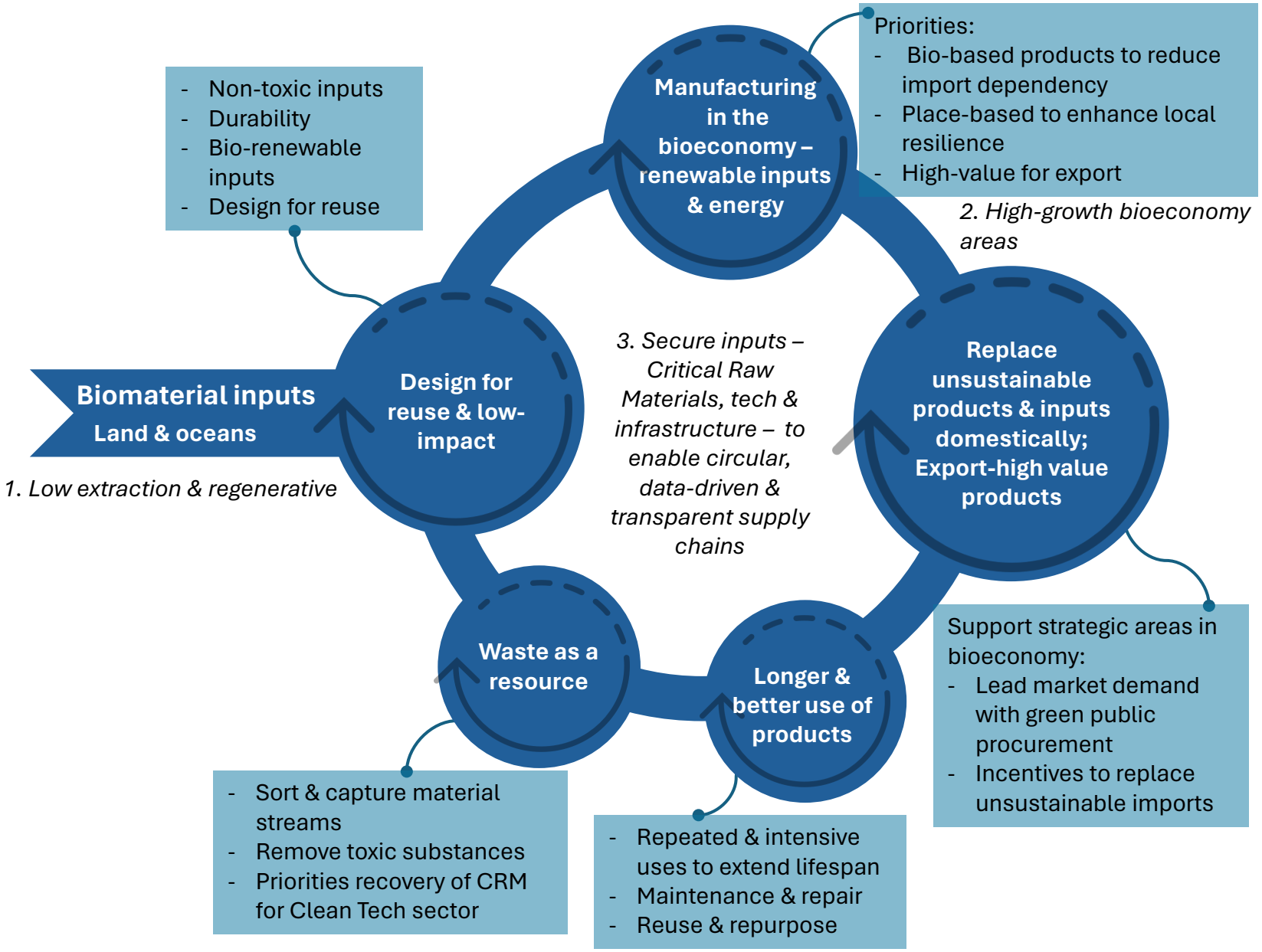
- Barrier
- Enabler
- ●●● Strong system connections
- ●● Medium system connections
- ● Low system connections

New Zealand's Biggest Opportunity Area: Leveraging the nation's bio-based primary sector, both on land & in the ocean

Three parts to deliver opportunity

1. Accelerate transition to low-extraction, regenerative land and ocean practices
2. Focus on high-growth bioeconomy sectors & prioritise areas to mitigate import dependencies
3. Ensure security of critical inputs for tech & infrastructure required for successful circular bioeconomy:
   - Priority bioeconomy areas
   - Decarbonise transport & process heat to ensure low-input supply chains
   - Tech to capture data linked to planetary boundaries

Cross cutting opportunity for Māori-leadership at two-levels: Place-based for local resilience & high-value Mātauranga led enterprise



Whole Economy: Green Growth & Steady State

Green Growth

Economic expansion is decoupled from carbon emissions and other environmental harms

Improved prosperity and wellbeing for the majority

Country's transitioning to a circular economy widely employ green growth approaches in the short-term

Steady state

Economies are independent from growth, prioritising instead human and environmental well-being

Biophysical and CRM limits suggests there are not enough resources to enable infinite growth

Evidence points to the impossibility of decoupling at the necessary scale to avoid environmental breakdown

Green growth & steady state are not mutually exclusive & can complement each other. Europe, for example, is pursuing growth in the bioeconomy, alongside exploring how to downscale and localise production and consumption

Hybrid approaches may be the optimal path forward for NZ – enabling growth alongside local resilience – in the face of an uncertain global landscape, where old models are being challenged while alternatives are still taking shape

Whole Economy Opportunity Areas: Green Growth & Steady State

Green Growth	Steady State
Expand renewables & decarbonise transport and process heat	Downscale consumption of energy for resilience
Utilise significant bio-material sectors to diversify into high-value manufactured products	Low extraction primary sectors to enhance ecosystems, while mitigating dependencies on unsustainable inputs
Apply Circular Economy of Water approach & capitalise on shifting global water patterns	Place-based catchment management
R&D for high-growth opportunities & low impact – Mātauranga Māori leadership & brand	Socially & ecologically just blue future to enhance the mauri of coastal communities and marine ecosystems
Climate scenario-resilient infrastructure to enable scaling of circular activity	Scale green infrastructure, invest in public transport, get smart with brownfield development
Mobilise private wealth to accelerate circular transition at multiple scale	Prioritise the role of money as an enabling tool for value creation
Establish Circular Economy Living Labs to leverage systems approaches and innovation	Foster cultures of ‘enough’ & non-consumptive happiness

Manufacturing: Barriers, Enablers and Key roles for Government

Barriers to more circularity

- Export-orientation inhibits domestic access to bio-materials
- Competitive behaviours between companies prevents collaboration
- Undercapitalised SMEs
- Some trade agreements make local supply chain resilience challenging
- Limited support for early-stage innovators
- Low workforce skills and capabilities
- Lack of strategic market-shaping by Govt
- Negative perception of manufacturing by workforce and business finance
- Limited knowledge of circular benefits

Enablers to more circularity

- Global market pressures for low-carbon and green products (e.g., regulatory drivers and disclosures)
- Government support for R&D, commercialisation and growth
- SME dominated sector: small and agile
- Pockets of niche innovation (e.g., food, cleantech, mass timber and textiles)
- Government initiatives that support more circular business e.g. Industry 4.0 and better data for material flows
- Policies to support manufacturing sectors critical to New Zealand's success, as trading partners do

Key Roles for Government

Immediate/Short term (1-2 yrs)

1. Government procurement to lead market
2. Targeted R&D grants for circular inputs, design and remanufacturing
3. Incentivise and support industry collaboration on shared challenges
4. Expand producer stewardship legislation

Longer term (2+ yrs)

1. Policies to support manufacturing sectors critical to NZ's success
2. Pan-sector bio-refinery that can take multiple feedstocks from multiple sectors
3. Introduction of material passports to boost value of NZ products and brand
4. Ban landfill for priority and critical materials and components

Manufacturing Systems Map

The stronger the system connection, the higher the leverage point to support a more circular economy

Macro level drivers

- International regulatory pressure from countries leading the circular transtion and the financial sector (TCFD and TNFD)
- Geopolitical environment
- Momentum to improve productive capabilities in NZ
- Global consumer demand for green products
- Global competition is challenge for infant industries in a small isolated market

Manufacturing: Barriers and enablers to more circularity

GOVT
- Commitments for climate action ●●●
- Short term electoral cycles ●●
- Collaboration with Industry ●●●
- Lack of long-term patient capital for manufacturing ●●●
- Market-based policy ●●●
- Industrial policy and market-shaping ●●●
- International dispute resolution ●

Financial
- Undercapitalised companies ●
- Financialisation of the economy ●●●
- Upfront cost of AM tech ●●
- High-cost of raising capital ●●
- Impact investment ●●●
- Unconditional FDI ●

Human Capabilities
- Lack of time and headspace ●●●
- Lack of skilled workforce in AM ●
- Gaps in understanding social metabolism ●●
- Education for AM tech and processes ●
- Lack of knowledge on use and benefits of AM tech ●
- Link Industry to science and R&D ●●●
- Diversifying the workforce ●●
- Risk aversion ●●●
- Overall low spend on R&D ●●●
- Increased awareness that manufacturing drives productive capabilities ●●●

Social
- Systemic labour market barriers for Pacific peoples in manufacturing ●●
- Long-term strategic collaboration ●●●
- Global connectivity ●●
- Strong Māori AM networks ●●
- Low demand for circular products - creates barrier for supply side ●●
- Increased collaboration between Industry on shared challenges ●●●

Physical infrastructure & tech
- Demand for circular infrast and tech globally is aleady outstripping supply ●●
- The Smart Industry Readiness Index (SIRI) ●
- Lack of system-wide enabling infrastructure ●●●
- Low resilience of critical infrastructure ●●
- Large RE sector ●●
- Lack of tech uptake ●●●

Value Chain
- Focus end of value chain ●●●
- Integrated product design ●●
- Stuck in commodity cycles ●●●
- Majority of businesses are SMEs ●●
- Innovation in Food & Fibre and Textiles ●●
- Circular demonstrations ●●
- Utilisation of waste streams ●●
- Lock-in and path dependency challenges ●●●
- Lack of long-term supply contracts in and often inaccurate client forecasts ●●●
- Competition from imports, building an international reputation ●●●
- Export challenges ●●

World View
- Perceived as unattractive work option ●
- Perception of circular materials as high-cost ●
- Go it alone mindset ●●
- Circular is important to remaining competitive ●●●
- Perception of NZ as a world leader in sustainable materials and practices ●●

Natural
- Utilise significant primary sector - land and oceans ●●●
- Tension between regen land use and increasing biomaterial inputs ●
- Export-orientation of raw materials ●●●

KEY

- Barrier
- Enabler
- ●●● Strong system connections
- ●● Medium system connections
- ● Low system connections

Manufacturing: Biggest areas of opportunity

Opportunity area 1: Utilise extensive bio-based resources to manufacture high-value products and increase productivity

Why?

- To add more value to our bio-resources (oceans, agriculture, forestry) as majority of raw bio-materials are manufactured abroad
- New Zealand's manufacturing sector can apply global trends to drive productivity through greater innovation, via technology and chemical processes into higher-value products. This can support economic diversification and a higher skilled workforce
- Increase economic resilience and meet low-carbon targets by manufacturing goods for import-dependent sectors (e.g., construction is 90% dependent on imports, including timber – despite significant local forestry resources).
- Utilisation of waste from forestry and agriculture, opportunity to valorise by manufacturing into new bio-based materials. Opportunity for New Zealand global leadership.

Focus areas

- Scale timber manufacturing, including high-value mass timber for use in domestic market (substitute for high-embodied carbon building materials), and for exports.
- Manufacturing of 'alternative meat and dairy' plant proteins
- Identify and support high-value manufacturing in the ocean economy (e.g., nanocellulose from seaweed processing residue)
- Utilising residual organic material streams into bio-based materials (e.g., forestry waste into biochar and bioplastics)
- Plan to secure near and long-term supply of New Zealand bio-materials to support manufacturing growth

Manufacturing: Biggest areas of opportunity

Opportunity area 2: Strengthen national and regional value and supply chains for economic resilience and growth

Why?

- Covid-19 and subsequent geo-political events have highlighted the fragility of New Zealand's supply chains. Especially for import dependent sectors such as energy, construction, machinery and equipment.
- Supply chain fragility and competition for resources are projected to increase globally. This has led to many governments 'on-shoring' critical sectors
- Opportunity for New Zealand to enhance the connectivity of local and regional supply chains to enhance resilience and growth.

Focus areas

- Localising value/supply chains, focusing on: Existing Māori efforts to diversify local economies; forestry and timber processing; localised supply chains for blue economy and food and beverage – co-benefits for food security and regional wealth creation; emerging cleantech sector; and circular recovery of critical materials.
- Identify and implement demonstration pilots for co-location and industrial symbiosis and Special Activation Precincts.
- Regionalism – build strong relationships with countries in Oceania to ensure secure supply of critical raw materials and technologies required for low-carbon transition

Manufacturing: Biggest areas of opportunity

Opportunity area 3: Protect NZ's brand and ability to charge a premium for exports

Why?

- New Zealand's clean green image is viewed by industry as a comparative advantage
- This image has become more valuable with global momentum to tackle climate change (e.g., TCFD) & strong demand for 'green'
- Our image is threatened by increasing awareness that New Zealand's land use practices and processing of bio-resources are not that 'green'. Food and beverage at risk.
- Opportunity for New Zealand to develop world leading practices in the regenerative production of bio-materials and circular design to preserve our green image brand
- 'Green' is expected to become the future comparative advantage and earning a premium

Focus areas

- Build on existing industry and niche activity in regenerative land and ocean practices
- Phase out unsustainable imports e.g. unsustainable fertiliser and irrigation
- Mātauranga Māori led exports led by and for Māori
- Bio-polymers for pharmaceutical and biomedical applications
- Sustainable wood treatment and processing into high-value timber products, including mass timber; innovating in re-use and remanufacture
- Technology to increase transparency across the supply chain – standardised data capture and measurement
- Introducing material passports to show that New Zealand's materials come from sustainable sources

Manufacturing: Biggest areas of opportunity

Opportunity area 4: Recovery and remanufacturing to support a resilient low-carbon economy

Why?

- Global gap between supply and demand for critical materials to manufacture low-carbon technologies, especially the precious metals in nearly all renewable energy technologies, including wind turbines, solar panels and fuel cells
- Given rising prices and volatility of markets for these metals – it's prudent to invest in more circularity to recover and reuse these materials to feed growing niche innovators in New Zealand's Cleantech sector
- It's important to incorporate the ability to remanufacture into the design of bio-materials
- Reuse and remanufacture is essential as renewable bio-materials are not sufficient to replace demand for abiotic materials
- Reduce reliance on global supply chains that are becoming less dependable
- Help meet New Zealand's net-zero, biodiversity, waste reduction and other commitments

Focus areas

- Support existing niche innovators in clean tech. Metal recovery will feed other clean technologies, such as renewable energy. This applies to building existing cleantech (e.g. solar) as they move through their first service lifecycle and for remanufacturing
- Timber manufacturing and remanufacturing as construction become more low carbon, there is opportunity in wood-based construction products and components
- Sectors with significant single uses, e.g. health care and plastics used in construction.
- R&D and expansion of advanced manufacturing technologies such as additive manufacturing and utilisation of AI can enable resource-efficient manufacturing
- Product certification: Demand from consumers for food and bio-extractives for human health. Timber and other bio-materials also

Manufacturing: Biggest areas of opportunity

Opportunity area 5: Circular business models to drive innovation and mitigate undercapitalisation of manufacturing SMEs

Why?

- Alternative circular business models such as “product-as-a-service” can drive innovation, aligning business imperatives and wider social and environmental drivers
- They can also help mitigate the current challenge of under-capitalised SMEs, moving business capex to opex
- Circular business models in manufacturing can add revenue streams by valorising by-products and waste streams and drive the design of more efficient and durable products
- These models can remove the “split incentive” issue between asset owners and operators
- Due to the large number of SMEs in New Zealand, there is an opportunity to quickly adapt their business models and take advantage of new markets

Focus areas

- Consumer goods e.g. textiles and consumer apparel, electronics and packaging
- Capital goods e.g. manufacturing equipment and healthcare
- Construction and building components e.g. lighting, HVAC systems, flooring and facade

Food Sector: Barriers, Enablers and Key roles for Government

Barriers to more circularity

- Limited focus on upstream i.e. inputs and design
- Investment and support flows into conventional food production
- Export-orientated food sector, but poor domestic food sovereignty
- Dependency on unsustainable imported inputs – fertilizer and stock feed (e.g. Palm Kernel Expeller)
- Demands of domestic consumers out of sync with demands of global markets in the US and EU
- Limited coordination between policies and funding and between different actors in food system

Enablers to more circularity

- Global and national regulatory pressures
- Global consumer demand for transparency in food value chain
- Global consumer demand for products created from sustainable, chemical free ingredients and inputs
- Increased support for R&D
- Trend towards localism - intersect between local more resilient food systems and health
- Agriculture's loss of social license to operate based on growing awareness of the disconnect between 'green' image of New Zealand food system and reality

Key Roles for Government

Immediate/Short term (1-2 yrs)

1. Smart policy mix to support niche innovations, especially upstream
2. Regulation to bring maximum pesticide in line with key export countries
3. Tighter and more streamlined food regulations from farm-to-fork
4. Use Policy tools to support meta-network of local regenerative food networks

Longer term (2+ yrs)

1. Investment in digital passports and traceability technology
2. Legislate for more sustainable land and water use practices
3. Include agriculture in ETS
4. Partner with international Governments on circular initiatives

Food Sector Systems Map

The stronger the system connection, the higher the leverage point to support a more circular economy

Food Sector: Barriers and enablers to more circularity

Macro level drivers	International consumer demand in EU and US markets for food products produced from 'sustainable and green' inputs and ingredients	International regulations: Regulatory pressures stem from meeting the Paris CC Agreement targets.	Trend towards localism: Local food production strengthens the intersect between local more resilient food systems and health.	Limited coordination between policies and funding and between different actors in the food system	NZ's Ag sector currently depends on unsustainable imports of fertilizer and feedstock – plus unsustainable water use in naturally dry regions	NZ's food systems is overshooting planetary boundaries and failing to meet the food security needs of all New Zealanders.
GOVT	Commitments to climate action ●●	Limited innovation support in new areas ●●●	Regulatory guidelines ●●	Omission of agriculture from NZ ETS ●●	Place-based bio-regional focus ●	Export oriented food sector ●●
	Genetic engineering restrictions ●●●	Higher pesticide limits than export markets ●●				
Financial	Cost of energy ●	Limited finance for emerging production ●●●	Perceived risks for multi-party-owned Māori land ●●	Global supply chain fragility ●●	Supermarket duopoly ●●	
Human Capabilities	Lower NZ consumer demand due to cost ●●●	Fear of change ●●	Reliance on seasonal labour ●●	Corporate innovation on alternative proteins ●●	Māori investment in aquaculture ●	EU and US offer premium markets ●●
Social	Domestic demand inhibits innovation ●●	Māori interests in food sectors ●●	Disconnect between NZ green image and reality ●●	Trend to local food networks ●●	Oversupply and wastage ●●	
Physical infrastructure & tech	Lack of support for networks across sector ●●	Lack of labelling consistency ●●	Supply-chain shocks ●	Reliance on fossil fuel process heat ●●	Lack of data ●●	
Value Chain	Limited upstream focus ●●	Trend for local and bioregions ●●	Regenerative farming ●●	Current value / supply chain norms ●●●	Centralised distribution ●●	Export-orientated food sector ●●
rld View	Agriculture seen as NZ heritage ●●●	'NZ feeds the world' slows change ●●	Narrative farming in NZ is sustainable ●●●	Shift to plant-based diets ●●	GMO-free movement ●	NZ-grown produce is 'safe' ●●
	Consumer education on circular outcomes ●●					
Natural	Dependency on unsustainable imported inputs ●●●	NZ food overshooting planetary boundaries ●●●	Overconsumption of nature ●●●			

KEY

- Barrier
- Enabler
- ●●● Strong system connections
- ●● Medium system connections
- ● Low system connections

Food Sector: Biggest areas of opportunity

Opportunity area 1: Upstream Innovation - Increase R&D and innovation in upstream segment of food value system

Why?

- Most harm occurs upstream: land use practices, inputs, design and processing
- Agriculture sector depends on unsustainable imports of fertilizer and feedstock – & unsustainable water use in dry regions.
- Need for upstream solutions to:
  - Protect New Zealand's natural capital for the long-term
  - Address global regulatory pressure and consumer demand for sustainable and climate smart-food production
  - Close gap between international best practice and current state circular food system innovation in New Zealand
  - Protect New Zealand's green image internationally and to maintain competitive
- Challenge current focus on downstream waste to instead focus on inputs e.g. feedstock and business model redesign

Focus areas

- Upstream circular solutions (products and practices) R&D and expansion:
- Expand regenerative farming and aquaculture
- Transition to foods that build soil health (e.g., legumes grow well in New Zealand)
- Local and sustainable inputs (e.g., biofertilizer)
- Renewable energy and Circular food product design (e.g., plant-based meats)
- Consider impacts of food e.g. poor nutrition due to ultra-processed food and concentrated power of supermarket duopoly

Food Sector: Biggest areas of opportunity

Opportunity area 2: Meta-network - Cross-sector participatory meta-network of food system actors

Why?

- New Zealand's food system is overshooting planetary boundaries and failing to meet the food security needs of all New Zealanders.
- If current food production practices continue, there is a real risk (exacerbated by climate impacts) that New Zealand's food system will irreversibly degrade the natural capital on which it depends. Soil health is a concern that is arguably not addressed in current food policy, with soil lifespans shorter than a century in most continents.
- Pockets of cross-disciplinary transition networks exist – but are under resourced, under supported and fragmented..

Focus areas

- Through support and connect existing food stakeholder groups (e.g. Quorum Sense NZ, NZ Food Network, Aotearoa Food Rescue Alliance AFRA etc) and cross-disciplinary food system groups in one 'transition network' and online platform.
- Model data on value creation benefits of the transition (cost saved, emissions, water use and quality, biodiversity, soil health).
- Support better understanding on aquaculture

Food Sector: Biggest areas of opportunity

Opportunity area 3: Real-time traceability - Increase transparency and traceability to meet consumer demand and global regulatory frameworks

Why?

- Pressure from global regulatory frameworks (e.g., EU import requirements, TCFD, TNFD)
- Increasing citizen awareness that New Zealand is not as green as its image implies
- Demand for ‘green’ food products, transparency and trend towards “provenance stories”
- Consumers willing to pay more for transparency & labelling inconsistency is confusing
- Growth of plant-based and lab alternative proteins pushing NZ ag to remain competitive
- New Zealand’s green image is an asset – enabling expansion into global markets. Protect and build brand

Focus areas

- Real-time data would enhance visibility of flows through the system and help consumers and food stakeholders make more informed decisions
- Digital tech innovation to enable transparency and traceability from farm-to-fork (e.g., RFID tags). Needs more capability and skills
- Industry is in a unique position to drive uptake of regenerative practices, consistent measurement and transparency (e.g., farm practices, fertilizer inputs, water use, etc.)
- To build brand, focus on products that emphasise: New Zealand provenance stories – including connecting our Māori, multigenerational farming, and Pacific stories to the food we produce; cannot be produced in other countries such as Māori indigenous products Innovation in food product development that utilises local ingredients.

Food Sector: Biggest areas of opportunity

Opportunity area 4: Place-based resilience. Develop place-based, circular food systems to improve resilience and food security

Why?

- Industrial food systems are a major source of emissions, biodiversity loss and declining human health linked to increased consumption of chemicals and processed foods
- Place-based food security, where healthy food is grown regeneratively and locally where appropriate, is global best practice
- New Zealand has serious food insecurity challenges and related significant health costs.
- 80% of all food will be consumed in cities by 2050 and some circular food systems require scale
- There is a large and growing interest in community gardens and regenerative and urban food initiatives
- Funding is currently directed at reducing methane in animals – as opposed to wider systems transformation
- A place-based approach considering bioregions aligns with a te ao Māori approach

Focus areas

- There is already a large and growing interest in community gardens (with over 200 in New Zealand). Innermost Gardens in Wellington used in 2019-20 by over 4,700 people, processing over 7 tonnes of food waste and sequestering over 26,000 tonnes of CO2e (as well as providing home-cooked meals to people during lockdown). However, these gardens are fragmented and lack support. With support and as part of a larger network these would help create community resilience across New Zealand and a more resilient food system (consider Covid or Cyclone Gabrielle).
- *Note: A focus on cities does not obviate the need for addressing rural food poverty. Rather it considers cities as an artificial bioregion for which inputs, stocks, flows and outputs can be better controlled or influenced for circular outcomes*.

Built Environment: Barriers, Enablers and Key roles for Government

Barriers to more circularity

- Lack of overarching circular strategy to de-risk innovation and risk taking
- Lack of infrastructure required for reverse logistics
- Need for consistent and reliable collection of data across supply chains
- Lack of end-of-life options for copper chromium arsenic (CCA) treated timber
- Preference for free-market and export-orientation of bio-materials
- Labour gaps, particularly high-skilled
- Limited supply chain collaboration
- No secondary wood processing capacity
- Capital intensity of offsite construction
- Public perception of medium to high density and re-used materials

Enablers to more circularity

- Pockets of innovative policy to shape sustainable built environment markets
- Significant drivers beyond low carbon – resilient construction industry e.g. the housing crisis, and critical infrastructure
- Innovation in mass timber and other bio-based materials
- Increased support for R&D
- World Green Building Council Circular Playbook
- Large and growing forestry stocks
- Utilization of Mātauranga Māori in the built environment
- Industrialised offsite construction to increase construction sector productivity

Key Roles for Government

Immediate/Short term (1-2 yrs)

1. Smart Public Procurement to lead market demand
2. Public demonstration projects
3. Significant increase in landfill gate fees for C&D waste
4. Promote secondary material processing and expand facilitating infrastructure

Longer term (2+ yrs)

1. Consistent and broad standards for re-used materials
2. Material Passports to track material sustainability, reuse and recycling
3. Streamlined and cheaper permitting for new MMC sites
4. Update building code to incentivise lower waste and embodied carbon design and construction

Built Environment Systems Map

The stronger the system connection, the higher the leverage point to support a more circular economy

Macro-level drivers

- Population growth
- Climate-related risks to critical infrastructure, housing and land use sectors
- Increasingly volatile international markets coupled with high-import dependency - need to increase anti-fragility of building sector
- International reputation at risk from housing crisis - culture of using homes as financial assets

Built Environment: Barriers and enablers to more circularity

GOVT

- Free-market policy
- Unregulated land ownership market
- Short-term election cycle
- Enabling regulation
- Government-industry collaboration to get more value from NZ's forestry sector
- Market-shaping experiments
- Growing capabilities with government for circular and urban design
- Support scaling timber in medium-density builds
- Limited co-ordination of national, regional and local planning
- Costs of buying offsets vs transformative change
- Lack of support for industry to tackle path-dependency challenges

Financial

- Financialised land market
- Community Renewable Energy Fund
- High-upfront capital costs
- New Zealand Green Investment Finance (NZGIF)
- Significant underinvestment in horizontal infrastructure
- Capital access challenges for smaller more environmental minded providers
- Low impact investment in Built environment

Human Capabilities

- Lack of labour
- Lack of training in prefabrication/off-site construction
- Lack of diverse construction workforce
- Expertise in circular urban design
- Wellbeing impacts of housing crisis

Social

- Fragmentation and insufficient collaboration across the supply chain
- Co-designed urban spaces
- Community-led renewable energy
- Impacts of urban planning on wellbeing
- Integration of Māori worldviews in Forest-to-Frame supply chains
- Lack of Māori involvement in construction processes
- Triple-helix research projects

Physical infrastructure & tech

- Lack of resilient critical infrastructure
- Lack of circular urban water infrastructure
- Transport network
- Medium Density Residential Standards
- Green infrastructure
- Underutilised urban space and brownfield development

Value Chain

- Lack of secondary wood processing capacity
- Design to reuse and remanufacture
- Localise to reduce import dependency
- Dominance of large players
- Circular steel industry
- Innovation - low-carbon build materials
- Retrofit and multi-use
- Integrated Design Engineering
- Reverse logistics
- Industrialised/ offsite construction
- Norm of building with concrete and steel
- Data collection gaps and challenges
- Lack of end-of-life options for copper chromium arsenic (CCA) treated timber
- Material Passports
- Undersupply of housing

ld View

- Public resistance to densification
- Siloed land use
- Car-based transport culture
- Consumer culture of ownership
- Te ao Māori and eco-centric worldviews
- Culture of investing in land

Natural

- High-reliance on carbon farming
- Most forestry assets under foreign ownership
- Significant underutilised forestry sector
- Small-wood lots
- Export-orientated forestry sector
- Transport is highly-dependent on imported fossil fuels
- Pushing planetary boundries in land use and biodiverity
- Pockets of climate-resilient forestry modes
- Low climate-resilience of forestry sector
- Opportunity for Māori leadership in regenerative inputs

KEY

- Barrier
- Enabler
- Strong system connections
- Medium system connections
- Low system connections

Built Environment: Biggest areas of opportunity

Opportunity area 1: Extract more value out of New Zealand's timber resources via mass timber and Modern Methods of Construction

Why?

- Import dependency: 90% of all construction products sold in New Zealand are imported either as a finished product or manufactured locally using imported components
- Export-orientated forestry sector, with most logs exported raw
- Mass timber and MMC are opportunities to add-value, decrease supply chain fragility, and significantly improve the speed, sustainability, and efficiency of builds. Mass timber has the additional benefits of being substitutable for high-embodied carbon concrete and steel in medium and high density builds and it is resilient to earthquakes and easily re-usable
- Practice climate smart forestry to balance the tension between conservation & production
- Despite benefits, path dependency and regulatory challenges are barrier to uptake
- Use non-polluting options for treatment of wood (i.e., safer alternatives to copper chromium arsenic (CCA), which is still allowed in New Zealand (Australia, the US and the EU have stopped or restricted the use of CCA))

Focus areas

- Invest in on-shore wood processing capabilities
- Support existing niche innovators in Modern Methods of Construction (e.g., off-site and modular)
- Expand mass timber production and use in domestic built environment
- Utilisation of small wood lots through engaging owners to aggregate their offering to achieve better prices and strengthen their negotiating power

Built Environment: Biggest areas of opportunity

Opportunity area 2: Scale up the renovation wave and unlock $116 billion worth of benefits

Why?

- The best way to avoid emissions is to use assets already in the building stock
- Research conducted by Business and Economic Research Limited (BERL) in 2023 and commissioned by BRANZ, showed that a massive investment retrofit programme targeting 400,000 homes in New Zealand would drive $116 billion worth of benefits to households.
- Many homes in New Zealand are not meeting the heating and energy needs of its users, resulting with cold, draughty and damp spaces and high energy cost as well as high health service bills
- Need for renovation and retrofit of all building types (commercial and public), to address their age and seismic concerns

Focus areas

- Large-scale and neighbourhood scale retrofit (not individual houses)
- Large landlords e.g. Kāinga Ora and Community Housing Providers
- Domestic blocks and high rises

Built Environment: Biggest areas of opportunity

Opportunity area 3: Increase utilisation of urban space and buildings to capture value

Why?

- New Zealand recognizes the need to increase building density through its Medium Density Residential Standards
- A more circular economy can promote higher density building development which can be resource- and land-efficient, and can utilise existing brownfield land within urban areas
- Opportunity to increase the value of existing building assets through Adaptive Reuse; that is to update the built asset for a new purpose, rather than the asset remaining vacant
- Multiple unused sites in New Zealand cities (e.g., post-industrial, abandoned construction sites, unused or uninhabited spaces)

Focus areas

- Public procurement as a leverage point
- More dense and compact urbanism – integrated green spaces
- Multi-use spaces which combine different uses throughout the day (day - night) and year (working period - nonworking period) avoid the need for new builds and support circularity of space (spatial use)
- Adaptive reuse strategies can include converting post-industrial sites and buildings as well as office-to-residential conversion

Built Environment: Biggest areas of opportunity

Opportunity area 4: Incentivise and enable the recovery and reuse of construction and demolition material using physical and digital tracking

Why?

- Construction and demolition waste accounts for up to half of all waste in New Zealand's landfills
- Around 470,000 tonnes of construction waste generated annually: 78% sent to landfill/clean fill; 14% recycled; 8% reused - Missed opportunity to capture the value of such secondary materials
- Of the materials that are recycled, concrete possesses the highest rate (44%), however, recycling of concrete is typically low-value processes, such as for use as crushed aggregate

Focus areas

- Develop infrastructure to enable reuse of building components. This includes both physical and digital infrastructures (including circular supply, resale and reuse market platforms).
- Stimulate the use of secondary materials in construction - for example through development of secondary material criteria within procurement, requirement of a 'circular economy statement' for developments.
- Implementing material passports to track where materials come from as well as where they go after buildings have been demolished, increasing the likeliness of companies recycling and reusing materials.
- Mandate material passports to check against compliance with low carbon building targets, procurement and reuse/recycling.
- AEC (architects, engineers, manufacturers and construction companies) actors need to work together from the project start to unlock benefits arising from Integrated Design Engineering. Up to 80% of a product's environmental impact is determined in the design phase. To embed circularity as a central design consideration, there needs to be design for disassembly (e.g., reversible and/or bio-based adhesives and connections).