

:WELL_NZ

Reframing New Zealand's Food Sector Opportunities

A CONVERSATION STARTER FROM TE PUNA WHAKAARONUI:
THE FOOD AND FIBRE SECTOR THINK TANK



**Te Puna
Whakaaronui**

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TE PUNA WHAKAARONUI

Te Puna Whakaaronui is New Zealand's first primary sector think tank. The establishment of Te Puna Whakaaronui is a key action under the *Fit for a Better World*, Acceleration Roadmap and fulfils the Primary Sector Council's recommendations for pan-sector thought leadership. It will support New Zealand's Food and Fibre Sector transformation over the next 10 years. Te Puna Whakaaronui's role is to help lead, co-ordinate and implement transformation; through partnering with Māori and sector participants to provide thought leadership, strategic insights and advice.

Te Puna Whakaaronui has a governance board comprised of an independent Chair and senior government officials. It is supported by an industry focused Thought Leaders Group comprising: Lain Jager (Independent Chair), Debbie Birch, Neil Richardson CNZM, Murray Sherwin CNZM, Rob Hewitt, Nick Hammond and Andrew Ferrier.

The think tank has a voice independent of the Ministry for Primary Industries, its view does not represent Government policy.



**Te Puna
Whakaaronui**

Foreword

New Zealand's Food and Fibre Sector is intrinsic to our country's economic success; agriculture has defined our culture, communities and landscape for decades. With thirteen million hectares of land in production, 14% of jobs, 82% of merchandise export earnings and 11% of our gross domestic product dependent on food and fibre production, the importance of the sector to our nation's wellbeing is clear. Economic, societal and environmental prosperity is achievable – sector growth is fundamental to New Zealand's success in tomorrow's world.

Structuring the Food and Fibre Sector (the Sector) for growth must build on our strengths: our farming heritage, te ao Māori, our people, our existing food ecosystem and our love of our land, freshwater and oceans. In the near term, food production is being impacted by the consequences of pandemic, inflation and war: rising fuel and fertiliser costs, labour shortages, as well as shipping and trade constraints. Underlying these immediate concerns New Zealand is facing some significant structural challenges that will push our nation's wellbeing backwards if we fail to act with sufficient strategic focus and urgency. Specifically:

- economic wealth and societal wellbeing disparities;
- the environmental impacts of climate change on food production and biodiversity;
- the imperative to decarbonise production;
- water quality and availability;
- rapidly changing technology;
- an ageing population;
- the evolution of global consumer needs and food value chains; and
- capacity and productivity constraints, particularly skilled labour.

The scope and pace of change being thrust on the Sector is overwhelming. The direction of its response is challenging all value chain participants. Negative narratives and finger-pointing at the Sector over methane and water quality is divisive, destructive and distracting. A collaborative “national mission” to optimise the rate of positive change and continue to grow the Sector for the benefit of all New Zealanders is a much more effective platform for success.

Taking action now to develop a strong and widely supported strategic focus, as well as aligning change leadership, can set the Sector up to realise significant export growth in under forty years. Success for the Sector, and all New Zealanders, needs alignment and optimised policy, incentives and investment. We need to implement change to:

- improve environmental sustainability measures, including emissions and water quality;
- accelerate and implement new methane mitigation technologies;
- support the adaptation of dairy and meat sector systems and production methods;
- incentivise and co-ordinate the development of carbon sequestration capabilities;
- accelerate ocean farming opportunities;
- develop natural fibre products and opportunities;
- build a significant high-value nutrition sector;
- deepen the food and fibre investment eco-system.

Perceiving the Sector as a ‘problem’ masks the significant economic opportunities it can create and maximise, as well as the opportunities for a coherent response to climate change.

There are four drivers of success for the Sector:

1. a commitment to environmental excellence;
2. alignment of incentives, investment and policy to optimise innovation rates;
3. support to sustain the Sector's current strong natural foods position; and
4. sustained leadership to realise New Zealand's potential in new sectors and markets.

Producers, industry, communities, Māori, science and research, as well as government, can create a resilient and rich future for New Zealand by working together with a common purpose. An integrated approach and cross-sector alignment are crucial if we are to adapt to, and leverage off, the three drivers of current economic change: increasingly complex consumer preferences, technological progress and climate change.

Consumer preference analysis shows a significant and rapid shift to healthy, nutritional food choices, and towards ethical and environmentally friendly production. Preferences are becoming increasingly segmented and more complex. Climate change is impacting production methods and outputs. Technological change is already opening-up new frontiers for food production, distribution and consumption.

:WELL_NZ considers the implications of these three global drivers of change on New Zealand's food production systems:

- climate change;
- consumer needs;
- rapidly developing technology.

Investment that aligns with these drivers will see returns within a decade. High commodity pay-outs now, and in the near future, provide investment headroom. Ensuring that investment is well informed and strategically aligned are challenges that our conversations through 2022 will begin to debate. This approach progresses the Government's *Fit for a Better World* vision and aspiration for an 'enriched future'.

The pace of change is confronting. Continuing to build a Sector information base, engaging in conversations on options and opportunities, creating strategies for long-term success and then developing aligned change processes is crucial. New Zealand must support its evolving production system with world-class innovation, increased investment and new channels to market and grow New Zealand-based brands.

:WELL_NZ is the first of a series of four insight publications from Te Puna Whakaaronui to be published in 2022. It raises the need for an urgent, and wide, conversation about reframing Food and Fibre Sector growth opportunities within a future focused food ecosystem that benefits New Zealand's overall economic, environmental and community health and the physical and mental health of our people. Work begins now to build an ecosystem design with industry and sector leaders. I look forward to your input and sharing progress with you at the end of 2022.

Te Puna Whakaaronui Thought Leaders Group
May 2022

Te Puna Whakaaronui Thought Leaders

Lain Jager (Chair),
Debbie Birch,
Andrew Ferrier,
Nick Hammond,
Rob Hewitt,
Neil Richardson CNZM
and Murray Sherwin CNZM



Growing the sector from
\$48 billion to \$85 billion
in exports by **2050**
is possible, assuming
sector growth of
2% annually

Lain Jager, Chair Te Puna
Whakaaronui Thought Leaders

Executive summary

Globally we are experiencing one of the largest convergences of new technologies at any single point in history. This is happening at a time when demographic, financial and geopolitical change is also occurring. Many of these changes will fundamentally alter how the world works. When we add to the mix the urgency of climate change, war and a global pandemic it is easy to see how addressing symptoms distracts from dealing with underlying issues.

Many of the current global food system issues cannot be untangled from three drivers of change: climate change, technology and consumer preference. Countries like New Zealand have very little ability to influence these drivers, they are significant forces which, in turn, are influencing our economic and societal health.

New Zealand can, however, seize the opportunity to support our Sector to understand these forces of change better than our competitors, and to empower and support the Sector to take strategic action that ensures New Zealand can:

- **Sustain:** our industries by supporting them to adapt and transition our food ecosystem into tomorrow's world; maintain and develop skills, knowledge and capital as well as protect our communities, land and ocean.
- **Enhance:** our natural food production systems to deliver future markets' needs and wants.
- **Create:** new industries and capabilities that can add value to our existing food ecosystem and open new market opportunities with new customers.
- **Maximise:** our ecosystem to ensure our food system can continue to prosper and fairly capture the value it creates.

The stratifying and repositioning of consumers, products, production and marketing systems, as well as value-chain ownership/control, has created diversified opinion on where risk and opportunity lie. However, within those markets already undergoing change, it is clear that companies offering the sustainably produced foods consumers want are seeing the greatest lift in value at the fastest rate.

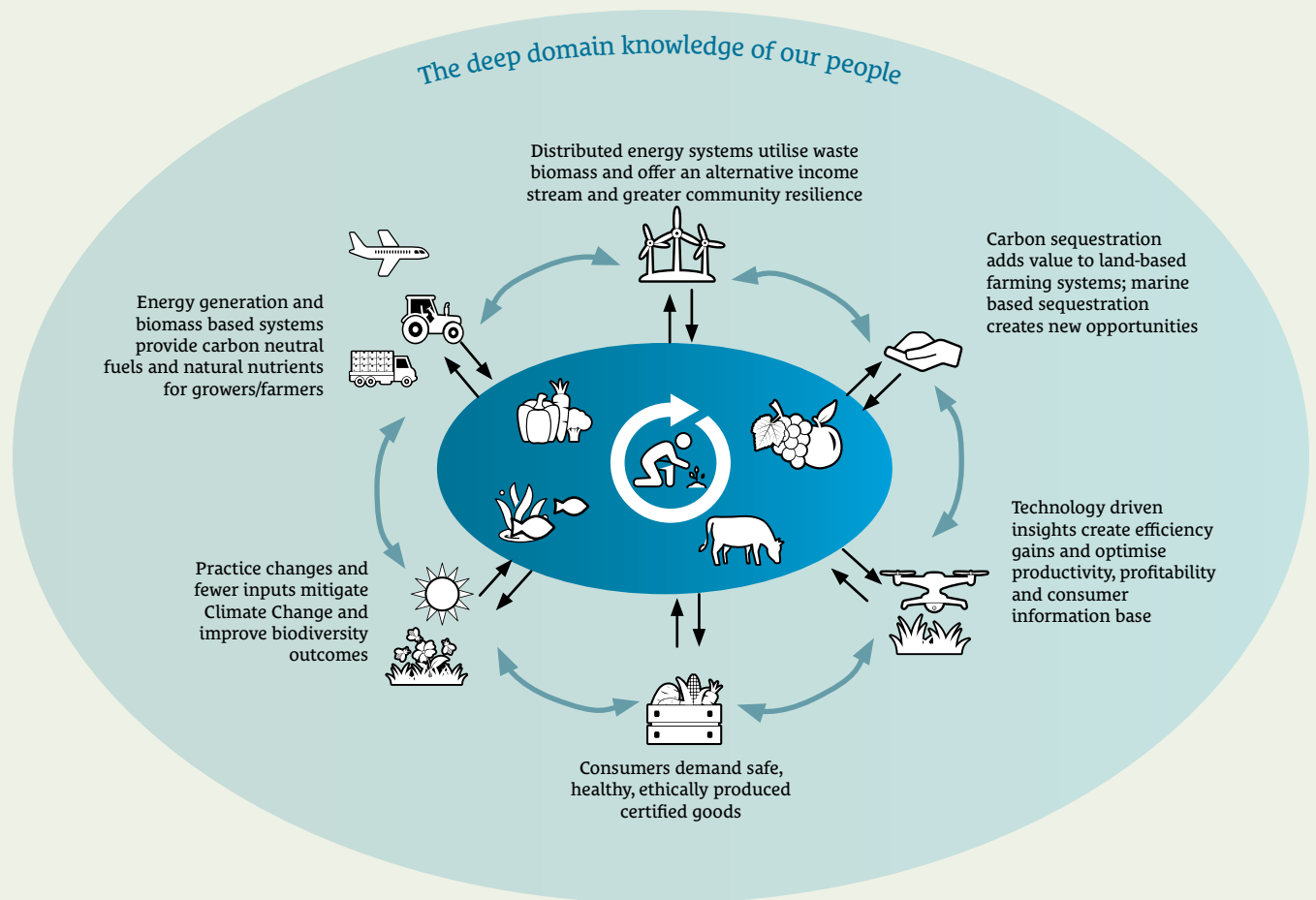
New Zealand's food sector is well positioned. We have a solid reputation for safe and healthy food built on the efforts of farmers, growers, fishers, processors, and agri-marketers. Current strong commodity returns provide the Sector with the means to invest in a new, resilient future. Quality data and analysis will give farmers and financiers confidence to invest in and to scale up new technologies and systems that will support the Sector's transition. This needs to happen at pace.

:WELL_NZ outlines a framework that sees the rapid combination of our existing natural terrestrial and marine environment capital, infrastructure, science and people with new technologies and capabilities to maximise food, wellness, beauty and future consumer product opportunities. It proposes a fusion of old and new systems and knowledge that can help future-proof New Zealand's position in a broader, more complex, and evolved food ecosystem.

Te Puna Whakaaronui expects exponential growth of both alternative food production systems and personalised nutrition; they will become profitable industries, ripe with opportunities for New Zealand to seize within the decade. This does not mean we try to compete with the large global agribusinesses. The early movers in the 'modern foods' categories are both small businesses and larger enterprises – many of which are backed by big investment capital and large agribusinesses. For New Zealand, multi-national aggregation has left gaps and undeveloped niche segments that we can nurture and create a competitive advantage in.

Recognising the importance of our existing food system and the opportunities to continue to evolve it will give confidence to our farmers and growers. And while it

Integrated production system improvements benefit the entire system.



won't be easy for all farmers to make changes, it is important for them to know that they are not on their own through this process. In fact, as much, if not more, change will be needed outside the farm-gate for the Sector to succeed in the new consumer markets.

There are technologies now and in the near future that will support change – technologies that will reduce on-farm methane production, improve water resilience, gather data for decision making, create new income streams, and support carbon sequestration without the need to remove land from the food production system.

The introduction of specialist crops, plants and modern food technologies will enable further fortification of foods and the creation of new products extending the Sector's value proposition to local communities and international consumers. The current global food ecosystem represents more opportunities than risks – we must start to discuss and explore the opportunities before they are lost.

The combined elements of **:WELL_NZ** offer a powerful proposition. New Zealand could take its place at the international table and contribute to the development of a new global food paradigm.

:WELL_NZ does not attempt to outline a strategy or action plan, it describes key risks, opportunities and sector needs. It is the start of a conversation and the first of a series of insight publications from Te Puna Whakaaronui. We intend that **:WELL_NZ** will provoke a dialogue towards future, sustainable solutions as well as engender urgency in the conversation.

Delivering on the **:WELL_NZ** proposition will require the support and resources of the broader innovation ecosystem. An additional section, **MAXIMISE :WELL_NZ**, sets out potential system and capability enhancements that the Sector will need to consider as it develops a strategy for success. Te Puna Whakaaronui will work with industry and the Sector towards a Food and Fibre Sector ecosystem design for wider discussion in late 2022.

There is much to do.

Why we need a :WELL_NZ framing

The COVID-19 pandemic has produced the biggest disruption to our way of life in decades, amplifying changes already underway around the world. The European war has resulted in rising fossil fuel and fertiliser costs, restricted shipping and supply disruption for New Zealand.

Traditional food production systems are coming under increasing pressure from technological and climate changes. Science has enabled the production of substitute food products. Consumers are becoming focused on the nutritional value of food and their preferences are evolving rapidly.

Changes that would have seemed impossible just five years ago are now scaling up to potentially redefine the Food and Fibre Sector ecosystem. Governments and companies are jockeying for position and competitive economic advantage. New Zealand has not yet landed on a clear strategic direction and is already falling behind.

Conversely New Zealand's traditional food system is currently thriving, and food producers are on track to achieve record profits this coming year. However many of our international competitors are already under pressure from a variety of global macroeconomic forces, technology disruptions and consumer shifts. They are implementing growth strategies which pose a substantial threat to our share of existing export markets. Sitting back to admire the view is not an option.

New Zealand's farmers are in a strong position; high pay-outs now and for the next two or three years, coupled with work under the Government's *Fit for a Better World* vision and Te Puna Whakaaronui's targeted market insights, allow for the Sector to strategically align investment and make-up lost ground.

Te Puna Whakaaronui's investigation of global trends, innovative technologies, business models, market shifts and emerging research has identified short and long-term risks and opportunities for the Sector. Our research and trend analysis has not revealed a silver bullet, but it has enabled us to form a platform of understanding about:

- how other countries are strategically addressing the same issues at regional, country, regulatory, company and producer level;
- which technologies are shaping the nature and pace of the change; and
- potential opportunities for New Zealand: practical technologies, practices and products.

It is clear that the factors New Zealand has depended on to create and maintain economic growth are changing rapidly. For example, technological advances in distributed energy, and the opportunity this creates for water harvesting, could change the way we think about water production, its distribution and how food is produced. These technologies, and others, are challenging traditional ideas about the locations of food production. Global markets are moving food production closer to population centres, which will have a huge impact New Zealand's economic, export and social models.



The opportunity for :WELL_NZ

WHAT IS :WELL_NZ?

So what are the options for New Zealand? Our investigation has shown exponential growth in the wellbeing market. The global pandemic has increased consumer focus on healthy food and nutrition. As an efficient producer of a diverse range of quality food New Zealand can capitalise on this burgeoning health food and product market which includes healthy eating, nutrition and weight-loss, personal care and beauty, preventive and personalised medicinal products.

To access and maintain a share of this potentially lucrative market we must build the science, research and innovation structures to enable sector growth. A long-promised boom in the health food and product market is now on the horizon, growing global demand for personalised nutrition, up-sized by the pandemic context and technological advances will see expansion in the near future

Doing what we do best – but better – is a strategy for success in these uncertain times.

:WELL_NZ describes a market-driven approach which examines product opportunities, future markets and, in tandem, the fundamental contribution the Food and Fibre Sector can make to the overall economic, physical and mental wellbeing of our land and our people. It proposes enhancements to our existing natural food production system to tell a compelling New Zealand food story to high-end consumers in global markets.

In addition, :WELL_NZ proposes a focus on the potential of a micronutrient production system, underpinned by solid scientific research, to meet future consumer demand. The two systems will have points of difference and synergies. The whole is greater than the sum of the parts.

Alongside a conversation about economic impact, Te Puna Whakaaronui has been considering how our food production system can better support the health of all of our people. Pricing and transport to deliver affordable food in both rural and urban areas impacts the food choices, and ultimately the health, of our population. Poor individual and community health comes at a high social and financial cost. Ageing 'well' is a concern for many people.

The COVID-19 pandemic brought the depth of food poverty into national focus and current economic indicators do not suggest an end is in sight. Conversations towards solutions to alleviate food poverty must be cross-sector. There is a place for community and sector solutions as well as government and commercial influence.

WHAT DOES IT MEAN FOR OUR VALUE CHAINS?

Positioning New Zealand's food system for long-term growth requires leadership, innovation and differentiation to compete in an increasingly complex global food market. Transitioning to a full value chain model for our Food and Fibre Sector will take some work at all stages of the value chain.

At the sharp end – farmers and growers

The work of New Zealand's growers and producers will continue to underpin the value proposition of the :WELL_NZ food production system. The Sector will need to consider its position to maximise the value of our natural systems, meet shifting consumer demand and remain competitive in existing markets (EU, UK, US). Consumers in these markets are increasingly prioritising sustainability credentials. New Zealand will need to ensure

A tightening of our focus on wellbeing enables New Zealand to leverage the best of our Food and Fibre Sector, as well as fairly reflect the value of our rich Māori heritage and our reputation for providing quality food. We can marry this with a huge market opportunity, new science and a compelling food story for global consumers.

The wellness economy is one of the largest and fastest growing global consumer segments. New Zealand companies have tried to access segments of this market in the past and made slow progress.

Currently the scale, location and drivers of the growth in demand for improved wellness, presents an opportunity. The pandemic has increased demand across our developed export markets. The global wellness economy of US\$4.5 trillion is expected to grow by a further US\$1.5 trillion over the next decade.

McKinsey predicts that over the next decade 80% of consumption growth in Asia will come from the top two income tiers. Over the last twenty years consumption growth has sat firmly in middle income tiers. This prediction aligns with New Zealand's aspirations to claim market position in high value health and nutrition market segments.

(McKinsey: Beyond income: Redrawing Asia's consumer map, Sept 2021)

our production systems meet – or exceed – our trading partners’ expectations if we are to remain competitive.

For the purposes of :WELL_NZ, we consider on-farm sustainability as:

- achieving verified carbon neutral/negative systems;
- using restorative environmental practices and circular resource flows; and
- continuing to strive for world leading animal welfare standards.

Target markets

High-end consumers are already paying premiums, and these premiums have been maintained throughout the pandemic. Demand for healthy food and health products has increased across markets. The consumers within our major export markets are stratifying, with the highest value consumer groups looking the most promising for continued growth. Agility and focus are going to be critical. Sharing information quickly back through the value chain will also strengthen the opportunity for success.

While New Zealand’s food producers are developing more sustainable and ethical natural food production systems, changes off-farm are needed to support the Sector’s development. Work is needed to develop a clear line of sight on customers’ wants and needs, to inform new product design and build the New Zealand food story into the package. Some of the steps and opportunities are described in ENHANCE :WELL_NZ on pages 20-29.

HOLISTIC APPROACH FOR THE SECTOR

:WELL_NZ is an “and” proposition for our Food and Fibre Sector. A successful change process will rely on government and the Sector, as well as a wide range of industries, developing a deep understanding of the landscape, threats and opportunities. Cross-sector relationships and understanding, as well as a shared vision for direction and future outcomes, will help to remove barriers and enable progress to be made.

There is an opportunity to work with Māori at the outset of this process to ensure a partnership that is mutually beneficial. A process must be recognisable as good for business, for the planet, animals and the communities it supports. There is a real opportunity to build on existing strengths and mātauranga Māori, as natural food and fibre producers.

:WELL_NZ proposes a transformative ecosystem approach that:

- values and prioritises its partnership with Māori;
- creates a shared sector purpose;
- provides a collective position to present to global consumers;

- improves nutrition and access to nutritional food for all New Zealanders within a high value food system;
- builds on New Zealand’s reputation for high quality, safe, natural food;
- contributes to New Zealand’s sustainability and wellbeing improvements; and
- creates new industries, economic opportunities and expands our combined food sector.

BUILDING OUR SYSTEMS

The development of an enhanced food production system will take time, considerable investment, broad based collaboration and, most importantly, co-ordination. The forces of change and disruptive technologies are converging at a time when our country is dealing with multiple, once in a generation global issues:

- climate change;
- pandemic response and recovery;
- chronic illness;
- mental health pressures; and
- ageing populations.

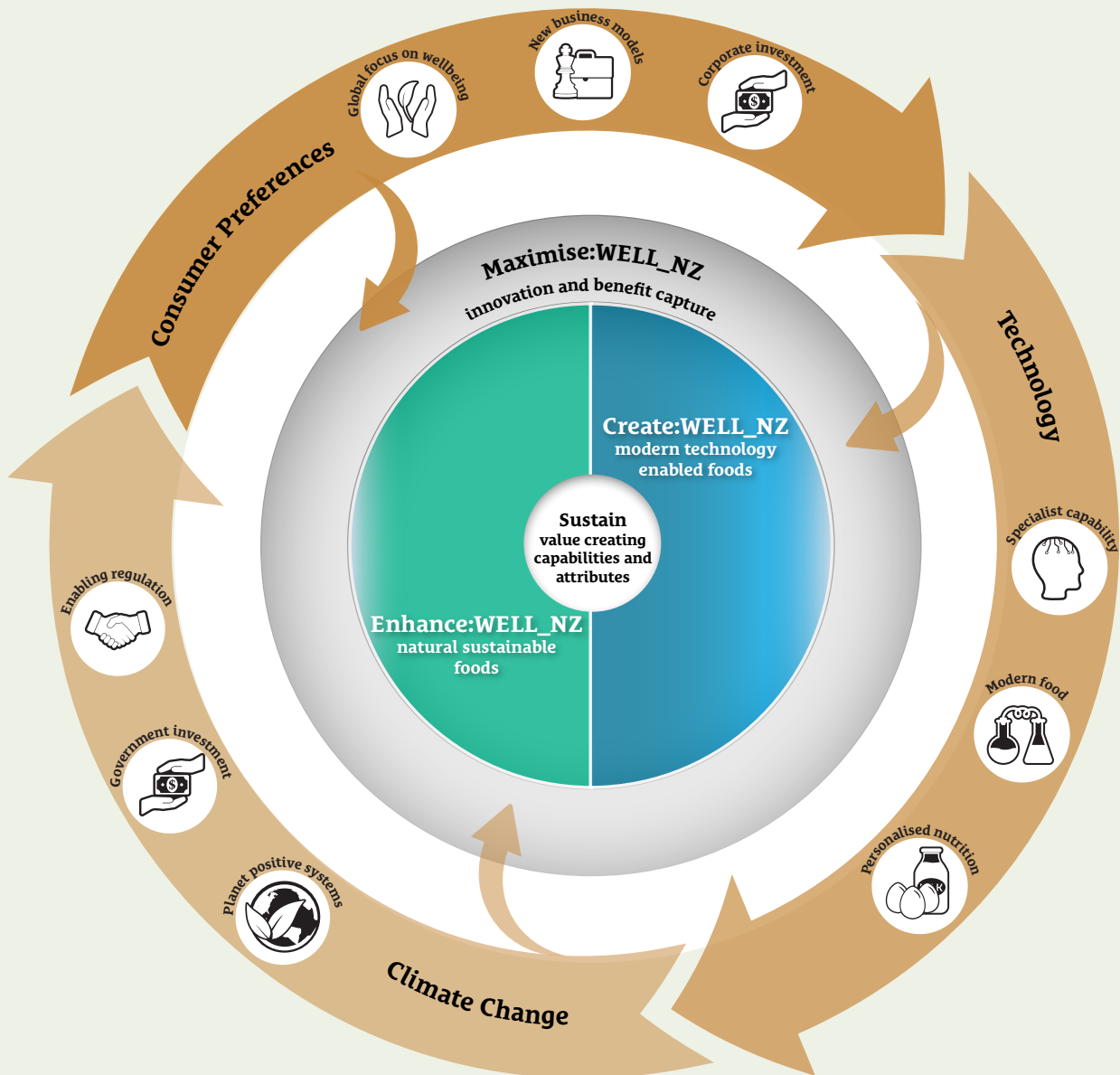
The full impact, the timing and scale, of these technological changes, are not yet fully understood.

:WELL_NZ is underpinned by the premise that, by working with the willing across sectors, significant progress towards repositioning the Sector can be achieved within five years. To execute an ambitious transition the Sector will need to operate with shared goals. There are questions to be asked – and answered – to signpost the way to an inclusive structure for growth.

Some foundational questions we must ask are, how can we:

- partner with Māori and the Sector to agree and implement environmentally positive farming practices based on shared knowledge and values?
- enhance consumer confidence in our product claims and sustainability of our food production systems, bioavailability and nutrition?
- improve population health by producing nutritious food and making it readily available?
- undertake widespread, and scientifically validated, bioprospecting for bioactivity, health and wellbeing compounds/ molecules for future products?
- develop globally valuable intellectual property, capabilities, and wellbeing-based solutions?
- develop personalised food products to meet consumer demand for improved wellbeing?

Transitioning New Zealand's Food and Fibre Production – existing and new systems creating synergy



:WELL_NZ seeks to raise a conversation across sectors and government to sustain New Zealand's production and trading position but also build systems that create sustained growth for New Zealand. Alongside geopolitical influences there are three global drivers of change impacting our Food and Fibre Sector: climate change, technology and consumer preference.

Through **:WELL_NZ**, Te Puna Whakaaronui suggests that our natural food system can be enhanced to meet future market expectations and highlights some key actions that will support this. Te Puna Whakaaronui believes a tandem and synergistic Food and Fibre Sector that uses new technologies can be created that will strengthen our market position and ensure a healthy future for our people.

Both existing and new systems are synergistic and will continually grow and transition.

Te Puna Whakaaronui believes the Sector should begin a conversation to develop a government and sector strategy to sustain, enhance, create and maximise the Food and Fibre Sector for the benefit of all New Zealanders.

Position

:WELL_NZ

The :WELL_NZ framing hopes to inspire and inform the development of pathways for New Zealand's Food and Fibre Sector to help it navigate through the significant global shifts being made at an international and national level. The operating context for the Sector has become more complex and it must acknowledge, and respond, to the international policy environment it now sits in.

In 2015 United Nations (UN) member states agreed on an ambitious global agenda: “Transforming our world: the 2030 Agenda for Sustainable Development, to end poverty, promote peace, share wealth and protect the planet by 2030”. There are seventeen sustainable development goals, which at their core, aspire to shift the global economy for the good of all now, and for future generations.

These goals provide New Zealand with an overarching framework. They challenge us to get serious about delivering an integrated and balanced social, economic and environmental agenda. Aligned to the UN goals, New Zealand's economic development efforts aim to create a productive, sustainable and inclusive economy that features high wages and low emissions. It aims to benefit all New Zealanders, as well as contribute to shared global aspirations.

THE NEW NORMAL

The focus for New Zealand's economic recovery in the context of a new “COVID-19 normal” includes a more active and strategic role for government to collaborate with the private sector to ensure investment, innovation and enterprise aligns with, and delivers, the outcomes needed to realise our economic aspirations.

The Sector has committed to owning its part in New Zealand's future and to lead the change that comes with it. As a collaboration under the Primary Sector Council, operational 2018-20, our food and fibre producers committed to meeting the greatest challenges humanity faces:

- rapidly moving to a low carbon emissions society;
- restoring the health of our water;
- reversing biodiversity decline;
- ...and, at the same time, feeding our people.

Work to align the Food and Fibre Sector within a delivery system that recognises each of the global and domestic principles led to the creation of *Fit for a Better World* – *accelerating our economic potential*, a roadmap for the Sector, launched in July 2021. Alongside innovative science and technology it outlined a design for a modern regenerative production system.

The *Fit for a Better World* roadmap aims to contribute to, and accelerate, New Zealand's economic recovery. :WELL_NZ frames and informs the next phase of changes and actions needed to transform the sector for long term, future success.



DRIVERS OF CHANGE

The factors and drivers shaping the New Zealand economy, and by extension the Sector, are changing and moving at pace. New Zealand's leaders, food producers, regulatory and funding bodies, as well as industry enablers need to recognise the change and gear up the innovation, science and entrepreneurial system to respond. Structural resilience will mitigate risk and enable innovation. New Zealand will need collective courage and conviction to join those countries already investing for tomorrow's world.

These three drivers help frame the discussion of potential avenues for the Sector's success:

- climate change,
- increasingly complex consumer preferences,
- technological progress.

DRIVER 1: CLIMATE CHANGE

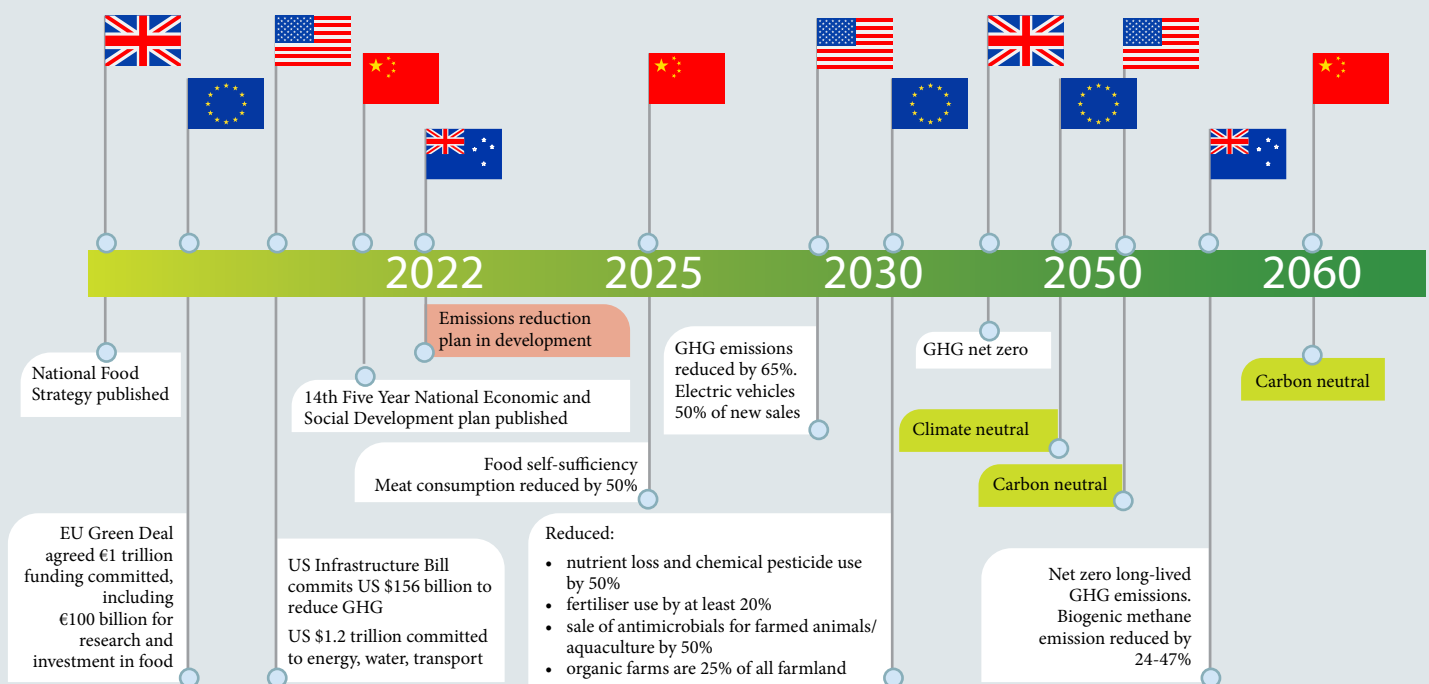
The impacts of climate change on food production are already front of mind for the Sector. Both land and marine-based food producers are all too familiar with the impact of changing weather patterns and extreme weather events on yield, as well as the increasing risk management load on their businesses. Government and industry bodies have instigated mitigation action plans. Farmers and growers are responding, adapting and building resilience into their business models.

The longer-term challenges of climate change and lowering New Zealand's emissions have been comprehensively traversed by the New Zealand Climate Change Commission and the New Zealand Productivity Commission. There is a considerable amount of work underway across government to develop an emissions reduction plan. :WELL_NZ does not duplicate this work but aims instead to highlight climate change as a major driver of global change which will impact considerably on New Zealand's operating context.

Globally the focus on climate change is shifting from simply addressing problems, to identifying opportunities for economic, social, individual and environmental wellbeing, as well as the potential for future growth. To this end, governments and large multi-national companies alike are carving out dedicated funding to support change. They are making policy decisions to reshape their domestic and export food markets. While we can expect further commitments, some international policy positions are outlined in the diagram below.

Carbon footprint, methane and nitrous oxide are pressure points for both global and domestic industries. Practical knowledge of how to mitigate these pressures is increasing. Commercial solutions are coming to market as a consequence of a decade of intensive research work. This year the first methane treatment for animals may reach the New Zealand market. Farmers need options, and options are starting to arrive.

Environmental sustainability goals of our major trading partners



Consumer sentiment on sustainability before COVID-19

During the pandemic, public attention shifted from environmental threats towards urgent social priorities. Consumers expected brands to protect the health and wellbeing of their workforce while also helping local communities. Consumers will maintain their enthusiasm for brands that help make the world cleaner, healthier, more resilient and equitable.

Consumers' environmental focus:

64.5%
reduce plastic use



61.0%
worried about climate change



59.7%
reduce food waste



36.4%
reduce carbon emissions



Consumers' social focus:

31.3%
buy from brands that support their social/political values



23.2%
Buy from purpose-driven brands



Reducing the Sector's overall climate impact, however, will require a whole of value chain approach: logistics providers, food processing, cold chain and food waste all need to be considered within a holistic solution.

DRIVER 2: CONSUMER PREFERENCES ARE CHANGING

Peoples' food choices are changing in favour of sustainable, ethical and healthier options. Climate change and security of supply considerations have seen the emergence of 'buy local' marketing campaigns. Currently two major global trends are capturing the attention of governments, food producers and manufacturers. Consumers are increasingly willing to pay for foods that:

- enhance mental and physical health; and
- are environmentally sustainable, or go further to be planet positive.

In addition, the global pandemic has brought wellbeing to the fore. Scientific research has found strong links between nutrition and mental wellbeing. Heightened awareness of the deep links between nutrition, and mental and emotional health has created a demand for products that can help restore and sustain people's overall wellbeing. Within the market for high quality natural products, there is a growing segment of consumers prepared to trade-off "natural" aspects in favour of products that have been more ethically and sustainably produced and incur less waste in both production and consumption.

The consequence of consumer's nutritional awareness is a market growing at the rate of 5-10% each year, or an estimated US\$1.5 trillion growth over the next decade. Predicted inflationary increases may have a short-term impact. *The Food Navigator*, June 2020, survey found that while personal health probably outranks it, climate change mitigation is also high on the agenda – especially for young consumers – with 82% of respondents willing to pay more for food products containing sustainably produced ingredients.

Over the last two years research findings from Mintel, Euromonitor International and McKinsey have found significant consumer appetite for both healthier and sustainable foods which has translated to growing a measurable change in consumer behaviour. Against a backdrop of growing consumer demand for sustainable and plant-based products, leading food manufacturers have become increasingly agile and brought to market innovative new products with improved environmental credentials.



Multinational Corporation Driven Initiatives Focused on Ethical Production, Sustainability and Climate Change

Nestlé

Nestlé is supporting regenerative agriculture and will accelerate the transition to a regenerative food system.

Will invest US\$1.3 billion over the next five years to help transition towards low-impact agriculture across its supply chain.

PepsiCo

PepsiCo and Beyond Meat have teamed up to form The PLANeT Partnership, to develop, produce and market innovative snack and beverage products made from plant-based protein.

They aim to release new plant-based snacks and drinks by early 2022.

JBS

JBS, the world's biggest meat processing corporation, acquired Dutch plant-based meat maker Vivera in response to shifting consumer demand. Vivera's more than fifty plant-based meat products are sold across thousands of European outlets including Asda and Tesco. In 2020 they announced a €30 million, 3-year investment to expand its product line, machinery and workforce.

How consumers are buying their food

The global pandemic has accelerated changes in purchasing behaviour. Euromonitor highlights that the e-commerce share of all spending on food and beverage surpassed 10% in 2020, up from just 3% in 2015. This blurring of the line between retail and food service is placing pressure on existing business models whilst creating space for entirely new ones. Euromonitor goes so far as to say that this shift is on a par with the mid-20th century emergence of highways/motorways and cold chains which fuelled the rise of modern grocery retail and quick-service restaurants. The 20th Century was, it says, about mass availability, the 21st is about the growth of on-demand availability with fresh food accounting for more of this than ever.

The growth required to meet increasing demand will require hundreds of billions of dollars in infrastructure spending, and a range of yet-to-be-achieved advances in automation, payments, food production, and more. However capital investment from giant multinationals continues apace. Amazon's annual capital investment (of which fresh food distribution accounts for a growing portion) now routinely exceeds that of telecommunications and energy companies like ExxonMobil and AT&T, surpassing US\$40 billion in 2020, according to company reports.

PREDICT is the largest in-depth nutrition study in the world, conducted by scientists from Massachusetts General Hospital, Stanford, Harvard and King's College London.

PREDICT encompasses a collection of clinical trials to understand and predict personalised metabolic responses to foods. This research has enabled the development of an at-home test kit to support individuals to understand their unique metabolism and gut microbiome.

PREDICT studies reveal multiple factors impact an individual's ability to achieve optimal metabolic health: gut microbe, blood sugar, exercise, sleep, fat and insulin levels. The studies also show that dietary inflammation varies dramatically among healthy adults. Key findings include:

- even identical twins respond differently, they share only a third of their gut microbe type;
- dietary inflammation varies up to ten-fold in healthy adults;
- personalised eating plans may help to sustainably combat weight and health; and
- a test-kit has been developed to help people achieve their healthiest weight, by profiling their unique gut microbes after meals and creating a personalised eating plan.

A similar report published in the *Journal of the Academy of Nutrition and Dietetics* devised a guide for nutritionists on how use the technology to deliver tailored health outcomes for people.

DRIVER 3: TECHNOLOGY

Energy, cultured meat, bio-processing, climate change and waste mitigation technologies are accelerating simultaneously providing integrated, locally-based and cost-effective options for energy production, waste mitigation, net (or negative) carbon emissions and social wellbeing.

Global food systems will be affected by changes across all of these technologies, however the immediate technologies that are key for the Sector to consider are outlined below.

Alternative Protein Technologies

Alternative protein is a commonly used term for a wide range of products. Sources range from algae and insects to re-engineered plant-based legumes and a variety of meat substitutes including lab-grown meat. In 2021 US\$4.9 billion was invested, more capital than the previous three years combined, and with a year-on-year increase of over 58% year. Last year, cultivated and fermented food technology investment accounted for more than half the annual investment total.

The various proteins are not equal in their potential for disruption with cell-based proteins and precision fermentation technologies being potentially more disruptive than plant-based foods.

- **Plant-based foods:** use plant material to mimic the taste, flavour and texture of meat, seafood, eggs, and dairy. Advanced plant-based technologies use both modified and non-genetically modified organisms, as well as modified methods and complex extrusion technology that enables plant proteins to mimic meat like textures.
- **Cultivated or cell-based proteins:** use a bioreactor (or "cultivator") to enable cell growth that replicates the cell tissue structure of different cuts of meat or other animal proteins accurately. Cell-based start-ups specialise in different elements of the process, including producing the scaffolding that determines the texture and 3D structure of the end-product, the cell culture medium to feed the cells, and the cell lines from which the end products are cultivated.
- **Precision fermentation:** uses micro-organisms, like bacteria or yeast, to produce specific molecules such as proteins, enzymes, flavour molecules, vitamins, pigments, and fats. These molecules are produced in a vat, like a beer brewery, instead of via animals or plants. Because the doubling time of growing microbes is hours, rather than the months and years required to grow traditional proteins, precision fermented proteins are expected to be considerably more efficient than their traditional counterparts within this decade.

Personalised Nutrition

This approach uses technology and biology to understand which foods can support an individual/group of individuals towards optimal physical and mental health. Work is already underway in countries around the world to apply this thinking. It falls into three categories:

1. **Stratified nutrition:** attempts to group individuals with shared characteristics and to deliver nutritional advice that is suited to each group;
2. **Personalised nutrition:** goes one step further by attempting to deliver nutritional advice suited to each individual based on, predominantly, biological measures such as genetic characteristics; and

3. **Precision nutrition:** combines an individual's genetic, environmental and lifestyle information to deliver advice suited to each individual.

Food-as-software (FaS)

Food which integrates the latest advancements in science and technology to make food production radically easier and faster has the potential to disrupt the food industry and traditional production methods in ways we have not yet seen before. While still in its infancy, food-as-software is essentially the continual design and improvement of food products and ingredients through rounds of iteration, in near real time, using large databases of food grade molecules and nutrients adjusted for specific variations such as taste, texture, and nutritional content.

THE IMPACT OF CONVERGING TECHNOLOGIES

Technologies are not disruptive by themselves, they amplify change. Think digital cameras: this technology was not disruptive until small cameras could take high quality photos and they were paired with cell phones as phone technology advanced in tandem. Similarly, convergence will create synergies and fast paced change across the food production system. For this reason, Te Puna Whakaaronui is monitoring for the convergence of the following technological developments.

Renewable energy technologies

Renewable energy technologies are continuing to reduce in cost and improve in efficiency. Solar panels are expected to drop a further 70% this decade. Rapid innovation will increase the number of new energy sources. The impact of cheap energy means energy intensive production systems, such as indoor vertical farms and

precision fermentation, will become proportionally cheaper and more competitive over time.

Alternative feedstock for cellular meat

New or alternative feedstock sources are needed to improve price competitiveness. Companies are actively exploring alternative technologies such as precision fermentation and are already publicly reporting significant advancements. For example, Mosa Meats recently reported 98.5% savings for 2020/21. Big gains are being made in this space now; it is reasonable to expect these will significantly improve over the next few years.

Food printing and textures

This technology still has the greatest development challenge, but trials are progressing quickly. A recent announcement that Japanese researchers from Osaka University have 3D printed Waygu beef illustrates the shift from mass produced chicken nuggets to premium cuts with complex textures. These technologies probably have the furthest development path ahead, but ongoing and significant investment suggests further gains will be made in multiple meat/food types in the coming years.

Bioreactor technology

Precision fermentation in a vat becomes inefficient above 10,000 litres for some cultures. Linear flow bioreactors that are now being production tested by the pharmaceutical industry could soon be tested for protein/food production. Pharmaceutical production tests have shown up to 400x efficiency gains, significantly lower infrastructure costs, and up to 6x lower operating costs. Bioreactors have the potential to become a foundational technology for precision fermentation, and when coupled with food-as-software capabilities, adoption could be accelerated.



Gene Editing

Genetic Modification (GM) is a challenging topic in New Zealand and elsewhere. Conversations are underway in the EU and UK about the possibilities and implications of new gene editing techniques, and we need to have them too. We need an open conversation about risk and how to manage it.

Regulations vary internationally. Some consider the product, some the process. For example, in several countries, products developed using random mutagenesis bypass GM regulations but products produced using CRISPR technology do not.

New Zealand, Australia and Europe regulate based on the technique used to make the genetic modification. Other regulatory approaches, such as plant regulation in Canada, consider traits, the premise being the potential for risk lies in the new trait and not with the technique by which the trait was introduced.

Several countries (including the EU, UK, Japan and Singapore) are actively considering their regulatory settings on GM. Some of New Zealand's trading partners are already adjusting their stance on Gene Edited (GE) and New Genomic Technique (NGT) produced foods. For example, Japan's Sicilian Rouge High GABA tomato is the world's first direct consumption genome-edited tomato, developed using cutting edge CRISPR/Cas9 gene editing technology. It contains high levels of gamma-Aminobutyric Acid (GABA), an amino acid believed to aid relaxation and help lower blood pressure.¹

At Wageningen University in the Netherlands, research into genomic selection continues to give breeders new opportunities to meet increasing demand for high-quality animal protein in a sustainable way. It views its breeding programmes as necessary to increase the efficiency of the food chain, minimise the ecological footprint, address changing consumer demands and contribute to the wellbeing of people and animals alike.²

Singapore has given regulatory approval for the world's first "clean meat" that does not come from slaughtered animals, paving the way for San Francisco-based start-up, Eat Just, to sell lab-grown chicken meat.

Opportunities for New Zealand

There are two aspects which could increase product opportunities for the Sector.

The first is the potential role of plant and animal products obtained from NGTs in contributing to a more resilient and sustainable agri-food system. Examples include:

- plants that are more resistant to diseases and environmental conditions, or climate change effects in general;
- improved agronomic or nutritional traits³ (Such as Japan's Sicilian Rouge High GABA tomato);
- reduced use of agricultural input, including plant protection products; and
- faster plant breeding.

The second aspect is the ability to develop cell cultures for use in precision fermentation to create cell-based meat or milk. For milk, this is usually done by genetically modifying microorganisms which enables them to produce real milk proteins through a precision fermentation process.

Creating plant-based meat, such as the "Impossible Burger" made by the US-based Impossible Foods Company, is done by precision fermentation. The company has developed a process for using the gene for heme (found in soy bean roots) and inserting it into a genetically engineered yeast cell. A fermentation process then multiplies yeast cells and produces large concentrations of heme. "Meat" products can also be created from animal cell cultures such as Just Eat's lab grown chicken nuggets.



¹ Fruitnet.com

² Wageningen University & Research, Animal Genomics

³ European Commission: Study on the status of new genomic techniques under Union law and in light of the Court of Justice ruling in Case C-528/16.

In addition to developing product opportunities like these, strengthening New Zealand's overall scientific capability is a key economic enabler. We know that New Zealand's existing expertise in animal, milk and dairy science is valuable, it is used and commercialised by large multi-national companies. New Zealand's deep knowledge of milk at a molecular level is of particular interest in the production of modern foods.

New Zealand's science and research capability extends across: protein and metabolites, plant and animal biotech, as well as bioactive compounds and enzymes. This platform can support the sustainable development of both terrestrial and marine economies.

SUMMARY

Change and technological evolution is a constant. With its reliance on global trade New Zealand is impacted by international policy and disruptive converging technologies we cannot influence. We must be adept at monitoring the variables of change and adapt swiftly.

New Zealand's dual heritage provides us an opportunity to evolve a shared set of values, principles and language in response to the challenges and opportunities climate change, technological change as well as increasingly segmented and complex consumer markets will present to us.

We must not be shy of asking the tough questions and challenging existing assumptions as we prepare ourselves for the changes ahead. The time to examine risks, opportunities, benefits and market response is now; particularly in relation to game changers such as genetic engineering.

Te Puna Whakaaronui has focused on exploring the three macro drivers of change to help understand the Sector's transformation needs to maximise New Zealand's position and identify new opportunities. These drivers only indicate the direction of the change ahead, their impact will be determined by our collective actions.

New Zealand has a short window of opportunity to invest and make progress. We can build resilience into our natural food production system and identify opportunities within a modern food space to grow and innovate. The global food and wellbeing economies represent opportunities for New Zealand's Food and Fibre Sector... if we are prepared to embrace change.

Perfect Day

A Californian start up that has recreated real dairy proteins via precision fermentation with the same real taste, texture, and nutrition as dairy – but without cows. It has developed a type of microflora that can ferment simple plant ingredients to produce the milk proteins, casein and whey, historically found in milk.

The milk is the very same blueprint, in the form of DNA, that cows produce every day, but with limited environmental impact and without lactose, hormones, or antibiotics. Perfect Day has done this, not by extracting DNA from live cows, but by accessing a copy of bovine DNA code sequenced by scientists in 2009, as part of the Bovine Genome Project. Using this database, Perfect Day was able to take a copy of the DNA sequence for milk protein and feed it to its microflora, *Trichoderma*, and produce an identical milk protein.



Sustain :WELL_NZ

The future for the Food and Fibre Sector is difficult to read. Global changes are multiple and fast moving. It is clear that people will always need primary produce... but will they need New Zealand produce? Will the market swing away from imported goods as countries develop self-sustaining capability?

New Zealand's success to date is based on a solid international reputation, core assets (including the natural environment), and capabilities. Farmers have invested and developed high performance production systems through generations. They have, and will, continue to adapt and diversify; the growth of the wine industry is a recent example. Building new systems and markets will require flexibility and change, but there is a need to protect, and enhance, what we already have to drive future success.

The nutritional health and wellbeing of New Zealand's people and communities is a conversation we must have alongside strategies that consider the economic sustainability, productivity and growth of the Sector.

SUSTAINING OUR HOMEGROWN VALUES

New Zealand's farming sector influences the shape and vitality of communities the length and breadth of the country. Without question the Food and Fibre Sector underpins our ongoing economic success. Total Sector exports increased from NZ\$33.3 billion in 2011 to NZ\$50 billion in 2021. However, while forecasts to 2025 remain strong, the ability to generate high returns over the medium to long-term will come under increasing pressure.

The Sector will need to be well supported and remain proactive in the face of technological change, substitute food products, increasingly complex consumer preferences and the need to demonstrate that New Zealand's production methods are meeting the highest standard of sustainable, ethical and climate change commitments. The Sector and the Government must continue to collaborate to maintain existing markets and build new positions, sharpen the Sector's competitive edge and create a wider range of opportunities for high value export growth in the future.

INDIGENOUS HERITAGE A CORNERSTONE OF SECTOR TRANSFORMATION

New Zealand has inherited two powerful knowledge systems. Using the wisdom and understanding of both systems we can develop a unique and relevant response to the drivers of change. To do so we must evolve a strong partnership with shared values, strong collaboration and shared success.

RESTORATION FOR A SUSTAINABLE FUTURE

Sustaining and restoring our natural resources for future generations and establishing New Zealand's environmental credentials with our global trading partners is essential.

New Zealand's unique profile – a developed country with high per capita agricultural emissions – provides a unique opportunity to become world-leading in the science, R&D and the practice changes required to transition towards a low-emission sector across the value chain. Through tackling this challenge, New Zealand has an opportunity to lead this change and recognise that our farmers, growers and businesses can help to enhance our biodiversity, climate and water goals.

New Zealand has committed to net zero long-lived green house gas emissions and a reduction of biogenic methane emission of 24-47% by 2050. There is potential to be more ambitious if a wider range of opportunities are considered. For example, the potential to utilise the New Zealand Economic Exclusion Zone to propagate seaweed to sequester carbon as an alternative to tree planting.

Alongside climate change New Zealand has committed to restoring the health of our waterways within a generation, reducing biodiversity loss, improving soil health, and reducing waste and plastic use across the food chain. There needs to be a step-change in restorative farm practices and post-farmgate production to establish New Zealand's sustainability credentials to the standards being asked of us by our major trading partners, or we risk losing these key markets.

Sustaining the health and interests of people and the planet is now a global baseline expectation occurring in conjunction with increased investment in digital traceability. We need to ensure that we can communicate and provide the evidence needed to verify our sustainability story to discerning consumers in high value markets.

SUSTAINING AND DEVELOPING NEW ZEALAND'S SCIENTIFIC KNOWLEDGE

Making changes on-farm will achieve some gains but will not provide the level of flexibility needed to successfully meet many of the disruptive challenges on the horizon.

New Zealand's Food and Fibre Sector businesses and institutions already house substantial scientific expertise. The New Zealand economy's reliance on trade has fostered the development of world class engineers, bioengineers, scientists and food scientists. These represent critical core capabilities which have historically been geared to traditional production systems, but which can be applied to further the development of modern foods. For example, New Zealand's deep knowledge of dairy products at the molecular level is a key capability that can be utilised to develop opportunities in precision fermentation products.

PARTNERSHIP – INTEGRATION – COLLABORATION

Bringing together the collective strengths of our natural food system, Māori agri-industry, and science and research teams within a :WELL_NZ framing, alongside an awareness of our new global consumer, places New Zealand in a unique position to claim a "wellness" position in the market.

Building the case for transition and transformation to enduring, success is ambitious. As Te Puna Whakaaronui continues to develop future scenarios and pathways, our work will be shaped by the following goals:

- a partnership process, including Māori, to agree and implement environmentally positive farming practices based on shared knowledge and values;
- production systems, bioavailability and nutrition;
- enhance sustainability of our food system;
- improve the health and vibrancy of local communities through improved knowledge and access to nutritious healthy food;
- undertake widespread bioprospecting for bioactivity, health, and wellbeing compounds/molecules for future products; and
- leverage our existing scientific and business expertise to develop globally valuable intellectual property, capabilities, and wellbeing related solutions.

Enhance :WELL_NZ

Farmers and growers play a crucial role in New Zealand's economy. They have proved their adaptability to market changes again and again. However, the current rate and complexity of change in multiple spheres means rapid and complex transition will need government support. The quickly evolving operating landscape is going to need a sustained effort by the sector and government to continue to evolve existing natural land-based food and fibre products.

This evolution will need collaborative effort. We must continue to tackle environmental sustainability, a focus on sophisticated consumer targeting and value chain positioning, adding some new products to our portfolio of natural foods and do some deep, yet fast-paced, thinking about marine based opportunities.

To inform sector business continuity and resilience planning in a complex global market, we have framed on-farm changes, research and global trends as ENHANCE:WELL_NZ. In this section we describe how consumer market segmentation is now stratified according to specific preferences, including:

- values;
- dietary needs;
- production impacts on the environment;
- climate change;
- population; and
- a desire for increased physical and mental health from food.

We look at where the opportunities may lie for New Zealand.

Enhancing current production of natural foods will re-position growers and producers to meet the changing needs and wants of the global consumer.

On-farm system evolution

New Zealand's farming practices have consistently evolved and will continue to change for as long as our customer's wants, needs and tastes continue to evolve. Adaptability has been key to New Zealand farming success in the past and will continue to be so in the future.

So, what do we know about the current situation of our Sector? We have:

- a shared understanding of the change required, the tools to make them need to be developed;
- unique practice knowledge from two powerful knowledge systems, (traditional Māori and scientific knowledge), that can improve the sustainability of our systems; and
- enough market/consumer information to understand the potential for change in the global food system and the what's driving our competitors.

We know enough for the Sector to begin to take action. Sustainable, planet-positive production systems are going to be critical for our future.

DEVELOPING OUR EXISTING NATURAL FARM SYSTEMS

Our natural food production systems are well positioned to evolve and succeed, although they will not be able to do this on their own. Continued success requires change across our economy and throughout the value chain. We must embrace the best of our two knowledge systems to create competitive advantage in global markets – science and mātaurangi Māori. The three main areas of change include:

1. **on-farm system evolution** that improves sustainability, biodiversity and strives for carbon neutral/positive systems;
2. **value chain positioning** connecting with consumers and understanding value chain changes; and
3. **novel natural products** to meet consumer demand for products with health benefits.

Many of these changes seek to build, secure and maintain areas of competitive advantage that persist across New Zealand's Food and Fibre Sector and that will deliver returns now and in the future. This is true for both “consumer” and “specialist” products identified in :WELL_NZ.

The :WELL_NZ framing of the future Sector is designed to recognise the additional benefit of a nutritious natural food system. It recognises the impact food has on building, maintaining and restoring physical and mental health. New Zealand's quality, natural nutrient rich foods are perfect for this. Global, and New Zealand-led, scientific research is supporting a deeper understanding of the science underpinning the role of food and nutrition in supporting and improving physical and mental health.

Currently research is showing promising results with the use of targeted nutrition to reduce many common conditions and chronic diseases such as diabetes, cardiovascular disease, dementia, mental health, autoimmune diseases and irritable bowel syndrome to name just a few. A food system that could improve a person's physical and mental health, and thereby reduce associated costs from health conditions, has considerable global value.

This future food system would include products in their natural state, native foods, fermented, prebiotics, probiotics, concentrated vitamins, and natural fortified processed foods with potential health benefits. We can transition our food system from a provider of products to a provider of solutions.

Improving the nutrient density of our foods over time, communicating these endeavours and the benefits to our consumers will be essential to achieve market differentiation and higher product prices. Pages 28-30 offer some insights into the research findings on the positive impacts of nutrient advances on physical and mental health.



It's impossible to imagine a future 10 years from now where a customer comes up and says, 'Jeff I love Amazon; I just wish the prices were a little higher,' [or] 'I love Amazon; I just wish you'd deliver a little more slowly.' Impossible. [...] When you have something that you know is true, even over the long term, you can afford to put a lot of energy into it.

Jeff Bezos, Amazon Founder

Entrepreneur, Jeff Bezos, identified the fundamental drivers of consumer purchase decisions: price, range and availability. He acknowledged that there were further elements that drove a purchase, but by focusing his attention on providing a platform that met these three needs, he created the global phenomenon that is Amazon.

New Zealand can emulate this strategy for success: identify the foundational elements of our current and future markets and structure our business platforms accordingly.

Artificial intelligence uncovers new plant compounds

There are millions of plant compounds in the world. Less than 0.1% of these compounds have been explored. U.S. biotechnology company, Brightseed, is the creator of Forager®, the world's first and only AI technology for phytonutrient discovery, that maps millions of bioactive natural compounds (phytonutrients) and considers their value for specific human health outcomes.

By utilising the most advanced computational biology and plant processing techniques, Brightseed claims to be able to develop “molecular signatures” of all of the plants in the edible and medicinal plant kingdom and predict which compounds exist in various plants and how they impact health outcomes.

Through Forager, Brightseed says it is in the process of building the world's largest plant compound library focused on the three key health targets: metabolic health, digestion and immunity

To date, the platform has analysed over 700,000 compounds for health properties. By 2025, Brightseed intends to have mapped all of the estimated 10 million bioactive compounds in the plant kingdom.

continued...

MAINTAINING COMPETITIVE SUSTAINABILITY

The Sector has made significant in-roads into environmental sustainability. However, our trading partners continue to raise their minimum requirement standards, and we must too. New Zealand has developed a good base knowledge of methods and techniques. There is no single solution, or action, that will achieve sustainability for all food producers – farm characteristics and resources are unique.

Sector groups, research institutes organisations and companies continue to work on regenerative and sustainable practices. Some examples include:

- **Synlait – Lead with Pride:** an incentive-led programme rewarding farmers for improved dairy farming performance and sustainability through milk returns;
- **Fonterra** – a value chain approach to improvement through setting targets and measuring progress for: land and water, climate impacts, packaging, procurement chain and animal welfare;
- **Silver Fern Farms** – Toitū Net Carbon Zero Certified Beef: excess emissions are off-set and on-farm performance supported through the Savory Institute “Land to Market” accreditation;
- **Quorum Sense** – a farmer-led group building good practice knowledge and expertise to enable on-farm change to regenerative and sustainable farming systems;
- **Calm the Farm** – a company targeting support, resources and capabilities to de-risk the change process for those moving to regenerative farming practices; and
- **New Zealand Merino ZQ programme** – a specialist programme for a customer-to-farm certified ethical wool, connecting regenerative practice changes with premium markets.

Many farms making changes will not be able to shift their position enough to be carbon neutral or positive. Supporting our farmers with additional tools and capabilities to become fully sustainable, productive and resilient will need to be an ongoing focus for government and sector agencies.

Sustainability example – methane mitigation: there are numerous approaches being explored ranging from animal genomics, dietary supplements, and animal treatments to name a few. And while there are no clear answers yet, existing methane reduction trials range from 15-20% (from supplementing with biochar) all the way up to 80% (for animal treatments). New Zealand may see an animal treatment commercially available this year with regulatory approval pending for one manufacturer.

Productivity example – a feature of regenerative farms internationally is the complementary integration of several forms of production within a single farming footprint (some have more than five animal species and numerous plant/tree crops). Additional activities also include agri-voltaics, perennial fodder crops and sensor technologies to manage on-farm inputs.



The majority of New Zealand's farms work under the principle of maximising production volume and minimising operational costs. Targeting high value consumers could see profits lift significantly, potentially doubling or quadrupling, the standard product price.

Resilience example – water management: having too much or too little water on farm are equally problematic and increasingly common place for farmers. Each farm has different needs. Future water management could include land-use design, in-soil water storage enhancement (e.g. biochar, also a carbon store), and technology solutions, such as air-capture water systems (producing 10,000 litres per day). These are all options that could be developed and deployed in the coming years.

Managing water on-farm also supports community catchment objectives, including helping to manage nitrogen impacts in the soil and limiting wider environmental impacts.

While New Zealand has many farmers using some of these, and many other systems, (cover or catch cropping, organics, blended forages, perennial forage crops), the change is not yet at a scale to realise their full benefits at a catchment level or in markets. Shifting the conversation from the issues, to informing and debating options, and aligning these to resources that accelerate change will move the Sector forward more quickly.

Potential future consumer segmentation

Consumer preference segmentation is becoming increasingly complex.

Consumer personas	Consumer preferences
Natural food devotees	brand position/recognition
Health and nutrition explorers	aligned purpose, evidence of claims and production practices
Individualised product seekers	evidence of material benefits
Planet focused	verified value chain transparency and traceability
Longevity planners	science and technology leadership, evidence of material benefits
Comfort in traditions	brand values
Community driven	alignment and endorsement with values

continued...

Currently, less than 1% of plant bioactives are known to science, and only 12 plants, such as corn, rice, wheat, soy, and oats account for 75% of the global food system. Brightseed's AI can identify new biological connections between the bioactives present in these plant sources and human health. Their potential can be mined and new territories for plant-based innovation can be explored. Brightseed's first proprietary plant bioactive discovery promotes a healthy metabolism by supporting the liver and can have consequences for type 2 diabetes, cardiovascular disease, and non-alcoholic fatty liver disease (NAFLD).

In August 2021 Brightseed announced a partnership with leading company, Danone. Through a multi-year collaboration, they will co-build unparalleled understanding of the world's most common crops and will explore lesser known plant sources.

www.brightseedbio.com

VALUE CHAIN POSITIONING

Growing nutritious food within a sustainable production system that can underpin a :WELL_NZ framing is not enough; we must change our relationships with our value chain and customers.

New Zealand will never produce enough natural foods to dominate a food category, we don't have the space, climate or topography to compete at scale. For these reasons we have tried to distinguish ourselves on quality, reliability and our country's reputation for safe, quality food. Targeting products to consumers who are both willing-and-able to pay a premium will be essential for our overall success.

Consumer segments

New markets are complex. Success will depend on applying traditional marketing principles: understanding, targeting and communicating with consumer groups. How feedback is captured and reflected in future food products will be important. We identified seven potential consumer groups that we think will be more resilient to changing market conditions, which collectively represent enough scale to generate more demand than we could ever meet.

Sustainability and nutrition are common themes throughout many of these descriptors. Consumers seeking to maintain and improve their health naturally represent a significant opportunity for natural nutrition food producers. Our natural food system is capable of precisely targeting two key market characteristics across multiple segments, through :WELL_NZ.

Capturing greater benefits requires value chain change

The global debate on food systems is currently dominated by environmental impacts from production systems, practices and inputs. While this is critical and change is needed in global food production, the greatest ecosystem level change is needed off-farm, if our farmers are to more fully benefit from their efforts.

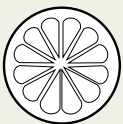
New Zealand's current natural food ecosystems are already some of the most efficient for carbon and food production globally. Based on existing sector capabilities and infrastructure, developing sustainable systems will require change:

- **on-farm** towards improved sustainability, system diversification and resilience measures (regenerative systems) which will result in the improved nutritional value of natural foods. These changes provide the sustainable, ethical and nutrient quality credentials consumers will demand;
- **in food processing** to develop increased agility to produce higher value blended products;
- **on business platforms** reflecting the introduction of new digital platforms, new product exchanges and delivery technologies; and
- **within market structure** reflecting a highly stratified consumer base, regulatory approvals for new foods and geopolitical impacts as countries seek advantages over their competitors.

While "what" farmers produce will ultimately determine the value proposition, farmers', and New Zealand's, economic success will ultimately be determined by the extent to which the broader value chain can step-up to create an holistic food production and distribution system.

Circular thinking creates opportunity

Orange skins



10,000 tonnes of oranges produced in New Zealand annually

90% is turned into fruit juice

- Good source of polyphenols hesperidin and polymethoxyflavones (PMFs) currently being studied for cancer treatments.
- Essential oils have limonene, studies show it has anti-inflammatory and anti-cancer properties.

How could circular thinking create greater value from these resource streams?

Grape skins



457,000 tonnes of grapes produced in New Zealand in 2020

20% of grape harvest is pomace

- High source of polyphenols with health benefits including antimicrobial, anti-inflammatory, anti-cancer, antiseptic, cardiovascular benefits.
- Widely used for oils and antiseptic eyewashes.

How could circular thinking shift this resource from animal feed or compost to higher value products?

NOVEL NATURAL PRODUCTS – THE OPPORTUNITY

New Zealand produces many high-quality ingredients, consumer and animal products. However, considering what we produce through a :WELL_NZ framing reveals greater opportunity. Growing and producing compounds that can improve a food's nutritional value has the potential to enhance the consumer's physical and mental health. It is a growing sector in which New Zealand can capture an early market share. How New Zealand develops and realises the potential benefits from this opportunity will need to be determined within a partnership that ensures appropriate use and acknowledgement of New Zealand's natural environment.

Native and exotic plants

The New Zealand natural health product (NHP) industry has grown rapidly in recent years, and products based on medicinal plants in particular (“herbal medicines”), have benefited from increased popularity and global sales. This trend is projected to continue. The global bio-actives ingredient market alone is projected to be valued at over US\$51 billion (NZ\$78 billion) by 2024, up from US\$36.17 billion in 2020. The overall nutraceutical market is forecast at US\$441 billion by 2026⁴.

New Zealand's unique habitat with its' range of microclimates, has enabled the evolution of a disproportionately wide variety of plants rich in therapeutic qualities and bioactive compounds. Some have noticeably higher concentrations of phytochemicals and phenolics than any other growing regions globally (e.g. blackcurrants, thyme and saffron)⁵.

Many of New Zealand's existing products and “waste” streams have nutrient properties with as yet unrealised market potential. On the previous page are two of examples of how to shift focus to explore wellbeing and health themes to unlock wider revenues and opportunities.

Bringing together the collective strengths of our science and mātauranga Māori knowledge systems can enable ‘new’ types of wellness-based natural health industries. Some of this work will be subject to the resolution of the Wai262 Waitangi Tribunal claim. New Zealand has a wealth of untapped native species that could be further explored developed for the nutraceutical, natural medicine and pharmaceutical markets.

Bioprospecting, the exploration of natural sources for molecules, biochemical and genetic information to develop into commercially valuable products, is an opportunity yet to be realised for New Zealand.

Preliminary ecological and chemical research into New Zealand's native and exotic species indicate there are a number of plants that could profitably grow commercially in New Zealand that have a broad spectrum of health benefits and properties for human immunity, mental health, and pain relief. These could become the starting point of further research and trials and an exciting journey for our Food and Fibre Sector.

The possibility for traditional & complementary medicine

New Zealand's natural food production system has a reputation for quality, nutritionally rich food and is well positioned to meet consumer product demands. Importantly for New Zealand's farmers and growers, some newer commercial crops complement existing production and can be profitable when grown at a small scale therefore offering a low-risk diversification option.

The potential global opportunity in the traditional and complementary medicines market (also known as nutraceuticals), is expected to grow rapidly to reach US\$441 billion by 2026. It includes everything from dietary supplements, and functional foods and beverages offering health/medical benefits including the prevention and/or treatment of disease. Breaking the market down further highlights functional foods as a standout opportunity, with a projected US\$217 billion market value by 2026 (representing 35.2% of the overall market) and has a compound annual growth rate of 7.8%.

⁴ <https://www.polarismarketresearch.com/industry-analysis/bioactive-ingredients-market>

⁵ <https://ir.canterbury.ac.nz/bitstream/handle/10092/17012/PhD%20Thesis%20Sandra%20Clair%202019%20FINAL.pdf?sequence=8&isAllowed=y>

There are known exotic and native plant species with physical and mental health benefits that gain a good economic return. Extracting these products has been difficult to scale in New Zealand, further research is needed to develop growing and/or alternative manufacturing technologies. Creating a leading position could open New Zealand farmers up to new production options and future economic gains.

SYNERGIES FOR MARINE AND LAND-BASED FOOD SYSTEMS

Our oceans are a significant natural asset. At four million square kilometres, or 15 times the size of New Zealand's land mass, they stretch from the sub-tropical to the sub-Antarctic. The size, breadth of habitat and depth of water within our Exclusive Economic Zone (EEZ) offers economic opportunities that can enhance our wider food ecosystem, and help mitigate on-land carbon emissions as well as generate financial returns for the nation.

Carbon sink

Our marine environment offers significant opportunities to sequester carbon. Recent studies show that globally our oceans can absorb an estimated 2.8 billion tonnes of CO₂ per year. The amount that New Zealand's EEZ can absorb can be increased using both natural and scientific methods, and even have a positive impact on marine biodiversity. For example, the recent development of upwelling technology, originally to draw cool sea water to the surface. This technique could support targeted fish stock management.

Recent estimates by US-based environmental innovation company, Running Tide, put the total global carbon sequestration from seaweed at 400-800 gigatons into the distant future. Using this

measure, and using New Zealand's Climate Commission's 2030 carbon pricing of \$150/tonne, the global opportunity would roughly equate to NZ\$60-120 trillion. The business case stacks up and requires only an administrative change to allow for seaweed to become a recognised carbon trading unit.

The option to offset carbon into marine-environments would relieve pressure on land-based options.

Unexplored protein source

As with our land-based systems, our oceans have well established food producing industries recognised around the world for delivering high quality and safe protein. Both our wild fisheries and aquaculture systems continue to achieve efficiency and productivity gains. The greatest additional protein opportunities are in the form of seaweeds and open ocean aquaculture.

Both opportunities are already well established commercially overseas. We can adopt technologies and tailor systems to New Zealand specific environments and species. Careful consideration will need to be given to markets and potential products. As with land-based animal proteins, many fish species and products are being targeted with both plant and precision fermented substitutes. Detailed business cases will be needed to describe these marine sector opportunities, work has begun with the Sector under the Government's *Fit for a Better World* road map.

Circular source of ingredients, nutrients and materials

Aquaculture can produce products highly valued in land-based systems. Seaweeds are a rich nutrient source, and many have a long history of use in both human and animal diets. They are also a source of nutrients for horticulture in a liquid form.



Seaweeds are also high in alginate and agar, which are prized across several industries. Alginate has many biomedical applications including healing, drug delivery and tissue engineering applications. Agar has many food applications and vegetarian substitute for gelatine, a thickener, food preservative, brewing agent, and used in paper and fabric production.

Enhancing marine-based opportunity

The development of New Zealand's marine environment is regulated by central and regional government and a recognised Treaty settlement framework. Innovation in the seaweed industry will need coordination and drive to align activities.

Given the scale of the opportunity and the relatively under-developed state of our marine environment “right now” is a very unique time, particularly when we factor in the lifespan of the carbon market which is expected to be an 80-100 year opportunity. If the global economy decarbonises, the value of carbon credits will eventually be zero.

Enhancing our position for marine carbon off-sets now is important if we are to maximise the economic value for New Zealand. Plans would need:

- to be developed with Māori;
- a new marine space allocation model, based on a partnership plan, with space sharing provisions for the seafood industry and Maritime New Zealand;
- to be based on shallow, medium and deep-water columns;
- an economic model that creates enduring wealth for future generations; and
- new investment models to ensure New Zealand benefits from our carbon industry.

SUMMARY

The coming years are likely to be some of the Sector's most profitable as food insecurity, climatic and geo-political disruptions drive global consumer prices, however, this represents a short window of time to reposition our systems, and we should begin now.

The global protein mass-market is not an arena New Zealand can compete in. There is no “silver bullet” product that we can grow at scale. The opportunity to enhance our existing system lies in growing the best, most nutritious natural foods that we can and, at the same time, looking for nutritional compounds that will add value to both natural foods and precision fermented foods.

Our natural food systems can adapt and shift. We have many of the capabilities and much of the knowledge we need to improve our overall sustainability and implement changes that can position the sector for the future, including:

- on-farm sustainability;
- novel products diversified on existing food production footprints;
- changes throughout value chains;
- benefit capture via new business models; and
- significant marine-based opportunities.

Global food system and technological changes are underway. Our competitors are investing and taking positions to adapt to global food system and technological change – New Zealand should be too.



POOR NUTRITION IS A SIGNIFICANT RISK FACTOR FOR THE DEVELOPMENT OF MENTAL ILLNESS

Julia Rucklidge, Professor of Clinical Psychology, University of Canterbury

This is Julia's story, it describes her passion for a deeper understanding of the link between nutrition, vitamins, food and a person's mental wellbeing. She has dedicated years of hard work identifying solutions that help people improve their overall physical and mental health. Her findings show that real improvements can be made for people suffering from many mental illnesses, and potentially offers hope to many New Zealanders going through difficult times.

Rates of mental illness are on the rise

Today, a quarter of New Zealanders suffer from poor levels of mental and emotional wellbeing, including nearly a third of women, according to a Mental Health Foundation commissioned report published in 2021⁶. Rates of anxiety disorders have doubled between 2012 and 2021⁷ and the prevalence of mood disorders in Kiwi adults has increased by over 50%, according to the Ministry of Health⁸.

Internationally, the number of children diagnosed with attention-deficit/hyper-activity disorder (ADHD) nearly doubled from 6.1% of the global population to 10.2% over a ten year period to 2018⁹. Statistics from the 2021 NZ Health Survey highlighting the rates of ADHD, autism and anxiety in New Zealand children (0-14 years) are concerning. Rates increased by 73%, 39% and 76% respectively between the period 2010/11 and 2020¹⁰.

Our national suicide rate also remains stubbornly high at over 13 deaths per 100,000¹¹ – with provisional data showing deaths in the last four years at a 30 year high. In New Zealand there has been a steady increase in the number of benefit claimants registering with an underlying mental illness. Supported Living Payment benefits increased by 5% and Jobseeker Support benefits by 10% between 2008 and 2017¹².

Contemporary diet and brain function

There are many causes of mental health problems, some are physiological or a result of injury. But wider societal issues: domestic violence, poverty, racism and the effects of colonisation also add to the growing levels of mental health problems in our communities. Conventional treatments are valuable and effective in many contexts but if they were the whole solution then rates of mental health would be falling not rising so significantly.

My investigations have focused on nutritional deficiency and poor mental health. It is a proof of concept we can no longer ignore: that our western society food environment is killing us. Poor nutrition is creating 'hidden brain hunger' impairing cognitive function and emotion regulation.

In developed countries over half our calories come from ultra-processed soft drinks, packaged snacks, sweetened breakfast cereal and chicken nuggets. The nutrients in these manufactured products have been replaced by preservatives, colours, flavours, taste enhancers and more. Most people are aware that diet affects physical health and is associated with chronic health conditions such as obesity, diabetes and cardiovascular disease. Generally people are less aware of the impact of nutrition on brain health.

6 Mental Health Foundation [12 January 2021]. *Wellbeing amongst New Zealanders*.

7 Ministry of Health indicators, 2020-21, 14 February 2022. <https://minhealthnz.shinyapps.io/nz-health-survey-2020-21-annual-data-explorer/_w_092fff0b/#/explore-indicators>

8 *ibid*

9 Adolescent Medicine JAMA Network Open [1997-2016]. American Medical Association, *Twenty-Year Trends in Diagnosed Attention-Deficit/Hyperactivity Disorder Among US Children and Adolescents*. <<https://pubmed.ncbi.nlm.nih.gov/30646132/>>

10 Ministry of Health NZ 2020-21 [14 February 2014]. *New Zealand Health Survey* <<https://www.health.govt.nz/publication/annual-update-key-results-2020-21-new-zealand-health-survey>>

11 Ministry of Justice NZ [2020]. *Annual Provisional Suicide-Statistics 2020*. <<https://coronialservices.justice.govt.nz/assets/Documents/Publications/2020-Annual-Provisional-Suicide-Statistics.pdf>>

12 Welfare Expert Advisory Group [February 2019]. *Current state: the welfare system and people with health conditions or disabilities*. <<http://www.weag.govt.nz/assets/documents/WEAG-report/background-documents/d820b16862/HCD-and-welfare-system-010419.pdf>>

Over the course of my research I discovered a startling statistic: 69% of food sold in New Zealand's supermarkets is ultra-processed¹³. While our brain is only 2% of our body weight it consumes 20-40% of the nutrients we eat. It is vital our brains receive the range of micro-nutrients they need to properly function.

Mental health treatment models

Currently the public health care system treats mental illness within a medical model. Typically, psychiatric medications are offered first, followed by therapies and other support. About half a million New Zealanders (13% adults) take antidepressants. Data released by the Ministry of Health¹⁴ indicates prescriptions for anti-depressants and anti-anxiety medications increased by 9% in NZ between 2017 and 2020¹⁵.

Psychiatric medication clearly has a place, and indeed saves lives. In the short-term psychiatric drugs, antidepressants, anti-psychotics and anti-anxiety medications are often very effective. Even when they produce a beneficial response, other symptoms that are similar to, but not severe enough for diagnosis, can be present. In some cases psychiatric drugs cease to improve mental health or even make life worse.

Important evidence that irritability, rage and unstable mood can be resolved with improved micronutrient intake comes from studies evaluating micronutrient supplements to treat mental health problems¹⁶. Most public awareness is restricted to the ill-fated search for magic bullets: studies of a single nutrient at a time. That is a common way to think about causality (for problem 'X', you need medication 'Y'), but that is not how our brains work.

Our brains require at least 30 micronutrients to ensure the production of neurotransmitters such as serotonin and dopamine, as well as breaking down and removing metabolic by-products. Many studies of multi-nutrient treatments have found improved mood regulation as well as reduced irritability and explosive rage, including in placebo-controlled randomised trials of children with attention deficit hyperactivity disorder and mood dysregulation¹⁷.

Gathering the evidence

In 2009, I received funding to run a randomised double-blind placebo-controlled trial looking at the effects of vitamins and minerals, (micronutrients), on adults with ADHD. The results were published in the British Journal of Psychiatry in April 2014. In patients taking micronutrients, specialist high-dose preparations not over-the-counter vitamin pills, we found:

- after only eight weeks twice as many responded positively, compared with the placebo group;
- depression went into remission for twice as many;
- hyperactivity and impulsivity dropped into the normal range;
- patients reported ADHD symptoms were less impairing and didn't interfere as much with work and social relationships; and
- at one year improvements were maintained, and symptoms further reduced.

These positive results aren't confined to a single study. My lab at the University of Canterbury, the Mental Health and Nutrition Research Lab, has published over 40 papers in medical journals supporting the benefits of micronutrients for mental health.

13 Swinburn, B., Eyles H, Young L., Gontijo de Castro. [2019]. *State of the Food Supply: New Zealand 2019*. The University of Auckland. <<https://doi.org/10.17608/k6.auckland.9636710.v1>>.

14 Ministry of Health Pharmaceutical collection [2021] <https://www.health.govt.nz/system/files/documents/information-release/data_on_antidepressant_prescriptions_2017-2021.pdf>

15 *ibid*

16 Johnstone, J.M., Hughes, A. Goldenberg, J.Z., Romijn, A.R., Rucklidge, J.J. [2020]. Multinutrients for the Treatment of Psychiatric Symptoms in Clinical Samples: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *Nutrients* 12(11):3394. <<https://doi.org/10.3390/nu12113394>>

17 Johnstone, J. M., Hatsu, I., Tost, G., Srikanth, P., Eiterman, L. P., Bruton, A. M., Ast, H. K., Robinette, L. M., Stern, M. M., Millington, E. G., Gracious, B. L., Hughes, A. J., Leung, B., & Arnold, L. E. [2021]. Micronutrients for Attention-Deficit/Hyperactivity Disorder in Youths: A Placebo-Controlled Randomized Clinical Trial. *Journal of the American Academy of Child and Adolescent Psychiatry*, S0890-8567(21)00473-1. <<https://pubmed.ncbi.nlm.nih.gov/34303786/>>

In two studies, one with 358 adults with bipolar symptoms and the second with 120 children with bipolar symptoms, micronutrients reduced symptoms on average by 50%, and this was sustained for six months with a simultaneous reduction in the use of medications.

We reduced the rates of probable post-traumatic stress disorder after the Christchurch earthquakes from 65% to 19% via a one-month intervention with micronutrients with no change in those not receiving the nutrients. Even after a year, people who received the nutrients did better than those who didn't. We also replicated the findings in collaboration with University of Calgary researchers, following floods in Alberta, Canada.

Internationally, there are over 50 positive randomised placebo-controlled trials showing the benefits of a broad spectrum of micronutrients for reducing aggression in prisoners, to slowing cognitive decline in the elderly, to helping people overcome addictions, to treating depression, stress, anxiety, autism and ADHD. The trials that typically show no effect studied people who did not have any psychiatric symptoms to begin with.

Micronutrients can be significantly less expensive than our current medical treatments. The message is clear: a well-nourished body and brain is better able to withstand ongoing stress and recover from mental illness.

Eating healthy helps

There are some studies showing the strong relationship between diet and mental health and three randomised clinical trials of adults with depression and poor eating habits. These show that education about how to improve diet led to dramatic improvements in mood in a matter of weeks. In many cases, complete remission of depression was achieved.

Within the last 10 years, there have been over a dozen epidemiological studies, studies of large populations, both cross-sectionally and longitudinally from around the world all showing the same thing:

People who eat 'traditional', or 'unprocessed', or 'Mediterranean', or 'prudent' diets have lower rates of depression and people who eat 'Western' or 'processed' diets have higher rates of depression. Only one study of this type that has found no association, and not a single study shows that the Western diet is good for our mental health.

What is the Western diet? It's typically energy-dense, heavily processed, high in takeaways, refined grains and sugary drinks and low in fresh produce. In contrast, a healthy diet pattern is fresh, high in vegetable and fruits, nuts, healthy fats, fish and low in processed foods.

Apply the science

There are many examples in our history where it took far too much time for new ideas to be fully embraced and where scientists who challenged the current way of thinking were dismissed and often ridiculed. Randomised trials in the 1600s showed that putting limes on board ships headed out for long voyages completely eliminated the 40% mortality rate from scurvy, but it took 264 years for the British government to mandate that all ships must provide citrus to their sailors.

How long will it take our society to pay attention to the research showing that that suboptimal nutrition is contributing to the epidemic of mental illness?

Create :WELL_NZ

The continued development of our natural food system must not come at the exclusion of New Zealand's participation in the fast and accelerating world of modern foods. :WELL_NZ defines plant-based, fermented and lab-grown products as modern foods, they share the common characteristic of a high level of technology use in their production. Modern foods present New Zealand with significant opportunities to participate in the food revolution over the coming decades.

New Zealand's two food pathways, natural and modern, are not binary, but complementary. A modern foods industry would add significant value to our natural foods ecosystem through the development of novel complementary products, expertise, technology, global connections, and to attract new capital.

Globally, food producing nations have made significant in-roads to the alternative protein market, a breadth of technologies have been deployed and there are several novel products under development. We are already 3-5 years behind in some product classes and do not have the resources to compete in many of these categories. Understanding where New Zealand can compete and create long-term value is critical.

CREATE: Well_NZ recognises this landscape and focuses on market segments that are yet to be fully defined or won. These are the opportunities in modern foods that New Zealand can build towards. This is not a space for the faint-hearted, there is much that is unknown and there is much to learn. But it is unexplored territory for other food producing nations too.

By building on our natural foods system New Zealand has the opportunity to develop modern food categories, specifically foods and products for the health and wellness market. Creating proteins, compounds and enzymes is relatively easy with modern technologies – turning them into valuable consumer products is harder.

We have a strong capability platform to build on, we have some of the best scientists and food experts in the world in:

- chemistry;
- chemical engineering;
- processing engineers;
- food engineers;
- microbiology;
- fermentation;
- bio-actives; and
- bioprocessing and drug discovery.

This capability resource could be harnessed to create a competitive advantage for modern food systems based in New Zealand.

To date, some of New Zealand's leading research institutes, including The Riddet, Cawthron and Plant and Food, as well as New Zealand university centres, have developed world class expertise in food nutrition, proteins and nutrient bioavailability. This work can support New Zealand enterprises to develop world class capability in modern foods. The supporting technology industry that builds our new modern food ecosystem has the potential to employ New Zealanders in high value jobs and to become a highly skilled work force.

Precision fermentation – what value can New Zealand add?

Fermentation technology for alternative protein has received much media and investor attention over the last 18 months, however the number of New Zealand companies in this space remains very small or in early-stage development. This puts New Zealand well behind the pack of first movers.

Millions of unique proteins and high value organic molecules can be produced using precision fermentation techniques. With some targeted research, science and technology investment, the costs to produce these at industrial scale will drop exponentially, much as we have seen with high value molecules like insulin. Anywhere beer is made today, it will soon be possible to make proteins and new molecules for food, textile, pharmaceutical, flavour, fragrance, household product, cosmetic and personal care markets.

These proteins will go far and beyond the traditional animal derived molecules we have relied on in the past. They will have the potential to be more functional and command high price premiums. A focus on developing physical and mental health solutions offers a significant opportunity for New Zealand.

Much is possible. A focus on new molecule development for New Zealand means we can leverage precision fermentation technologies without competing head-on with our traditional farming industry, or with existing alternative protein start-ups.

NOVEL NUTRITIONAL PRODUCTS, BIOAVAILABILITY AND INTELLECTUAL PROPERTY

There is growing global demand for healthy products and natural supplements in the pursuit of better immunity, health and wellbeing. There are some key areas that New Zealand can capitalise on:

- personal nutrition;
- therapeutic plant derivatives; and
- precision fermentation.

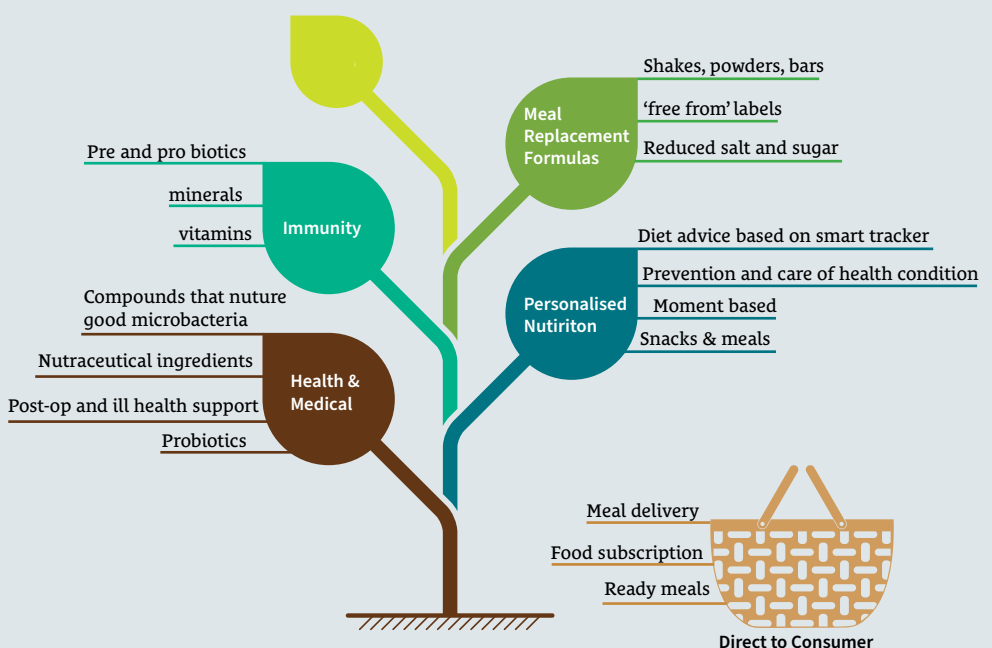
LEVERAGING PERSONALISED NUTRITION

As touched on in the “drivers of change” (pages 11-14), personalised nutrition could become commonplace. New Zealand can produce superfoods in abundance, products to support everything from gut health, medicinal remedies, fitness and wellbeing, to highly personalised nutritional products.

In 2020, the worldwide market for personalised nutrition was estimated to be worth US\$8.2 billion¹⁸. By 2025, the market is forecast to be twice this at nearly US\$17 billion with further forecasts of compound annual growth rate around 15%. Food-as-software developments may open-up new lucrative markets that merge food, health and therapeutics. These are huge opportunities for New Zealand to seize, to enhance our Sector, as well as embed wellbeing into the foods we produce.

Specialist nutritional opportunities for New Zealand

New Zealand can explore new market opportunities such as nutritional, healthcare supplements, as well as healthy whole food and functional food and drink.



¹⁸ Size of the worldwide personalised nutrition market in 2020 with a forecast for 2025 (in billion U.S. dollars) www.statista.com/statistics/1201697/personalized-nutrition-market-size-worldwide/

In the future, consumers will want their nutrients to disclose provenance and scientific credentials. New Zealand has a developed a food story, however, we need to do more work verifying the underpinning science, particularly for nutritional products, if we are to provide consumers with the confidence they will demand.

The table below highlights just some of the exciting areas for New Zealand to explore. When combined with technologies like gene home test kits that collect specialised data (DNA, blood nutrient levels, gut microbiome levels), New Zealand could begin to develop leading IP and world class technology platforms that support better physical and mental health via food and nutrition¹⁹.

Irrespective of which food system we consider, the bioavailability²⁰ of the nutrients in the various foods we eat is key to our health and wellbeing. The competitive advantage for New Zealand lies not just in building knowledge of the ‘what’ but also of the ‘how’. We can build the technical skills, resources and systems to enable others to create products too.

The opportunity will grow as modern foods like precision fermented compounds and foods come online and become a more accepted fixture of global food supply. These foods currently lack the nutritional density of traditionally grown plants and animal products. With the exception of the “Impossible Burger” which has been fortified, key nutrients such as iron, zinc, and vitamin B12 are absent from most alternative products.

Creating foods that blend natural and modern produce (with nutritional/bioavailable qualities) offers New Zealand the “first mover” advantage. It can bring to market novel products that are unique in the global food system.

New Zealand is already developing critical capability focusing on bioavailability and nutrition, for example The Riddet Institute’s new *Future Foods in Harmony with Nature*²¹ core research programme. Ensuring our leading research institutes are well funded and efforts are aligned with the Sector, and any early findings or opportunities are quickly exploited, is critical to building momentum and securing potential first mover opportunities. The Riddet Institute’s current areas for research into nutrition and bioavailability are outlined below.

Food structure design and nutrient delivery and metabolism	Transformative technology (related to genetically engineered DNA) for modern protein production
Link between food structures and health outcomes	Novel processing methods and technologies to enhance modern protein functionality/utilisation
Structure, functionality and digestive behaviour of food materials	Understanding the structures, functionality and nutritional impact of novel and modern proteins
Effect of specific food materials and structures on metabolism and gastrointestinal tract	Food, enzymes and ingredients supporting precision fermentation (enzymes for meat substitutes)
Nutrient bioavailability uptake in the body and physiological response to particular foods	Meat and fish proteins and products from tissue culture
Sensory and experiential aspects of new foods (smell texture, taste and touch)	Novel processing methods and technologies to enhance modern protein functionality/ utilisation
Human digestion technology “digestome”	Integrated model of the human gastrointestinal tract (includes physical and computational models)

19 Deloitte: Future of Food: personalised, responsible and healthy: How to prepare for the future of personalised nutrition. <https://www2.deloitte.com/global/en/pages/consumer-business/articles/gx-foodpersonalised-healthy-nutrition.html>

20 Which is defined in this study as “the fraction of an ingested nutrient that becomes available for use and storage in the body. In this definition, bioavailability goes beyond mere absorption from the gut and also includes the use and storage (retention) in body tissue.”

21 <https://www.riddet.ac.nz/continued-centre-of-research-excellence-funding-for-the-riddet-institute/>



Consumers believe that the best way to address physical and cognitive health problems is to look to prevent them from occurring. As such, consumers are making day-to-day changes to their diets and lifestyles with long-term goals in mind. Consumers will look to eliminate certain dietary evils from their eating and drinking patterns, whilst also place greater attention to their cognitive health and mental wellbeing, as they look to bridge together all aspects of health.”

FMCG Guru 2021

FMCG Gurus provide market research and insight into consumer attitudes and behaviours across the food, beverage and supplement markets worldwide.

Harnessing the power of nature's chemistry for next-gen therapeutics

Enveda Biosciences is a Colorado-based biotechnology company founded in 2019. It is applying cutting-edge machine learning (study of computer algorithms), Artificial Intelligence and metabolomics (the large-scale study of small molecules) to a 50,000-year-old human practice: extracting medicinal value from plants.

The natural world has been the source of many well-known medicines, including: aspirin, statins, and morphine. Extracting active compounds from nature has been notoriously slow and imprecise. However, at the end of the 20th century, many drug discovery programs shifted to a higher throughput, target-based approach like Enveda's.

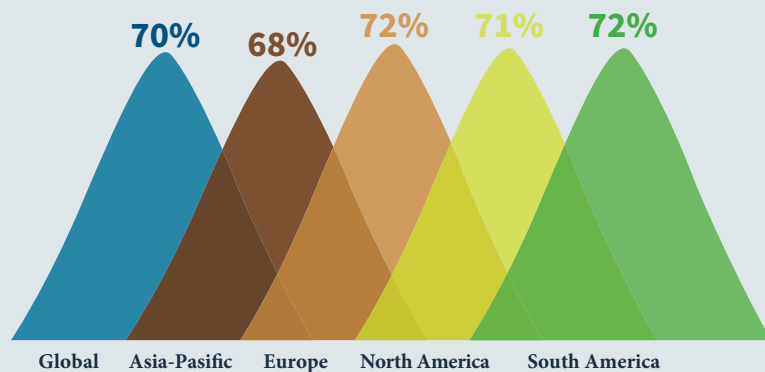
Enveda's platform essentially operates like a search engine, predicting novel chemistry at scale and speed. This chemistry is then used to generate biological datasets, leading to rapid identification of molecules with specific biological profiles.

Using this technology, Enveda claims to be on track to advance multiple molecules derived from plants. There are some promising candidates that may support treatments for Wilson's Disease, NASH, Parkinson's Disease, fibrosis, neurodegeneration and others.

In June 2021 Enveda Biosciences secured a US\$51 million investment. But it is not the only company in the world using AI to power the identification of plant-based molecules, medicines and therapeutics and investment in the world of drug discovery and AI powered discovery platforms is rapidly increasing.

The therapeutics sector presents an opportunity for New Zealand given the wealth of untapped plants and species in our natural world and their potential for high value therapeutics markets.

Proportion of consumers who have taken steps to improve their immune health over the last 12 Months
FMCG Gurus: Top Ten Trends for 2021, January 2021



Strong global consumer demand for nutrition and bioavailable foods will create demand for skilled and experienced people and organisations. New Zealand now has an opportunity to identify and secure strategic assets (including IP), and expertise to develop and support commercial development of this sector.

Examples already exist of companies generating commercial returns in these markets with mature business models and existing capabilities for:

- intellectual property, licensing process and technology innovations for enhanced nutrient delivery and functionality;
- commercial and technology transfer platforms involving new food nutrient discoveries; and
- working with multinational agri-food companies on commercial projects that enhance their products positions with consumers.

New Zealand aspires to build a productive, sustainable, and inclusive economy, featuring high wages and low emissions. This aim will only be realised through early adoption of, and long-term commitment to, developing and funding a well-designed and broadly supported strategic approach.



Maximise :WELL_NZ

New Zealand has the potential to develop natural, blended and advanced food products, to deliver physical and mental health solutions to the world, and to create a vibrant economy for the benefit of all New Zealanders. The Food and Fibre Sector will need to move quickly to maximise the opportunity. There is a significant co-ordination effort required from our agribusinesses alongside financial and commercial sectors, as well as Government, to enable the conditions for national success.

Change across the sector will mean significant investment. But, to maximise financial and community benefits, food sector innovation needs to be effective. Business models will need re-working and entrepreneurs will need a growth environment. Legislation and regulation must enable and support the Sector if it is to maximise investment returns.

STRATEGY FOR SUCCESS

In the wake of global economic uncertainty and risk, many governments are focused on reviving domestic and regional economies – as well as the wider global economy. With an eye on the future, government and business community investments are being strategically targeted through two channels:

- thriving research, science, innovation, and technology (RSI&T) ecosystems, and
- nationally held asset management/investment schemes to generate national returns and ensure both asset and returns are protected.

The Netherlands, Singapore and Israel have demonstrated that ecosystems with a track record of developing new commercialised IP will generate their own momentum. Japan's *Mission Oriented Innovation Policy*, the Dutch Wageningen University model, and the new *UK Innovation Strategy*²² are designed to attract and develop talent. Consequently the pool of specialist capabilities, research knowledge and connections will deepen and so too the investment and commercial partnerships. Israel's agribusiness, defence and water innovation hubs demonstrate the policy in action.

New Zealand's immediate and pressing challenge is understanding how to maximise support to mature its highly respected existing RSI&T capability. Creating a globally recognised ecosystem will accrue valuable benefits in, and for, New Zealand.

Across the RSI&T sector there are identifiable opportunities to improve capabilities and services. Increased government and sector investment through the transition period will be needed. The diagram on the next page outlines some opportunities to consider for RSI&T.

The Productivity Commission's research, *Focused Innovation Policy*²³, published early 2021, suggests that a focused innovation strategy needs to be both experimental and adaptive. The aim, it says, should be to build a portfolio of initiatives that has net overall benefits, while allowing some to fail. It sets out three priorities for Government to create:

- collaborative process to confirm focus areas;
- two tiers of governance, high-level and devolved; and
- substantial long-term funding for each focus area.

Realising the ambition for a productive, sustainable and inclusive economy, featuring high wages and low emissions, will need continued strong leadership and a future-focused strategy. It will require early adoption of, and long-term commitment to, developing and funding a well-designed and broadly supported strategic approach.

²² OECD: *Mission Oriented Innovation Policy in Japan*, April 13 2021

²³ *Focused Innovation Policy: Lessons from international experience*. p.43, New Zealand Productivity Commission, 20 April 2021

Capabilities of a full-service innovation ecosystem – opportunities to enhance New Zealand’s innovation system

Research, Science and Technology specialist capabilities



Intellectual Property and patents



Depth of capital and investment markets



Government investment and support funds – strategic positions



Business development bank



Base capabilities

New Zealand has a mature RSI&T system with a broad base of expertise across natural production and supporting food sectors.

New Zealand has a long history of generating IP and strong expertise in securing patents.

New Zealand has improved the depth of its early stage capital markets over the last decade.

New Zealand investment funds to support knowledge and commercial development.

Advanced capabilities

New Zealand has limited institutional capability and services in this area, the current capability is export focused rather than business development.

Opportunities:

Deeper understanding of:

- business needs
- new technologies
- disruptive capabilities and equipment
- evolving innovation systems

Deeper understanding of:

- modern foods
- evolving IP value models

Deeper understanding of:

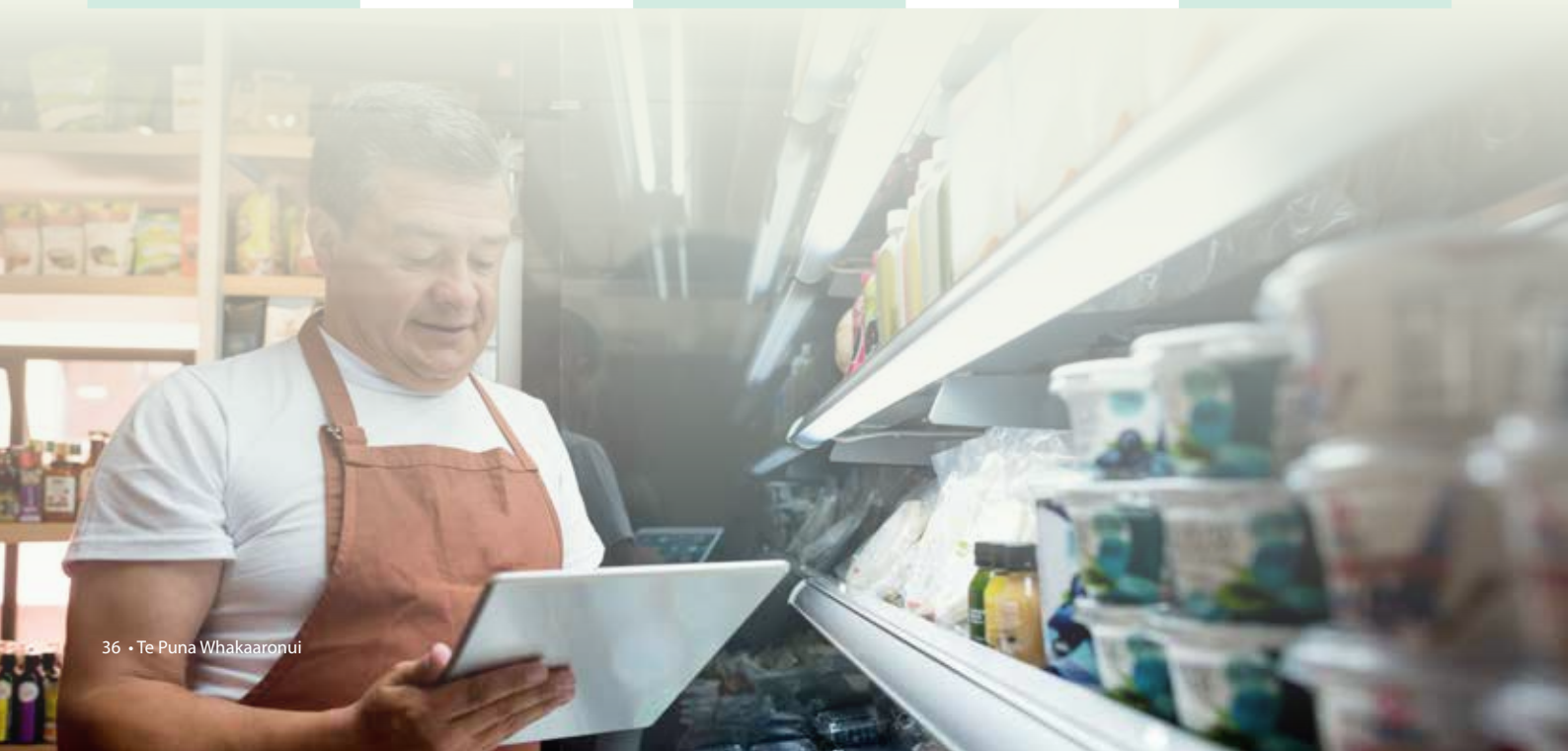
- evolving commercialisation models and opportunities

Deeper understanding of:

- evolving RSI&T models

Deeper understanding of:

- development banks that support export growth



REFRAMING THE “WHO BENEFITS” PARADIGM

A feature of “building back” the global economy post-pandemic will be the emergence of new business philosophies and technologies.

The size and scope of consumer networks, and the global digitisation of assets, will afford the opportunity for New Zealand’s Food and Fibre sector to harvest value through the supply chain, from farm gate to international plate, in a way that has not been possible before. Producers will be able to redefine who benefits and how they benefit.

The long-term economic transformation and transition to a circular, sustainable economic model²⁴ that New Zealand needs requires a long-term strategic view. It requires well mapped out scenarios and decision points to navigate dynamic global markets. New Zealand can maximise its current assets: a long history of food and fibre production, agri-knowledge, natural and human resource.

In a world where environmental outcomes, sustainability, and ethical production are gaining ever greater currency, partnering with Māori provides a unique dimension to New Zealand’s innovation strategy development, that can help deliver benefits to all our communities. Māori businesses typically serve multiple bottom lines and bring a long-term focus to decision making.

Developing a collaborative platform for farmers and growers to work with food businesses, sources of capital, leading researchers, technology platform developers, entrepreneurs, and innovative value chain providers will improve the long-term sustainability of New Zealand’s food ecosystem. New Zealand as a whole will benefit from a strategic approach that supports Sector and national economic success as well as greater wellbeing for all.

Capturing the value of our ethical food production

Digitisation has impacted the way business operates at many levels. Technological advancements will soon offer businesses the opportunity to evolve their business models to increase returns and maximise benefits through digitisation of assets and value chains. This redefinition of how value is created and shared can maximise New Zealand producers’ financial returns for the investment made in on-farm production values and quality food standards.

The current food and fibre supply chain moves product from the farm through the steps of: marketing, product development, manufacturing and distribution to the consumer. Digitisation will integrate the component parts of the supply chain network creating a more resilient and responsive supply ecosystem. It will increase transparency and efficiency. But where is the value-add to New Zealand’s Food and Fibre Sector?

The adoption of digitised models offers a once in a generation opportunity to redefine consumer relationships within and across markets. We can create an authentic connection for consumers with our products, production ecosystems and with fellow consumers who share their values. Digitised supply chains offer us powerful data to maximise returns from our products, to attach our unique New Zealand story as it moves into the hands of the consumer and gain financially from investment in ethical food production systems.

²⁴ European Commission LIFE and the Circular Economy

Singapore – constantly recalibrating innovation system settings

Singapore has achieved continued success through a well planned and executed strategy and is effectively leveraging its historical strength as a global trade entrepôt and Southeast Asian financial hub.

Various government programmes are in place to provide public funding or co-funding opportunities to entrepreneurs, such as the Early Stage Venture Investment Fund and SEEDS Capital.

Singapore continues to develop capabilities for success that take advantage of its high performing financial and legal knowledge base. In April 2021, Singapore released the Singapore IP Strategy 2030, a strategic plan built on the recognition the global growth of Intangible Assets (IA) and Intellectual Property (IP) model. Singapore’s 10-year plan consists of three “thrusts”:

- thrust 1: Strengthen Singapore’s role as a global hub for IA/IP;
- thrust 2: Attract and grow innovative enterprises using IA/IP;
- thrust 3: Develop a workforce with IA/IP skills.

The Singaporean government sees itself playing a highly significant role in cultivating their RSI&T ecosystems, not only in setting out a vision and strategy aligned to national objectives, but also in ongoing support from a range of agencies. For example:

- Enterprise Singapore;
- the National Framework for Innovation and Enterprise;
- the Innovation Cluster Programme;
- SPRING Singapore (Singapore’s enterprise promotion agency).

These policies and government support are targeted to calibrate their businesses to a changing economy and to take advantage of other schemes on offer such as Singapore’s Intellectual Property Development Incentive (IDI), Enterprise Development Grant and Skills Future Study Award to help defray IA/IP related costs.

Growing the possibility of new wellbeing futures

Governments and agencies can recognise and invest in frameworks for change. The case study below, from the USA, is an example of a sophisticated community initiative combining food, housing and employment options to solve a wicked problem. Including innovators from outside of industry and government at the strategy table will bear fruit, producing more resilient, targeted solutions.

Creative thinking has changed fortunes, in Bonton, Dallas, Texas. Some of the most vulnerable people had become disconnected from their communities and were not benefiting from local economic success. The statistics were grim:

- **95%** single parent households
- **48%** people live in poverty
- **50%** of men in prison before age 25 years
- **2x** rate of disease, diabetes, cancer, stroke.

Bonton Farms is an example of an agricultural intervention at a city level that has restored lives, created jobs, and ignited hope amongst its population. The former food desert now has a flourishing nutrition program that provides residents with nutritional counselling, cooking classes and general health and wellness guidance.

The model works with residents to ensure they have the seven human essentials: health and wellness, economic stability, safe and affordable housing, transportation, a sense of belonging, education, and access to fair credit.

Bonton Farms offers hope and opportunities based around access to healthy food, they have grown to offer jobs, empowerment, education, housing, and connectedness within communities and creation local businesses (a farmer's market and café).

"Investing in the soil yields healthy plants; investing in the soul yields healthy people."

Daron Babcock, Director

RE-INVENTING BUSINESS MODELS

Adapting our traditional business models to incorporate exponential models will be a challenge. Amazon revolutionised the retail shopping experience by revamping the logistics system, starting with books, then TV and electrical appliances. The Food and Fibre Sector can make a similar modal shift. Commerce can work hand-in-hand with the Sector to create a system that maximises returns. A collaboration towards shared goals will maximise financial, environmental and social returns for all New Zealanders.

Our larger food companies already have a strong base to build from and will play a pivotal role in the design, and transition to, these new business models. Environmental improvements on-farm or within catchment management systems can be incentivised or rewarded. Farmers, Māori, and local communities will need to be part of a company's redesign process, incentive and reward systems will need support to ensure supplier support and sustainability.

The Food and Fibre Sector's leadership will need support from their value chain partners to embed new business models. However those that succeed will create resilience within their production category and ultimately be in a position to inform and shape future food trends.

ENTREPRENEURIAL ENERGY IS NEEDED

There is a new cohort of ambitious entrepreneurs emerging. They seek to build billion-dollar businesses, develop new industries and create global service businesses from here in New Zealand, for the benefit of New Zealand. Ensuring these businesses have access to the resources, experienced advisors, and capabilities to remain onshore will be key to maximising the success of the sector and the wider benefits it can generate.

For entrepreneurs and small businesses to grow and develop, capital remains a constraint. While seed funding depth has improved significantly in New Zealand over recent years, demand has also increased. Business access to seed capital will continue to be crucial. Other growth interventions that can drive the faster growing end of the ecosystem are:

- alignment of the RSI&T system to fast growing or high potential industries, and partnership grants to support early stage investments;
- increased capital raising/structuring advice, mentoring and services for growing businesses to ensure business owners understand options and implications;
- evolution of investment options for New Zealanders to invest in the Sector; and
- investment models that build resilience in the Sector.

SUMMARY

The sustained success of the Food and Fibre Sector relies on building modern, responsive business and innovation models that maximise the work of New Zealand's farmers and growers. Understanding new value capture opportunities, as technology transforms the existing structures, is challenging. There is much work to do around business tables outside the farm-gate.

A sustainable partnership with Māori, commerce and government is essential.

:WELL_NZ

Next steps

Food produced in a beautiful and bountiful corner of the world will not be enough to sustain future success in a dynamic operating environment. Farmers, growers, producers and manufacturers need quality data and insightful leadership to enable investment decisions that respond to rapid market movement.

Delivering on the Sector's and Government's *Fit for a Better World* vision needs:

1. partnership with Māori;
2. strong relationships with companies and investors to drive the production changes required to meet future consumer demand;
3. government and business to strategically align the science, research, innovation, and technology sector with future food production needs; and
4. government and business to support the development and attraction of the expertise necessary to realise the vision.

INVESTMENT NOW IS CRITICAL

The Sector has made a start on strategy and action towards sustainability, it is aware that it must move to meet consumer expectations and demand. The pace and scale of change, however, needs to be super-sized, it needs boosting through targeted investment in progressive technology and practices.

To free up time and energy to make the progress that's required means a step-change – and it needs to be fast. Cross-sector conversation around, for example, on-farm management solutions, could seed alternative ideas, attract investment and generate sustainable change.

Current high farm-gate returns are likely to continue over the next two or three years. These strong returns, although off-set by rising costs, may represent a potential disincentive to change for some producers. Looking beyond the five and ten year horizon is imperative. The Sector has the resources to invest now – the opportunity to re-focus production systems is short-lived.

The Sector needs insightful leaders to articulate a shared vision, to guide strategic investment and deliver a future-focused food production system. Our competitors are increasing investment to maximise their future opportunities and hedge potential downsides. New Zealand's companies have been slower than international competitors to shift investment towards future foods and are falling further behind.

KOTAHITANGA

Developing a nationwide approach for cross-sector collaboration will bring about the pace and scale of production the future will demand. We must assess our options and make a deliberate decision on how to act, and soon. We need a value chain debate – and action – at a company, industry and regional level. We need to unleash the first movers and align core science, investment, capability and infrastructure development, and we need to do it with urgency.

There are some tough topics we need to explore as a country. Genetic engineering must be included in discussions. In particular, we must examine the potential uses of CRISPR²⁵ technology to support our natural systems and to create modified organisms, that will then be able to reproduce compounds or novel ingredients. We must contemplate the related regulations, operating rules and scope of uses for final products, for example *health v food* and *domestic v export consumption*.

²⁵ CRISPR, gene editing technology, has been applied to plant breeding, developing traits such as bacterial and fungal resistance, heat and cold tolerance, and increased grain size/weight in rice and wheat. Gene Modification has not been legal in New Zealand for two decades, debate in the agricultural and science sector about its position continues.

:WELL_NZ is a call to action, for the Sector, Māori, business and government. New Zealand's future – the health and wealth of all our people – is a collective responsibility. Transforming the sector will need all our agile thinkers at the table. The korero must welcome leaders already developing pathways: the Te Hono, partnership of food and fibre sector companies; iwi and government agencies leaders; and Me Uru Kahikate, the Federation of Māori Authorities, the Food and Fibre Partnership Group, as well as a broad and wide set of solution-oriented thinkers.

TE PUNA WHAKAAROUNUI'S PROPOSITION

Te Puna Whakaaronui's research demonstrates a high level of interest – and concern – about a course of action for New Zealand. Bringing a wide and deep pool of thinkers together to cross-pollinate ideas, make connections and generate change, will support the transformation the Sector needs. :WELL_NZ sets out a broad context and argues the case for change, it is a conversation starter.

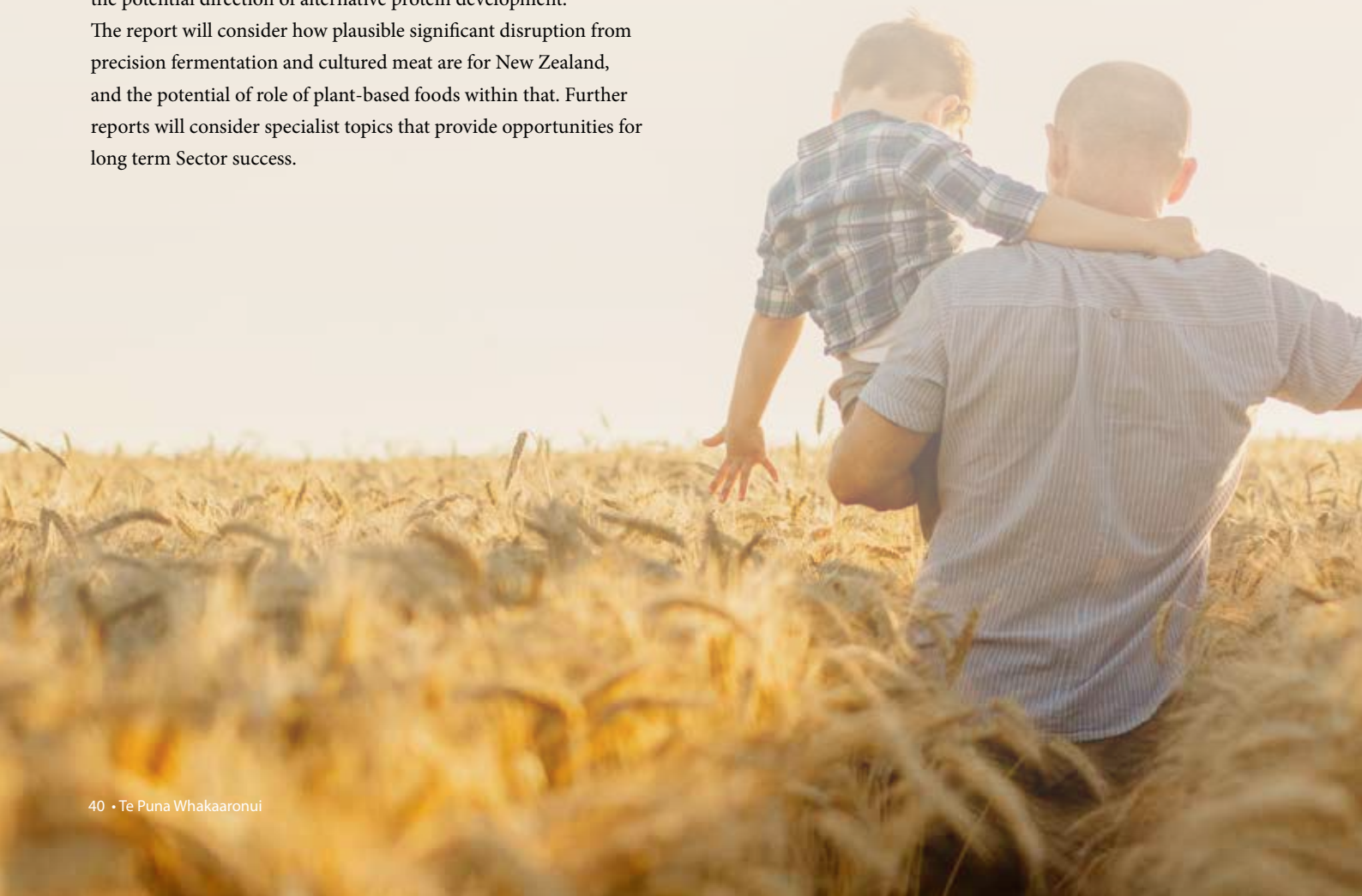
Te Puna Whakaaronui will begin cross-sector conversations in early 2022. It will garner opinion and ideas, test possible solutions with the Sector and work to inspire the necessary change within government, business or the Food and Fibre Sector.

In mid-2022 Te Puna Whakaaronui will publish a focused report on the potential direction of alternative protein development.

The report will consider how plausible significant disruption from precision fermentation and cultured meat are for New Zealand, and the potential of role of plant-based foods within that. Further reports will consider specialist topics that provide opportunities for long term Sector success.

:WELL_NZ is a "strawman" that offers a frame to communicate New Zealand's purpose, uniqueness, actions and value to future food consumers. :WELL_NZ proposes a deliberate focus on the rapidly growing global wellness market and a purposeful differentiation of our foods and products from those of other countries. The broad parameters of :WELL_NZ defines four focus areas:

- **SUSTAIN:WELL_NZ** – recognition of Māori's special role within the Sector, and importance of the Sector to New Zealand's economic future.
- **ENHANCE:WELL_NZ** – a framing to evolve our existing natural farming systems to become more sustainable and resilient in what they do, while being better targeted to consumers who are likely to seek natural foods that meet their needs.
- **CREATE:WELL_NZ** – a framing to develop complementary modern food capabilities that can be used to further fortify our natural foods, develop compounds, enzymes, novel and personalised wellness products.
- **MAXIMISE:WELL_NZ** – highlights the importance of RSI&T capabilities and the opportunities within our current ecosystem to create greater value, and new technology enabled opportunities to capture a larger share of the end value of our food system.



New Zealand's natural food sector has a bright future if we apply our collective knowledge to determine a course of action and execute the resulting plan. Discussions will have to include actions for: on-farm practices and systems, how we design our value chains, the technologies we use and our business models to ensure we capture our share of the benefits.

MAKING HASTE IS CRITICAL

Although our natural food systems are experiencing record financial returns, this is time limited. Looking beyond the current business cycle and securing future success will take courageous leadership now. We know the “unknowns” and the questions we need ask the Sector to inform decisions. We also have the expertise, capabilities, and knowledge to create scenarios and options to take the Sector forward.

In contrast to our natural food sector, our fledgling modern foods sector, has nearly unlimited opportunity – but with very limited resources. It has an increasingly condensed field of competitors rushing to replicate and “unseat” existing food sources capable of substitution. Our global competitors have made significant

technological and product advances over the last five years – New Zealand must work harder and smarter to create a competitive advantage through technological changes or by developing product attributes such as bioavailability or nutritional compounds.

Although the modern food ecosystem is complex (there are still unknown “unknowns”), we need to become comfortable with experimenting to build depth in our knowledge and capability. No matter how much time is spent on analysis, it won't be possible to identify all the risks or accurately predict solutions. For leaders this means gaining confidence to experiment and evaluate.

Advances in new technologies are allowing us the opportunity of redefining our food system for the first time in our history. We can both create, and capture, increased benefits that couldn't have been considered a few years ago. Our challenge is to move quickly before we lose the advantage. Broad and deep sector, and cross-sector, discussion and engagement on opportunities is our next step. Te Puna Whakaaronui will progress industry and sector input to a sustainable food production ecosystem and publish a progress report by the end of 2022. :WELL_NZ is the start of the transformation conversation.



:WELL_NZ

Reading list

Te Puna Whakaaronui considered a very broad and deep set of material, from global and New Zealand think tanks, research bodies, industry and government to develop :Well-NZ. Much of the content is identified here.

Alongside Food and Fibre Sector, climate change, consumer preference, economic and technological content, Te Puna Whakaaronui considered related areas of activity such as the rapidly changing energy sector as well as global government and commercial strategy. This content has not been included here.

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Te Puna Whakaaronui is currently investigating the impacts of alternative proteins on our dairy and meat industries. This work will give detailed technical analysis.

Join the **:WELL_NZ** conversation. Learn about engagement opportunities and keep up to date with food and fibre industry innovation and ideas at:

www.tpw.org.nz



**Te Puna
Whakaaronui**